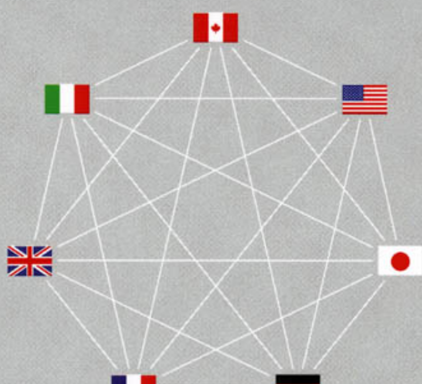
National Bureau of Economic Research

G7 Current Account Imbalances

Sustainability and Adjustment



Edited by Richard H. Clarida

G7 Current Account Imbalances

A National Bureau
of Economic Research
Conference Report

G7 Current Account Imbalances
Sustainability and Adjustment

Edited by **Richard H. Clarida**

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Introduction

Richard H. Clarida

This volume collects the eleven original papers that were written for the NBER Project on G7 Current Account Imbalances. The individual papers were commissioned in the winter of 2004. A preconference was held in Cambridge, Massachusetts in July 2004 at which participants presented outlines of their papers, reviewed preliminary results, and received extensive feedback from other project participants. The papers themselves were written during the fall of 2004 and the winter and spring of 2005 and were presented at a conference in Newport, Rhode Island in June 2005. In addition to the authors, the conference also included a distinguished group of experts who served as discussants for each paper. The written analysis by the discussants are also included in this volume.

As the title of this volume indicates, the focus of this project was on the current account imbalances of the world's seven major industrialized countries. The rationale for this focus was threefold. First, it recognized that current account imbalances in major economies with open capital markets and flexible exchange rates—both deficits and surpluses—are a general equilibrium phenomenon. Second, the subject of current account adjustment in emerging economies and the interplay between this adjustment and currency and financial crises were recently the focus of another NBER project. Third, the project's focus on the G7 allowed for, and indeed enriched, the very considerable analysis of and prospects for the ultimate adjustment of the U.S. current account deficit.

Four major themes emerged from the papers written for the project as

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well as the lively and informed discussion of them at the Newport conference. First, there was broad agreement among conference participants that the current account imbalances that prevailed among the G7 countries as of June 2005 would ultimately decline although there was no consensus on when this would occur or, conditional on its occurring, on the precise scenario by which it would occur. Second, there was agreement that adjustments in global currency markets would likely be associated with the shifts in global saving and investment patterns that would be required to bring about the ultimate decline in G7 current account imbalances. Third, while the focus of the conference was on current account imbalances in the G7 countries, it was recognized in several papers and more broadly in the discussion that the aggregate excess of saving over investment that existed among the emerging market economies at the time of the conference, as well as the currency intervention policies of some of these countries, was contributing to the current imbalances in the G7 that prevailed as of June 2005. Fourth, there was broad consensus that revaluation of the evolving foreign asset and liability positions of the G7 countries (via some combination of exchange rate and asset price adjustment) would play a role during the process by which current account imbalances narrowed although it should be noted that there was range of opinion concerning how large a role such revaluation effects would play in the adjustment process.

The eleven papers written for the project fall into three broad categories and are thus arranged in the volume in three sections. Section I: Origins of G7 Current Account Imbalances; Section II: Empirical Studies of G7 Current Account and Exchange Rate Adjustment; and Section III: Theoretical Perspectives on Current Account Sustainability and Adjustment. An overview of the contributions to this volume as contained in each of these sections is now provided.

Section I: Origins of G7 Current Account Imbalances

This section contains three papers written Pierre-Olivier Gourinchas and Hélène Rey; Philip Lane and Gian Maria Milesi-Ferretti; and Michael Dooley, David Folkerts-Landau, and Peter Garber. The papers by Lane and Milesi-Ferretti and Gourinchas and Rey emphasize the empirical importance of the currency composition of international assets and liabilities and the role of asset valuation changes, including those induced by exchange rate changes, in facilitating global adjustment to current account imbalances. The contribution by Dooley, Folkerts-Landau, and Garber focuses on the link between the currency regime and the development strategy of rapidly growing Asian countries, especially China, and in turn how sustainable and for how long is this currency or intervention regime and development strategy. Each paper, in its own way, offers a sophisticated and novel application of the venerable capital account theory of the current account.

The volume begins with "From World Banker to World Venture Capitalist: U.S. External Adjustment and the Exorbitant Privilege" by Pierre-Olivier Gourinchas and Hélène Rey. In their paper, the authors ask the following fundamental question: does the center country of the International Monetary System enjoy an exorbitant privilege that significantly weakens its external constraint as has been asserted in some European quarters? Using a newly constructed data set, the authors perform a detailed analysis of the historical evolution of U.S. external assets and liabilities at market value since 1952. They find strong evidence of a sizeable excess return of gross assets over gross liabilities. Interestingly, this excess return has increased after the collapse of the Bretton Woods fixed exchange rate system. It is mainly due to a return discount: within each class of assets, the total return (yields and capital gains) that the United States has to pay to foreigners is smaller than the total return the United States gets on its foreign assets. The authors also find evidence of a composition effect: the United States tends to borrow short and lend long. As financial globalization accelerated its pace, the United States transformed itself from a world banker into a world venture capitalist, investing greater amounts in high-yield assets, such as equity and foreign direct investment (FDI). Gourinchas and Rey use these findings to cast some light on the sustainability of the current global imbalances.

In "A Global Perspective on External Positions," Philip Lane and Gian Maria Milesi-Ferretti examine the increased dispersion in net external positions in recent years, particularly among industrial countries. The paper provides a simple accounting framework that disentangles the factors driving the accumulation of external assets and liabilities (such as trade imbalances, investment income flows, and capital gains) for major external creditors and debtors. It also examines the factors driving the foreign asset portfolio of international investors, with a special focus on the weight of U.S. liabilities in the rest of the world's stock of external assets. Finally, it relates the empirical evidence to the current debate about the roles of portfolio balance effects and exchange rate adjustment in shaping the external adjustment process. The paper makes extensive use of a new data set on international valuations of the foreign asset positions of the world's major economies.

The third chapter in this section is "Direct Investment, Rising Real Wages, and the Absorption of Excess Labor in the Periphery" by Michael Dooley, David Folkerts-Landau, and Peter Garber. This chapter argues that the expansion of the volume of trade in goods and services and the volume of two-way trade in financial assets is the backbone of a successful industrialization and development strategy. If the price to be paid for this strategy includes financing a large U.S. current account deficit, governments in the periphery will see it in their interest to provide financing even in circumstances where private international investors would not. The losses and abrupt price breaks forecast by the conventional wisdom of international macroeconomics arise from a model of very naive government behavior. In that model, periphery governments stubbornly maintain a distorted exchange rate until it is overwhelmed by speculative capital flows. In their view, a more sensible political economy guides governments in Asia. The objectives are the rapid mobilization of underemployed Asian labor and the accumulation of a capital stock that will remain efficient even after the system ends. The mechanism that regulates the mobilization is a cross-border transfer to countries like the United States that are willing to restructure their labor markets to accommodate the rapid growth of industrial employment in Asia. Net imbalances like those now observed for the United States may or may not be a by-product of this system. But such imbalances are only one of the constraints on the system and for considerable periods of time may not be as binding a constraint as in conventional theories.

Section II: Empirical Studies of G7 Current Account and Exchange Rate Adjustment

This section contains five empirical papers written by Caroline Freund and Frank Warnock; Richard Clarida, Manuela Goretti, and Mark Taylor; Muge Adalet and Barry Eichengreen; Catherine Mann and Katharina Plück; and Menzie Chinn and Jeffrey Frankel. The first three papers in this section share in common a focus on the possible empirical connection between the size of a current account imbalance and the way in which and the channels through which adjustment in that imbalance takes place. The paper by Mann and Plück makes the empirical case that a disaggregated analysis of trade flows across individual traded good sectors and bilateral country-goods pairs offers useful insights into the nature of current account adjustment once it begins to occur. The paper by Chinn and Frankel is an intriguing empirical exploration of the factors that could propel the euro to be a viable alternative to the dollar as an international reserve currency.

This section begins with "Current Account Deficits in Industrial Countries: The Bigger They Are, The Harder They Fall?" a paper by Caroline Freund and Frank Warnock that examines episodes of current account adjustment in industrial countries. There are a number of interesting findings reported in the paper. The main findings are (a) larger deficits take longer to adjust and are associated with significantly slower income growth (relative to trend) during the current account recovery than smaller deficits, (b) consumption-driven current account deficits involve significantly larger depreciations than deficits financing investment, and (c) there is little evidence that deficits in economies that run persistent deficits, have large net foreign debt positions, experience greater short-term capital flows, or are less open are accommodated by more extensive exchange rate adjustment or slower growth. The findings are consistent with earlier work showing that, in general, current account adjustment tends to be associated with slow income growth and a real depreciation. Overall, the results support claims that the size of the current account deficit and the extent to which it is financing consumption matter for adjustment.

In “Are There Thresholds of Current Account Adjustment in the G7?” Richard Clarida, Manuela Goretti, and Mark Taylor test for and estimate nonlinear models of current account adjustment for the G7 countries. They find evidence of nonlinear adjustment and show that a threshold model captures the essential features of the data. The model allows for country specific means and country- and regime-specific deficit and surplus adjustment thresholds. The evidence indicates threshold behavior in current account adjustment for the G7 countries such that the dynamics of adjustment toward equilibrium depend upon whether the current-account or net output ratio breaches estimated, country-specific current account surplus or deficit thresholds. Both the speeds of adjustment and the size of the thresholds are found to differ significantly across countries. In addition, the authors also find evidence of shifts in means and variances of exchange rate changes, stock returns, and interest differentials that coincide with the current account adjustment regimes identified by the model. Their paper concludes with an analysis of why the U.S. current account deficit as of 2005 had as yet failed to begin to adjust, notwithstanding the fact that it long since crossed a threshold at which adjustment would be expected to occur based upon the empirical estimates presented in the paper for the United States and other G7 countries.

In “Current Account Reversals: Always a Problem?” Muge Adalet and Barry Eichengreen take a first cut at measuring the frequency, magnitude, and effects of current account reversals in the gold standard era (1880–1914), the interwar period (1919–1939), Bretton Woods (1945–1970), and the post-Bretton Woods float (1972–1997). They use regression analysis to see how far one can get in ascribing the cross-period differences to observable characteristics of countries and the international economic environment. The results confirm that the gold standard era and the years since 1970 differed strikingly from one another: reversals were smaller, less frequent, and less disruptive in the gold standard period. Controlling for, inter alia, the size of the initial current account imbalance, the movement in the real exchange rate and the state of the global economy does not make this difference go away. Evidently, there was something else about the gold standard years that rendered current accounts more stable and their reversal less disruptive. The paper considers a set of case studies in an effort to shed more light on the issue.

In "Understanding the U.S. Trade Deficit: A Disaggregated Perspective," Catherine Mann and Katharina Plück presents new estimates for the elasticity of U.S. trade flows using bilateral, commodity-detailed trade data for thirty-one countries, using measures of expenditure and trade prices matched to commodity groups and including a commodity-and-country specific proxy for global supply-cum-variety. Using the United Nations Commodity Trade Statistics Database (UN Comtrade), they construct bilateral trade flows for thirty-one countries in four different categories of goods based on the Bureau of Economic Analysis's end-use classification system—autos, industrial supplies and materials (excluding energy), consumer goods, and capital goods. They find that using expenditure matched to commodity category yields more plausible values for the demand elasticities than does using gross domestic product (GDP) as the measure of demand that drives trade flows. Controlling for country and commodity fixed effects, they find that industrial and developing countries have demand elasticities that are statistically significant and that generally differ between income group and across product category. Relative prices for the industrial countries have plausible parameter values, are statistically significant, and differ across the product groups, but the relative prices for developing countries are poorly estimated. They find that variety is an important variable for the behavior of capital goods trade. Because the commodity composition of trade and of trading partners has changed dramatically, particularly for imports, they find that the demand elasticity for imports is not constant. Comparing the in-sample performance of the disaggregated model against a benchmark that uses aggregated data and GDP as the expenditure variable, the disaggregated model predicts exports better in sample, but does not predict imports as well as the benchmark model.

The final paper in this section is "Will the Euro Eventually Surpass the Dollar as Leading International Reserve Currency?" by Menzie Chinn and Jeffrey Frankel. This paper explores whether the dollar might eventually follow the precedent of the pound and cede its status as leading international reserve currency. They argue that, unlike ten years ago, there now exists a credible competitor: the euro. The paper econometrically estimates determinants of the shares of major currencies in the reserve holdings of the world's central banks. Significant factors include size of the home country, inflation rate (or lagged depreciation trend), exchange rate variability, and size of the relevant home financial center (as measured by the turnover in its foreign exchange market). Network externality theories would predict a tipping phenomenon. Indeed, the authors find that the relationship between currency shares and their determinants is nonlinear, but changes are felt only with a long lag. The advent of the euro interrupts the continuity of the historical data set. So they estimate parameters on pre-1999 data and then use them to forecast the European Monetary

Union (EMU) era. The equation correctly predicts a (small) narrowing in the gap between the dollar and euro over the period 1999 to 2004. Whether the euro might in the future rival or surpass the dollar as the world's leading international reserve currency appears to depend on two things: (a) do the United Kingdom and enough other European Union (EU) members join euroland so that it becomes larger than the U.S. economy? and (b) does U.S. macroeconomic policy eventually undermine confidence in the value of the dollar in the form of inflation and depreciation? What they learn about functional form and parameter values helps us forecast, contingent on these two developments, how quickly the euro might rise to challenge the dollar. Under two important scenarios—the remaining EU members, including the UK, join EMU by 2020 or else the recent depreciation trend of the dollar persists into the future—the euro may surpass the dollar as leading international reserve currency by 2022.

Section III: Theoretical Perspectives on Current Account Sustainability and Adjustment

This section contains three papers by Maurice Obstfeld and Kenneth Rogoff; Hamid Faruqee, Douglas Laxton, Dirk Muir, and Paolo Pesenti; and Aart Kraay and Jaume Ventura that draw upon and apply economic theory and, in the first two papers, careful calibration to offer valuable and novel insights into the issues of current account sustainability and adjustment.

In "The Unsustainable US Current Account Position Revisited," Maurice Obstfeld and Kenneth Rogoff show that when one takes into account the global equilibrium ramifications of an unwinding of the U.S. current account deficit, currently running at nearly 6 percent of GDP, the potential adjustment of the dollar becomes considerably larger than estimates from their previous papers. While global capital market deepening appears to have accelerated over the past decade, the paper argues that global capital market deepening turns out to be of only modest help in mitigating the dollar decline that will occur in the wake of global current account adjustment. Adjustments to large current account shifts depend mainly on the flexibility and global integration of goods and factor markets. Whereas the dollar's decline may be benign as in the 1980s, they argue that the current conjuncture more closely parallels the 1970s, when the Bretton Woods system collapsed. Finally, the authors use the model to dispel some common misconceptions about what kinds of shifts are needed to help close the U.S. current account imbalance. For example, faster growth abroad helps only if it is relatively concentrated in nontradable goods; faster productivity growth in foreign tradable goods will actually exacerbate the U.S. adjustment problem.

In "Smooth Landing or Crash? Model-Based Scenarios of Global Current Account Rebalancing," Hamid Faruqee, Douglas Laxton, Dirk Muir, and Paolo Pesenti use a sophisticated new open economy multicountry simulation model to explore different scenarios for global current account adjustment. These scenarios are designed to highlight the potential risks of large current account imbalances. The paper also explores some possible solutions that may mitigate these risks by gradually reducing the magnitude of these global imbalances over time. The paper argues that the short-run output costs for the U.S. economy that would be associated with a sudden loss in appetite for U.S. assets are likely to be the same order of magnitude as a large credible fiscal consolidation that would make a significant contribution to reducing these imbalances over time and making both the U.S. and world economy less susceptible to shocks. It also considers the effects of competition-friendly structural policies aimed at reducing distortions in the product markets in Europe and Japan. The analysis suggests that such policies could play a prominent role in reducing current account imbalances on a sustainable basis if they were associated with a sustained increase in growth and a permanent downward shift in the net foreign asset positions of these countries.

Finally, in "The Dot-Com Bubble, the Bush Deficits, and the U.S. Current Account," Aart Kraay and Jaume Ventura present a novel theoretical model that attempts to link present international imbalances and the bursting of the global equity bubble in 2000. They argue that a surprising aspect of the current debate is that stock market movements and fiscal policy choices have been largely treated as unrelated events. Stock market movements are usually interpreted as reflecting exogenous changes in perceived or real productivity, while budget deficits are usually understood as a mainly political decision. Their theoretical model is used to develop two alternative interpretations. Both are based on the notion that a bubble (the dot-com bubble) has been driving the stock market but differ in their assumptions about the interactions between this bubble and fiscal policy. In one interpretation of the model—one that is by far the more persuasive to the editor of this volume—a change in investor sentiment leads to the collapse of the dot-com bubble and implies that budget deficits are a welfare-improving policy response to this change in investor sentiment. In another interpretation, expectations of future budget deficits lead to the collapse of the dot-com bubble that in turn, allows a country to appropriate rents from foreign investors.

I

Origins of G7 Current Account Imbalances

1

From World Banker to World Venture Capitalist
U.S. External Adjustment and the Exorbitant Privilege

Pierre-Olivier Gourinchas and Hélène Rey

1.1 Introduction

This paper takes a fresh look at the historical evolution of the United States external position over the postwar period by carefully constructing the U.S. gross asset and liability positions since 1952 from underlying data and applying appropriate valuations to each component.

The last two decades have been characterized by a sharp increase in international capital flows and, in particular, by a rising globalization of equity markets.[1] The broadening of the set of assets internationally traded, the switch to a floating exchange rate regime in 1973, and the larger size of gross asset and liability positions have made it increasingly necessary to incorporate valuation adjustments when computing net foreign asset positions.

The net foreign asset position of a country is nothing but a leveraged portfolio where the country is short in domestic assets and long in foreign assets. Hence, changes in asset prices and exchange rate movements will either tighten or relax the U.S. external constraint. For instance, everything else equal, a depreciation of the dollar generates a capital gain on U.S. foreign asset holdings, which increases the return on its net foreign portfolio.

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We thank Rich Clarida, Barry Eichengreen, Richard Portes, Cédric Tille, participants at the NBER Conference on G7 Current Account Imbalances, and, especially, our discussant José De Gregorio for their comments.

1. These phenomena have been documented in particular in Lane and Milesi-Ferretti (2001) and Lane and Milesi-Ferretti (2004).

As of December 2004, the Bureau of Economic Analysis (BEA) reports a U.S. net foreign asset position of –$2.5 trillion (or 22 percent of gross domestic product [GDP]), with assets representing $10 trillion (85 percent of GDP) and liabilities $12.5 trillion (107 percent of GDP). Almost all U.S. foreign liabilities are in dollars, whereas approximately 70 percent of U.S. foreign assets are in foreign currencies. Hence a 10 percent depreciation of the dollar represents, ceteris paribus, a transfer of around 5.9 percent of U.S. GDP from the rest of the world to the United States. For comparison, the trade deficit on goods and services was 5.3 percent of GDP in 2004. These capital gains can therefore be very large.[2]

This paper revisits a number of historical stylized facts about the U.S. external adjustment in light of the new data that we have put together.[3] Of particular interest to us is the idea that the United States's unique position in the international monetary order allows it to enjoy an "exorbitant privilege," in the famous words attributed to de Gaulle in 1965.[4] The specific definition of this *exorbitant privilege* has varied over time and with different commentators. For some, it refers to the fact that the U.S.'s income balance has remained positive all these years, despite mounting net liabilities. For others—and this was the interpretation favored by the French in the 1960s—the exorbitant privilege referred to the ability of the United States to run large direct investment surpluses, ultimately financed by the issuance of dollars held sometimes involuntarily by foreign central banks. This particular interpretation views the United States as playing a pivotal role at the center of the world financial system. In the words of Kindleberger (1965) and Despres, Kindleberger, and Salant (1966), the United States was the "Banker of the World," "lending mostly at long and intermediate terms, and borrowing short" thereby supplying loans and investment funds to foreign enterprises and liquidity to foreign asset holders. Since then, the United States has become an increasingly leveraged financial intermediary as world capital markets have become more and more integrated. Hence, a more accurate description of the United States in the last decade may be one of the "Venture Capitalist of the World," issuing short-term and fixed-income liabilities and investing primarily in equity and direct investment abroad. While the latter interpretation of the exorbitant privilege is, of course, consistent with the former, it is conceptually distinct. The United States's excess return of its external assets over liabilities may come from a return effect (higher returns within each asset class) or

2. See also Tille (2003, 2004).

3. We present in appendix A a line-by-line description of the database we use in this paper and in Gourinchas and Rey (2005).

4. In fact, the quote is nowhere to be found in de Gaulle's speeches. It is actually Valéry Giscard d'Estaing, Finance Minister at the time, who spoke of an "exorbitant privilege" in February 1965. He was then cited by Raymond Aron in *Le Figaro,* February 16, 1965, from *Les Articles du Figaro, vol. II* (Paris: Editions de Fallois, 1994), 1475. We thank Andrew Moravcsik and Georges-Henri Soutou for this information.

from a composition effect (the structure of the balance sheet is asymmetric with more low yielding assets on the liability side). One contribution of this paper is to present a break up of the exorbitant privilege into these return and composition effects over the whole postwar period.

We begin by presenting our estimates of the net foreign asset position of the United States between 1952 and 2004 in section 1.2. In particular, we compare our results to the official numbers. Section 1.3 provides a first historical measure of the exorbitant privilege by estimating yields and total returns on the net foreign assets of the United States between 1952 and now. We show that our data support the notion that the United States enjoyed a substantial premium on its gross assets relative to its liabilities and that this premium has been increasing since the collapse of the Bretton Woods fixed exchange rate system.

Section 1.4 studies the evolution of the composition of gross assets and liabilities and relates it to the role of the United States as the world venture capitalist. We find that a nonnegligible fraction of the exorbitant privilege comes from the risk premium that the United States enjoys, even though the major part of the exorbitant privilege comes from return differentials between U.S. and foreign assets within each class of assets. Finally, in section 1.5, we present simple estimates of the amount of depreciation of the U.S. dollar needed to wipe out given amounts of U.S. external debt via both the valuation and trade channels.

1.2 Measurement of the U.S. External Asset Position

1.2.1 The U.S. Net Foreign Asset Position Reconstructed: 1952–2004

We first set the stage with a comparison of various estimates of the U.S. net foreign asset position. The methodological details on the construction of our own estimates are provided in appendix A. Briefly, the main drawback of the official series is that they generally measure the U.S. external investment position not at current prices but at historical cost. It is well known, for example, that the current account is measured at historical cost. This implies that the official statistics are inappropriate to study valuation effects. Hence, we construct market value estimates of each asset and liability category from 1952 by combining data from the BEA's international investment positions data (after 1980) and data on international transactions from both the BEA and the Flow of Funds. We compute dollar capital gains or losses for each asset category (equity, bonds, foreign direct investment [FDI], bank loans and trade credit) and apply those valuation adjustments to our international investment position series. We use available Treasury benchmark surveys on external asset and liabilities to form estimates of the currency and country weights in the U.S. investment portfolio. Our constructed series give, therefore, a quarterly account of

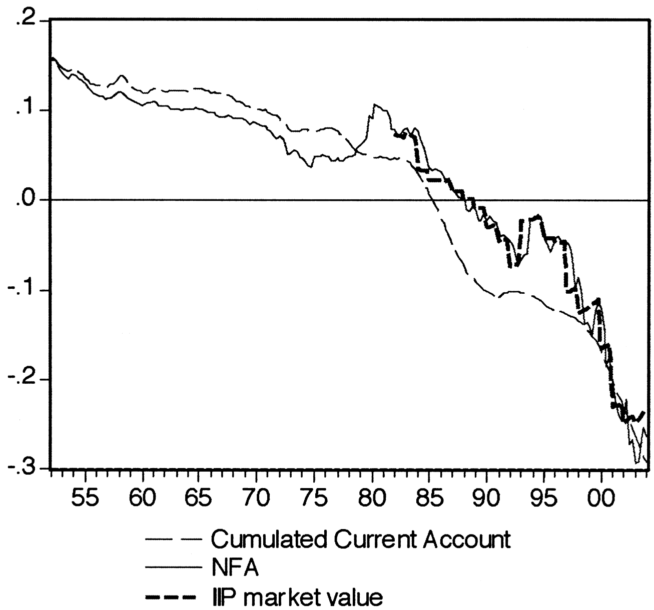

Fig. 1.1 U.S. net foreign assets, relative to GDP, 1952:1 to 2004:1
Sources: BEA (http://www.bea.gov) and authors' calculations.

U.S. external wealth dynamics at market prices since 1952:1, disaggregated by asset class.

Figure 1.1 reports three different measures of the U.S. net foreign asset position. We denote by NFA_t our constructed net foreign asset position at the end of period t. Figure 1.1 also reports the naive estimate obtained from cumulating current accounts,[5] as well as the BEA's estimates of the U.S. international investment position (IIP) at market value since 1982.

The three series exhibit a striking common trend: the United States went from a sizable creditor position in 1952 (15 percent of GDP) to a large debtor position (–26 percent of GDP) by the end of the period. According to our data, the United States became a net debtor around 1988, which is roughly similar to the official data with valuation effects (1989). Our NFA series is also reassuringly close to the BEA's IIP estimates available only after 1982, in spite of a different approach to valuing direct investment positions.

While the general tendency of the three measures is the same, figure 1.1 reveals that valuation components have an important influence on the

5. Starting from our estimate of NFA in 1952:1. The current account data are from the National Income and Products Accounts (NIPA, table 4.1) since the balance-of-payments (BOP) data only extend back to 1960. There are small differences between the BOP and the NIPA definitions of the current account. These are largely irrelevant for our analysis.

Fig. 1.2 Net valuation component (relative to GDP)

short- to medium-run dynamics of the U.S. external position. We define the *valuation component* as the difference between our measure (NFA) and the cumulated current account series (Σ CA). It reflects exactly the cumulated value of the capital gains and exchange rate adjustments omitted from the current account measure. Figure 1.2 reports this net valuation component as a share of GDP and highlights a number of interesting facts.

First, during the Bretton Woods period and until 1977, the cumulated current account measure tended to overestimate the NFA position of the United States, by up to 4 percent of GDP. Since then, valuation effects worked in favor of the U.S., and reached a peak of 9.4 percent of GDP in 1994:3. The figure reveals a striking correlation: the valuation component was on average negative while the United States was a net creditor and positive after the United States became a net debtor. The startling implication is that *over the entire period,* and with the exception of a few years, the valuation component worked to *stabilize* the net foreign asset position of the United States and offset current account movements.

Second, the evolution of the valuation component is consistent with the broad evolutions of the U.S. dollar. The period of the dollar depreciation after 1985 as well as the more recent depreciation can be clearly identified on the figure, associated with an increase in the valuation component. Conversely, between 1995 and 2003 the valuation component largely disappeared while the dollar appreciated.

Third, there are a few important exceptions to that pattern. Most dramatically, we observe a dramatic turnaround in the valuation component in 1977 to 1980. Between 1976:4 and 1980:2, the valuation components

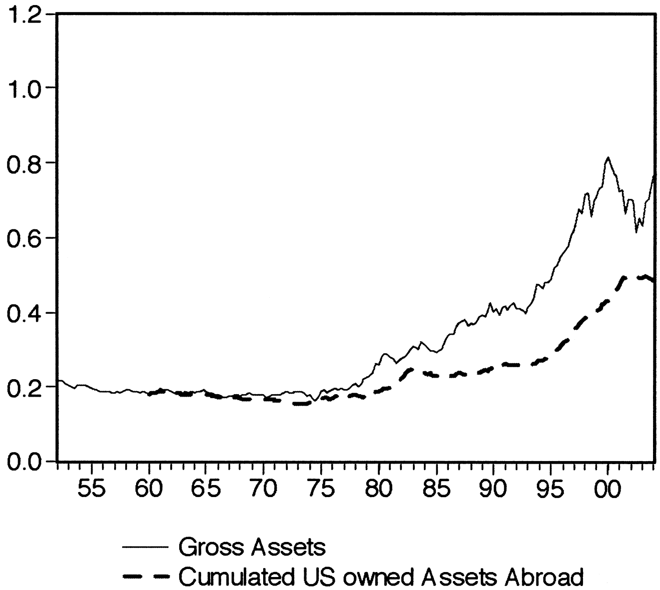

Fig. 1.3 Gross assets position and cumulated U.S.-owned foreign assets (relative to GDP)

shifts from –3.6 percent to 5.9 percent of GDP, a total shift representing about 10 percent of GDP. During that period, the returns on U.S. gross foreign assets far exceeded the returns on U.S. gross liabilities. This was in large part due to low returns on U.S. equities. The U.S. stock market dramatically underperformed the foreign stock markets over that period, which substantially increased the value of U.S. net foreign assets.[6]

1.2.2 Gross External Positions and Valuations

One additional benefit of reconstructing the net foreign asset position from the underlying disaggregated data is that we can document the time evolution of the gross assets and liabilities separately. Figures 1.3 and 1.4 report the naive construction of gross asset and liability positions, starting in 1960 and cumulating the corresponding balance of payment flows, together with our estimates. The difference between the two series provides a direct estimate of the valuation component on the underlying gross positions (figure 1.5 reports the two valuation components side by side).

We observe first that the share of U.S. gross assets in GDP remained

6. During this period, the annual dollar capital gain on the U.S. stock market averaged only 2.2 percent, while the same return was 31.7 percent on the U.K. stock market and 18.3 percent on the Japanese stock market. These two countries accounted for 38 percent of U.S. equity assets (see table 1B.2 in appendix B).

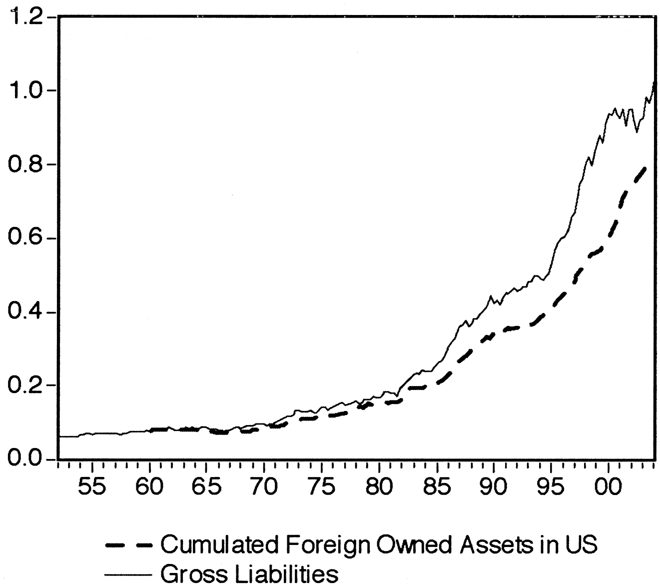

Fig. 1.4 Gross liability position and cumulated foreign-owned U.S. assets (relative to GDP)

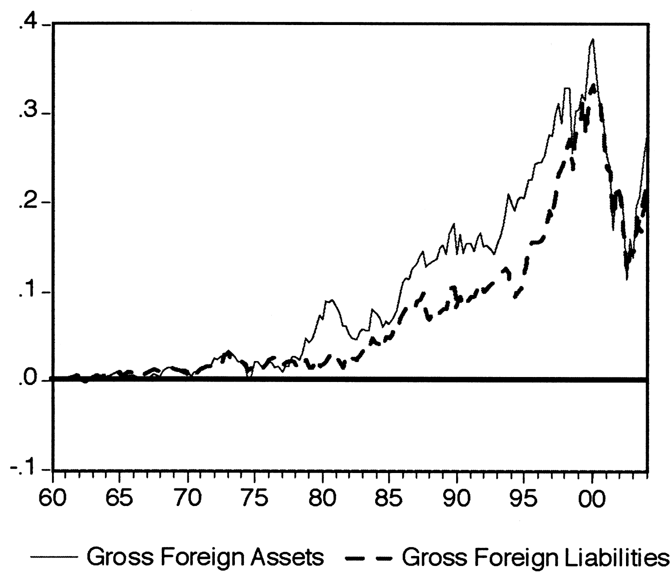

Fig. 1.5 Valuation effects, gross foreign assets, and gross foreign liabilities (relative to GDP)

stable or even slightly declining between 1952 and 1975 (figure 1.3). Starting in 1975, it has grown rapidly, reaching 80 percent of GDP in 2000. The share of U.S. gross liabilities in GDP, on the other hand, has increased throughout the postwar period, with a sharp acceleration post-1980 (figure 1.4).

The valuation component on the gross positions is an order of magnitude larger than on the net positions. It accounts for 45 percent of gross assets and 30 percent of gross liabilities in 2000 and around 35 percent of GDP. The evolution of that component reflects the evolution of asset returns. Both valuation components grew rapidly over time until 2000 (figure 1.5). Then they declined precipitously as asset prices around the world collapsed.

1.3 The Exorbitant Privilege Part I: Yields and Total Returns

Now that the stage is set, we begin our analysis of the external balance of the United States. We start with the famous observation that the large increase in U.S. net liabilities to the rest of the world has not been accompanied by a commensurate increase in net income payments. It is well known that the income account has remained positive for the United States despite gross liabilities exceeding assets by approximately 34 percent in 2004. In other words, the income generated by the (smaller) U.S.-owned assets abroad is larger than the income paid on the (larger) foreign-owned assets in the United States. This observation is sometimes taken as evidence that the United States enjoys an exorbitant privilege in the sense that it can borrow at a discount on world financial markets. Figure 1.6 presents the annual yield on the NFA as a percent of GDP, since 1960. Despite a substantial drop in the mid 1980s, it remained positive throughout the period.

One should recognize, however, that the yield represents only one component of the total return on U.S. gross external assets and liabilities. The other component is the dollar capital gain or loss due to asset price and currency fluctuations. Figure 1.6 reports our estimate of the total annual return on the net foreign asset portfolio as a percent of GDP.

The first striking observation is the volatility of total returns relative to yields, especially after 1975. Total returns fluctuate between –3.4 and 6.4 percent of GDP, while the income balance represents between 0.09 and 1.2 percent of GDP (we can see on this figure the large total return between 1976 and 1980 that underlies the turnaround in the valuation component as well as the effect of the depreciation of the dollar after 1985).

Second, total returns can be substantially negative. The annual return (relative to GDP) was indeed negative in all but two years from 1995 to 2001, a period during which the dollar appreciated substantially.

Third, despite this substantial volatility, the average total return on assets and liabilities is consistent with the evidence on yields. Over the sample

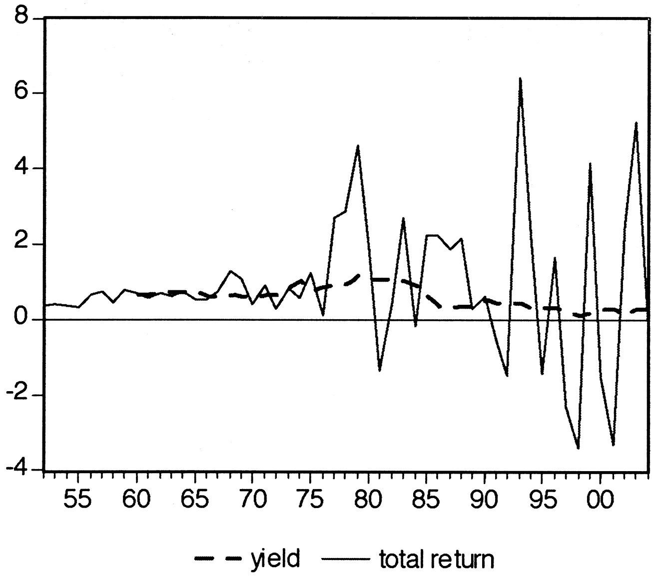

Fig. 1.6 Yield and total return on NFA (in percent, annual rate, relative to GDP)
Sources: U.S. international transactions (BEA; http://www.bea.gov) and authors' calculations.

period, we find that the annualized average real rate of return on gross liabilities (3.61 percent) is substantially smaller than the annualized average real rate of return on gross assets (5.72 percent). The difference, 2.11 percent, is quite considerable.[7]

Moreover, if anything, the puzzle has increased over time. Our estimates indicate that the average total return on assets during the Bretton Woods period (4.04 percent) was only 26 basis points larger than the average total return on gross liabilities (3.78 percent). Since 1973, however, the gap has widened enormously. The post-Bretton Woods average asset return is 6.82 percent, while the corresponding total liability return is only 3.50 percent. The excess return reaches an astonishing 3.32 percent (see figure 1.7). Hence, the exorbitant privilege puzzle is reinforced when one looks at total returns.

We can use these historical averages to assess the tipping point beyond which we should expect the United States to pay more on its gross liabilities than it earns on its gross assets. The calculation, first proposed by Obstfeld and Taylor (2005), goes as follows. The tipping point is defined

7. These returns are reported in table 1.1. For a study disentangling the effect of capital gains, investment flows and trade balance on the accumulation of net foreign assets of different countries see Lane and Milesi-Ferretti (chap. 2 in this volume).

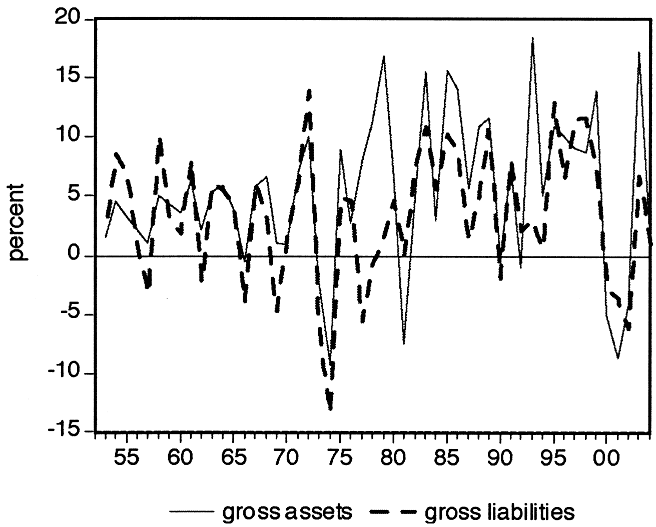

Fig. 1.7 Annual real return on gross assets and gross liabilities (1952–2004)

as that ratio of gross liabilities to gross assets beyond which $\tilde{r}^a A - \tilde{r}^l L$ becomes negative, where $\tilde{r}^a$ (respectively $\tilde{r}^l$) denotes an estimate of the *nominal* average total return on gross assets A (resp. liabilities L).

Using the nominal historical values of $\tilde{r}^a$ and $\tilde{r}^l$, we estimate a tipping point $L/A > \tilde{r}^a/\tilde{r}^l = 1.30$.[8] The implication of the exorbitant privilege is that a 2 percent excess return allows the United States to accumulate debt exceeding its gross assets by 30 percent and yet still be a recipient of positive investment income. Because the exorbitant privilege of the United States has increased over time, the tipping point has also been pushed back substantially. Calculated using the average returns over the Bretton Woods period, we estimate a tipping point of only 1.04. Using the post-Bretton Woods period estimates of returns, the tipping point now reaches an astonishing 1.43.

Interestingly, our estimates of the net foreign asset position of the United States suggest that the leverage ratio L/A has increased steadily over the period from 0.3 in 1952 to 0.73 in 1973, reached 1.09 in 1991 and, finally, 1.34 in 2004. Hence, the United States may be getting close to the position where it will have to start making net payments to the rest of the world.

Of course, this simple computation ignores the endogeneity of the returns on gross assets and liabilities. Reaching the tipping point where the

8. The values of the nominal returns on assets and liabilities $\tilde{r}^a$ and $\tilde{r}^l$ are, respectively, for the whole sample 9.15 percent and 7.04 percent; for the Bretton Woods period, 6.32 percent and 6.06 percent; for the post-Bretton Woods period, 11.00 percent and 7.69 percent.

United States for the first time since the second World War ceases to have a positive net return on its net assets could be seen by the market as a significant blow to the credibility of the dollar. In a context where the external net worth of the United States is negative and the return on its net assets also turns negative, market participants could start demanding a higher premium on their dollar assets, thereby setting off unstable dynamics. This may also affect the structure of market participants' borrowing: for example, they could start to coordinate on another international currency, such as the euro, to provide liquidity. They could also abandon short-term, low-yield U.S. securities such as T-Bills for higher yielding assets (equity, FDI).[9] This would considerably change the external balance sheet of the United States and narrow the gap between the total return on U.S. assets and liabilities, further deepening the adjustment problem. As the gap between the return on gross assets and gross liabilities declines, the net interest burden would rise rapidly, setting off further moves away from U.S. assets. While this is a possible scenario, we stress that understanding the dynamics of the composition of international portfolios, asset returns, and the exchange rate requires a dynamic general equilibrium model of the world economy, which is well beyond the scope of this paper.

1.4 The Exorbitant Privilege Part II: The United States as World Venture Capitalist

1.4.1 Composition of the Gross Asset and Liability Position

We now turn our attention to the structure of gross assets and liabilities and its evolution over time. This structure is particularly interesting in the case of the United States, which has been the center country of the Bretton Woods system since 1944 and has remained the most important financial center in the world, even after the collapse of the fixed exchange rate regime.

The United States has succeeded the United Kingdom as the "Banker of the World" and the issuer of the main international currency. This means, in particular, being able to borrow short (foreigners are willing to purchase liquid dollar assets) and lend long (the United States supplies long-term loans and investment funds to foreign enterprises). Just like a bank, the United States can extract an intermediation margin, given by the (positive) return differential between external assets and liabilities. During the whole period, U.S. assets have shifted more and more out of long-term bank loans toward FDI and, since the 1990s, toward FDI and equity. At the same time, its liabilities have remained dominated by bank loans, trade

9. Witness the recent attempts by China to move away from U.S. treasuries and into direct investment (Maytag, Unocal, IBM).

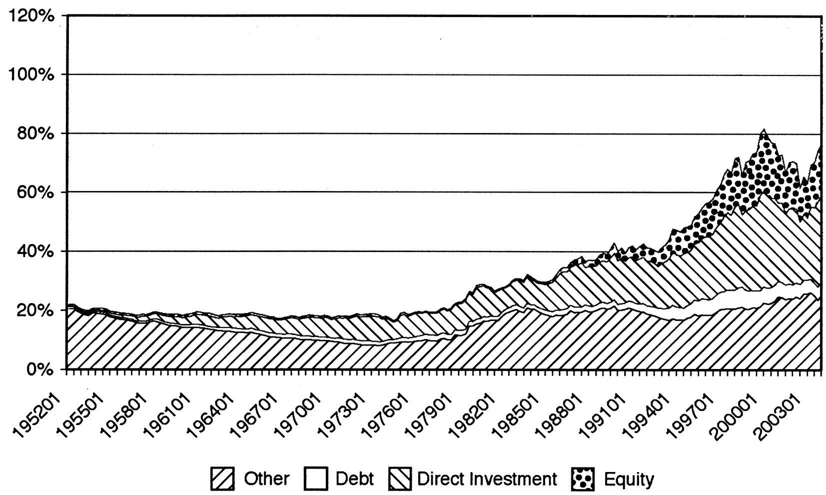

Fig. 1.8 U.S. gross external asset (share of GDP), 1952–2004
Source: Authors' calculations.

credit, and debt, that is, low-yield safe assets. Hence, the U.S. balance sheet resembles increasingly one of a venture capitalist with high-return risky investments on the asset side. Furthermore, its leverage ratio has increased sizably over time.

The currency denomination of securities is also rather specific. The issuer of the international currency is able to denominate its entire stock of liabilities in dollars, thereby shifting the exchange rate exposure to the rest of the world. This key characteristic of the external balance sheet of the United States, shared to some extent by other developed countries, is instrumental in the stabilization of the external accounts of these countries. As pointed out in Gourinchas and Rey (2005), a depreciation of the U.S. dollar has two beneficial effects on the external position. It helps to increase net exports (*trade adjustment channel*), and it also increases the dollar value of U.S. assets (*valuation channel*).

Figures 1.8 and 1.9 present our estimates of the ratio of each asset class to GDP. Several interesting episodes can be read from these graphs: (a) the petrodollar recycling in the 1970s until the Latin American debt crisis of 1982 (see the large increase in "other assets"—mostly bank loans over that period—followed by a stagnation and a decrease); (b) the erosion of the home bias in equity portfolios at the end of the 1990s (particularly spectacular in the U.S. asset portfolio); (c) the bursting of the equity market bubble in 2000 to 2001 (which affects both the U.S. gross assets and liabilities).

During the 1960s, the United States was running moderate current account surpluses but was investing sizable amounts abroad in the form of FDI. The share of FDI steadily increased between 1952 and 1973, from

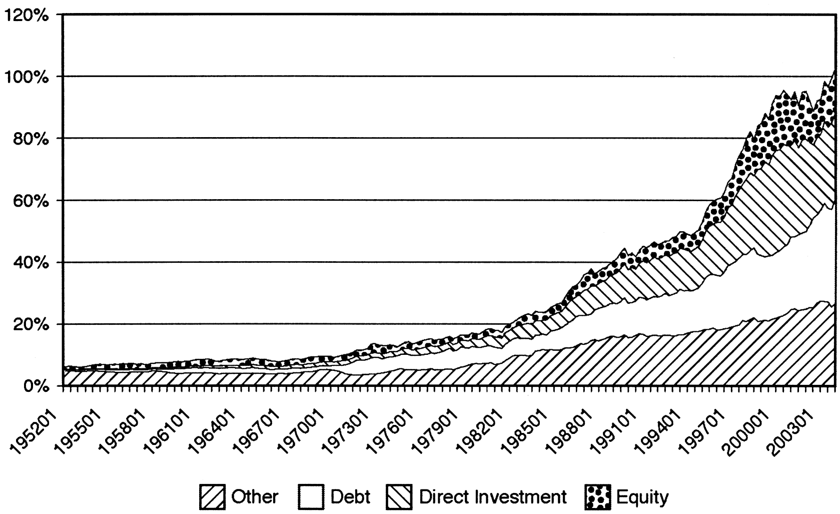

Fig. 1.9 U.S. gross external liabilities (share of GDP), 1952–2004
Source: Authors' calculations.

zero to 40 percent of gross external asset positions. On February 4, 1965, the French president de Gaulle famously complained in a press conference at the Elysée Palace that an increase in the U.S. money supply was leading to increased capital outflows from the United States and "for some countries to a sort of expropriation of their enterprises." For de Gaulle, the role of the dollar as the international currency meant that the United States could borrow money from the rest of the world free of charge. By printing dollars and using them to purchase foreign companies, it was claimed, the United States was abusing its hegemonic position at the center of the international monetary system. But these long-term capital outflows led to a continuous drain of the U.S. gold reserves, despite the numerous and futile attempts by the United States to limit the size of the balance of payments deficit. This is visible in figure 1.8 where a sharp increase in FDI assets is matched almost one for one by a decrease in other assets. As figure 1.10 documents, a substantial share of the decline in other assets was due to the drain on U.S. gold reserves. Successive U.S. administrations used various expedients such as the interest equalization tax, voluntary restraint programs, restrictions on tourism, offset agreements, and sheer political pressure on foreign central banks (especially the Bundesbank and the Bank of Japan) to prevent dollars held abroad from being converted into gold. Despite these interventions, the credibility of the convertibility of the dollar waned over time, and the tensions on the foreign exchange markets culminated in 1970 and 1972 to 1973, with successive runs on the dollar that triggered the collapse of the fixed exchange rate system of Bretton Woods.

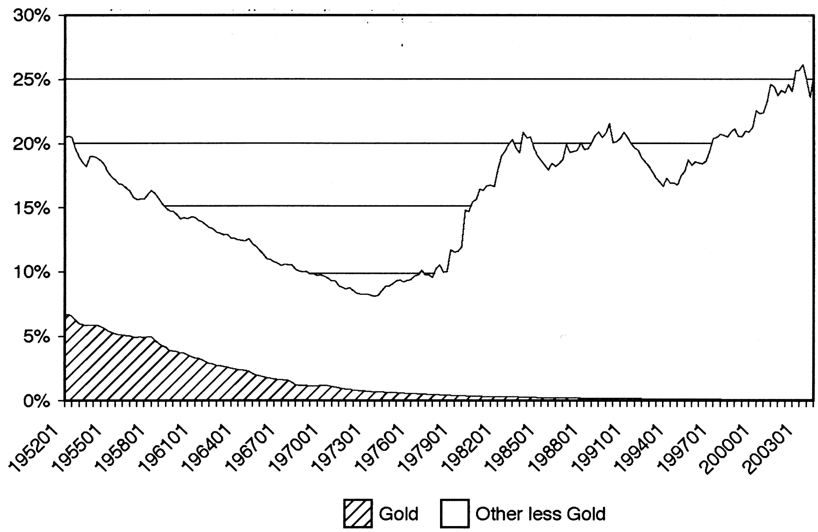

Fig. 1.10 U.S. other gross assets and gold (share of GDP), 1952–2004

The abandonment of gold parity, however, did not lead to the demise of the dollar as the main international currency.[10] The United States has remained the world liquidity provider ever since. As shown in figure 1.11, the share of liquid liabilities (defined as debt, trade credits, and bank loans) in total U.S. liabilities has gone down only slightly, from roughly 70 percent in 1973 to around 60 percent in 2004 (the decrease of the end of the 1990s is due to the equity bubble). This constitutes a remarkably high share of total liabilities. It reflects the high demand from the rest of the world for liquid U.S. securities as a transaction medium, reserve or store of value, both during Bretton Woods and after the collapse of the fixed exchange rate regime.

Over the same period, the share of high-yield risky investment increased considerably. From a conservative world banker, the United States became a bold world venture capitalist. The share of risky assets in total assets increased continuously during the Bretton Woods era, as growing FDI outflows led to a decrease in gold reserves. This gold drain was stopped in 1973 once the Nixon Administration decided to end the convertibility of the dollar. After the emerging market debt crisis of the 1980s and the deregulation of equity markets of the 1990s, the growth in FDI and portfolio equity flows gathered pace so that by 2004, the share of risky assets in the total asset portfolio of the United States reached about 60 percent, against

10. See Portes and Rey (1998) for a review of the dominant position of the U.S. dollar in the international monetary system.

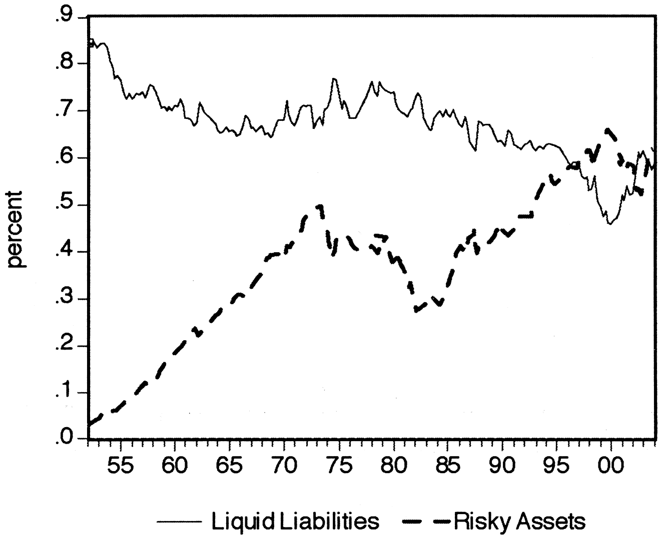

Fig. 1.11 Share of risky assets in all assets and share of liquid liabilities in all liabilities (1952–2004)

roughly 50 percent in 1973. Hence the collapse of Bretton Woods has not deprived the United States of its fundamental role as world liquidity provider. This upward trend in the share of high-yielding risky assets is consistent with the increase over time of the (positive) return differential between assets and liabilities, as documented in the previous section.[11]

1.4.2 Total Returns

The yields that the United States receives on its external assets are higher that the yields that it pays on its liabilities. In the previous section, we showed that this is also true for the aggregate total returns on the net foreign asset position of the United States. We now look at total returns on gross assets and liabilities and on each class of assets independently. Table 1.1 presents estimates of average total real annual returns on the different subcomponents of assets and liabilities for the whole sample, the Bretton Woods period and the floating exchange rate regime.[12] We denote by r^a, the return on gross assets; r^l, the return on gross liabilities; r^{ae}, the return on equities; r^{ad}, the return on debt; r^{af}, the return on FDI; and r^{ao}, the return on others (all returns are real). Symmetrically, r^{le} denotes the return on foreigners' holdings of U.S. equity (in other words, U.S. equity liabilities); r^{lf},

11. It would be of great interest to compare the balance sheet of the United States to those of other developed countries more precisely. This is the undertaking of Obstfeld and Taylor (2005).

12. See appendix B for details on how we computed the returns.

Table 1.1 **Descriptive statistics: Average quarterly total real returns (annualized; %)**

Total real returns	r^{a}	r^{l}	r^{ae}	r^{af}	r^{ad}	r^{ao}	r^{le}	r^{lf}	r^{ld}	r^{lo}
A. Summary statistics (1952:1–2004:1)										
Mean	5.72	3.61	13.68	9.57	4.35	3.43	10.28	9.56	0.51	1.19
Standard deviation	11.98	10.49	39.76	23.10	15.94	9.33	36.70	24.18	13.09	4.91
Sharpe ratio	47.73	34.40	34.39	41.43	27.31	36.78	28.02	39.56	3.87	24.29
B. Summary statistics (1952:1–1973:1)										
Mean	4.04	3.78	10.83	9.44	4.82	2.40	11.59	9.96	0.80	1.24
Standard deviation	4.79	9.60	36.83	16.32	17.67	1.75	36.29	21.33	10.66	1.32
Sharpe ratio	84.51	39.34	29.41	57.85	27.29	137.10	31.93	46.68	7.47	94.63
C. Summary statistics (1973:1–2004:1)										
Mean	6.82	3.50	15.54	9.65	4.05	4.11	9.43	9.31	0.32	1.16
Standard deviation	18.84	11.07	41.61	26.69	14.77	11.89	37.09	25.96	14.50	6.24
Sharpe ratio	45.91	31.60	37.35	36.16	27.40	34.54	25.43	35.85	2.19	18.58

the return on FDI liability; r^{ld} and r^{lo}, the return on debt and other liability, respectively.

Several features are noteworthy. First, as we already mentioned, over the whole period, the United States gained a sizable excess return in real terms on assets over liabilities (2.11 percent = 5.72 percent – 3.61 percent). This excess return is especially large during the floating exchange rate period (between 1973 and 2004, it is equal to 3.32 percent in real terms). Considering each asset in turn, the United States earns an average of 340 basis points (bp) excess return yearly on its equity assets (r^{ae} versus r^{le}), 384 bp on its debt (r^{ad} versus r^{ld}) and 214 bp on its bank loan and trade credits (r^{ao} versus r^{lo}). By contrast, the United States does not seem to enjoy sizable superior returns on its direct investment abroad. The excess return is only 1 bp (r^{af} versus r^{lf}).

Second, there is a sizable gap between returns on the safe assets (debt and others) and the returns on risky assets (equity and FDI). During the 1950s and the 1960s, foreigners earned a very low real return on U.S. debt (0.80 percent, on average): de Gaulle was not that far off when he was talking of the U.S. debt being free of charge. With the advent of the floating exchange rate regime, the real returns on debt became even lower (0.32 percent on average).

Third, the volatility of all returns has increased significantly after the collapse of Bretton Woods so that the Sharpe ratios of assets have in general declined during the floating exchange rate regime.

1.4.3 A Break Up of Total Returns

The large positive excess real return of gross assets over gross liabilities can be broken up into a *composition* effect and a *return* effect. The U.S. liabilities are dominated by low-yield safe securities, whereas U.S. assets contain a large (and increasing over time) share of FDI and equity. The United States can be therefore characterized as a very leveraged investor, which is increasingly shorting low-yield securities to buy high-yield investments. This is the composition effect. But there is also a return effect. Within each class of assets, the preceding discussion showed that the United States earned higher returns on its assets than on its liabilities. This return effect represents the other dimension of the exorbitant privilege and could occur, in particular, because of a liquidity discount for the issuer of the international currency as discussed in Portes and Rey (1998). Formally, we can decompose the return on assets r^a and the return on liabilities r^l as

$$r^a = \mu^{ae}r^{ae} + \mu^{ad}r^{ad} + \mu^{af}r^{af} + \mu^{ao}r^{ao}$$
$$r^l = \mu^{le}r^{le} + \mu^{ld}r^{ld} + \mu^{lf}r^{lf} + \mu^{al}r^{lo},$$

where μ^{ae}, μ^{af}, μ^{ao}, and μ^{ad} are the weights on equity, FDI, other foreign assets (bank loans and trade credit) and debt in total assets. Notations for the liability side are defined in an entirely symmetric fashion.

We can then write the expected excess return of assets over liabilities as

$$\begin{aligned} E(r^a - r^l) = {} & E[\overline{\mu}^o(r^{ao} - r^{lo})] + E[\overline{\mu}^d(r^{ad} - r^{ld})] + E[\overline{\mu}^e(r^{ae} - r^{le})] \\ & + E[\overline{\mu}^f(r^{af} - r^{lf})] + E[(\mu^{ad} - \mu^{ld})(\overline{r}^d - \overline{r}^o)] \\ & + E[(\mu^{ae} - \mu^{le})(\overline{r}^e - \overline{r}^o)] + E[(\mu^{af} - \mu^{lf})(\overline{r}^f - \overline{r}^o)], \end{aligned}$$

where E denotes the expectation sign, $\overline{\mu}^i = (\mu^{ai} + \mu^{li})/2$ is the average portfolio share for asset class i and $\overline{r}^i = (r^{ai} + r^{li})/2$ is the average return on asset class i. The first four terms represent the *return* effect. They denote the average excess return on external assets relative to liabilities within each class of assets. This return effect is zero if the return is the same within each asset class ($r^{ai} = r^{li}$).

The last three terms represent the *composition* effect. It quantifies the difference in weights between assets and liabilities for equity, FDI, and debt. The composition effect is zero if U.S. external assets have the same composition as U.S. external liabilities ($\mu^{ai} = \mu^{li}$).[13]

In table 1.2, we analyze the relative importance of the composition and return effects in explaining the high return enjoyed by the United States on its net foreign asset position. All the returns are in percentage terms.

We first observe that the return effect plays a dominant part in explaining the excess return of the U.S. net foreign asset portfolio. We find that it accounts for 1.97 percent of the 2.11 percent total excess return over the entire sample, 1.23 percent during the Bretton Woods period, and 2.45 percent since 1973. The return effect is especially significant for the short-term

13. The shares μ^{ai} and μ^{li} are time-varying. Hence, the overall excess return depends also upon the covariance between asset returns and shares.

Table 1.2 **Break-up of total real returns in a return and a composition effect**

	Return effect					Composition effect				Total
Period	Other (1)	Debt (2)	Equity (3)	FDI (4)	Total (1) to (4)	Debt (5)	Equity (6)	FDI (7)	Total (5) to (7)	$r^a - r^l$ (1) to (7)
1952–2004	1.00	0.56	0.35	0.06	1.97	0.03	–0.59	0.70	0.14	2.11
1952–1973	0.69	0.38	0.04	0.12	1.23	–0.23	–1.46	0.73	–0.96	0.27
1973–2004	1.21	0.68	0.55	0.01	2.45	0.20	–0.02	0.68	0.86	3.32

liquid assets (other and debt) where it accounts for about half of the total excess return (1.56 percent of the total 2.11 percent). It is smaller in the other asset classes, although it remains positive for all asset classes on all subsamples.

The composition effect plays a smaller role over the entire sample (0.14 percent), but its relevance has increased significantly over time, from –0.96 percent before 1973 to 0.86 percent since then. Hence, between a quarter and a third of the current excess return (3.32 percent) can be explained by the asymmetry in the U.S. external balance sheet and the fact that the United States earns an equity premium. Looking at the subcomponents of this composition effect, we find that most of it arises from the asymmetry in direct investment (0.70 percent). The increased contribution of the composition term, however, reflects mostly the increased symmetry in equity positions (from –1.46 percent to –0.02 percent), reflecting the decrease of home bias in U.S. portfolios (the share of foreign equity in U.S. portfolios has risen over time).

1.5 Exchange Rate Adjustment

Current external imbalances can be compensated either by future trade surpluses or by future favorable returns on the net foreign asset position of the United States. In this section, we perform a simple exercise, meant to illustrate the joint capacity of the *valuation channel* and of the more traditional *trade channel* to stabilize the external accounts of the United States. Gourinchas and Rey (2005) show that the valuation channel operates at short to medium horizons, while the trade channel operates in the medium to long run. Historically, the valuation channel has contributed around 30 percent of the process of international adjustment.

The exercise we perform in this section should be taken with a lot of caution and is meant to be illustrative as we do not have a structural model of the U.S. and foreign economies. The elasticities presented in table 1.3 in particular are dependent on the underlying model of the economy and of the shocks.

Table 1.3 **Elasticities of asset and liability returns to exchange rate changes**

	Horizon h (years)				Horizon h (years)		
$h =$	1	3	5	$h =$	1	3	5
β_a^h	0.28	0.26	0.19	β_l^h	–0.08	–0.15	–0.14
Standard error	(0.10)	(0.09)	(0.08)	Standard error	(0.08)	(0.09)	(0.09)
$\bar{r}_h^a$ (annualized)	6.64%	6.96%	7.52%	$\bar{r}_h^l$ (annualized)	3.6%	4.04%	4.44%

1.5.1 Theory

We start from the law of accumulation of foreign assets between t and $t + 1$:

$$\text{NFA}_{t+1} \equiv R_{t+1}\text{NFA}_t + \text{NX}_{t+1}, \tag{1}$$

where NX_t represents net exports, defined as the difference between exports X_t and imports M_t and net foreign assets NFA_t is defined as the difference between gross foreign assets A_t and gross foreign liabilities L_t measured in domestic currency at the end of period t. Equation (1) states that the net foreign position increases with net exports and with the total return on the net foreign asset portfolio R_{t+1}. Dividing through by U.S. GDP Y_t, and using lowercase letters to denote normalized variables (so that $\text{nfa}_t = \text{NFA}_t/Y_t$), we obtain

$$\text{nfa}_{t+1} = \frac{R_{t+1}}{g_{t+1}}\text{nfa}_t + \text{nx}_{t+1}, \tag{2}$$

where g_{t+1} represents the growth rate of output between t and $t + 1$.

Net exports and the return on the net foreign asset positions are both affected by movements in the exchange rate. In the case of the United States, a dollar depreciation helps on both counts. It stimulates net exports and it increases the dollar value of U.S. assets, thereby improving the return on the net foreign asset position. This is because most U.S. liabilities are in dollars, whereas a share of U.S. assets are in foreign currency.[14] We estimate the magnitude of a devaluation needed, ceteris paribus, for the U.S. net foreign debt and the U.S. net exports to satisfy the following long-run equilibrium (steady state) condition, obtained from equation (1):

$$\text{nx} = \left(1 - \frac{R}{g}\right)\text{nfa}, \tag{3}$$

where variables without time subscript denote steady state values. Numerically, we equate g to the historical average of real GDP growth (1.033 per

14. In contrast, for an emerging market with dollarized liabilities, a depreciation will be destabilizing.

year in gross terms). R is the steady-state rate of return on the net foreign asset position. From Gourinchas and Rey (2005), we know that $R = g/\rho$, where ρ is a growth-adjusted discount factor, a function of steady state weights on exports, imports, assets, and liabilities. Empirically, we assume that $\rho = 0.95$, which implies that $R = 1.033/0.95 = 1.0874$ (the net steady-state return on the net foreign asset position is therefore equal to 8.74 percent). Given these estimates, we find a long-run ratio of net exports to net foreign assets equal to nx/nfa $= 1 - R/g = -5.26\%$.

Next, we need to quantify the effect of an exchange rate depreciation on net exports and on the net foreign asset portfolio return. Estimates in the literature imply that a 1 percent increase in the ratio of net exports to GDP requires a depreciation of 11 to 20 percent of the exchange rate (see Blanchard, Giavazzi, and Sa 2005). We pick two estimates: a middle range estimate of 15 percent and a low estimate of 10 percent. Hence, we assume

$$\text{dnx} = \eta \frac{de}{e}, \tag{4}$$

where η is taken to be 1/15 or 1/10.

We now assess the effect of a change in the exchange rate on the first term on the right-hand side of (2). Using the definition of R_{t+1}, we can write

$$R_{t+1}\text{nfa}_t = r^a_{t+1}a_t - r^l_{t+1}l_t.$$

In the absence of a general equilibrium model of portfolio allocation and equilibrium returns, we make the assumption that the asset composition of the net foreign asset position remains constant relative to GDP over the period considered. Hence, the response of the net foreign asset position to changes in the exchange rate is solely determined by the response of the returns on assets and liabilities to exchange rate changes:

$$dR_{t+1}\text{nfa}_t = dr^a_{t+1}a_t - dr^l_{t+1}l_t$$

We use historical data of the floating exchange rate period to estimate the elasticity of the dollar returns on gross assets and liabilities to the exchange rate for a given horizon h. To do so, we estimate regressions of the form:

$$r^a_{t,h} = \bar{r}^a_h + \beta^h_a \frac{de_{t,h}}{e_{t,h}}$$

$$r^l_{t,h} = \bar{r}^b_h + \beta^h_l \frac{de_{t,h}}{e_{t,h}},$$

where $r^g_{t,h}$ denotes the annualized net returns on gross assets and $r^l_{t,h}$ the annualized net return on gross liabilities at horizon h, while $de_{t,h}/e_{t,h}$ is the annualized rate of depreciation between t and $t + h$. These regressions use quarterly data for the 1973 to 2004 sample. The results are reported in table

1.3, for horizons between one and five years, with standard errors in parentheses.

We find that depreciations are associated with significantly larger returns on gross assets and (marginally significantly) lower returns on gross liabilities. This indicates potentially powerful valuation effects.

Given these (admittedly) reduced-form relations, we can now estimate the magnitude of the depreciation needed for the United States to satisfy the steady state relation linking its net foreign asset position to its net exports within an horizon of h years. To do so, we start by w riting the accumulation equation (2) between t and $t + h$:

$$\mathrm{nfa}_{t+h} = \prod_{j=1}^{h}\left(\frac{R_{t+j}}{g_{t+j}}\right)\mathrm{nfa}_t + \sum_{j=1}^{h}\mathrm{nx}_{t+j}\prod_{i=j}^{h-1}\left(\frac{R_{t+i+1}}{g_{t+i+1}}\right)$$

Assuming that we reach the steady state in $t + h$, so that $\mathrm{nfa}_{t+h} = \mathrm{nfa}$ and $\mathrm{nx}_{t+h} = \mathrm{nx}$, and assuming that the growth rate of the economy is constant along this transition and equal to g, we obtain[15]

$$\mathrm{nfa} \approx g^{-h}\left[\left(\bar{r}^a_h + \beta^h_a h\frac{de}{e}\right)a_t - \left(\bar{r}^l_h + \beta^h_l h\frac{de}{e}\right)l_t\right] + \mathrm{nx}_t\frac{1-(R/g)^h}{1-R/g} + \eta\frac{de}{e}\sum_{j=1}^{h} j\left(\frac{R}{g}\right)^{h-j}. \tag{5}$$

The first term on the right-hand side reflects the impact of the change in the exchange rate on the net foreign asset position (the valuation effect). The second term represents the cumulated impact of the depreciation on the trade balance (the trade balance effect).

Finally, we observe that in the steady state, $\mathrm{nfa} = \mathrm{nx}/(1 - R/g) = [\mathrm{nx}_t + h\eta de/e]/(1 - R/g)$. Putting everything together, we can solve for the annual depreciation rate that restores the long-run external balance in h years:

$$\frac{de}{e} = \left[\frac{h\eta}{1-\dfrac{R}{\gamma}} - g^{-h}h(\beta^h_a a_t - \beta^h_l l_t) - \eta\sum_{j=1}^{h} j\left(\frac{R}{g}\right)^{h-j}\right]^{-1} \cdot \left[g^{-h}(\bar{r}^a_h a_t - \bar{r}^l_h l_t) - \mathrm{nx}_t\frac{(R/g)^h}{1-R/g}\right]$$

The required rate of depreciation depends upon the horizon h, the trade elasticity η, the semielasticity of returns to the exchange rate (β^h_a and β^h_l) as well as the initial trade balance (nx_t) and gross foreign asset positions (a_t and l_t).

15. This assumes that the growth rate of the U.S. economy is unaffected by the change in the exchange rate. Obviously, this is a strong assumption.

1.5.2 Numerical Application

We use data from 2004 for the net foreign asset to GDP ratio ($na_t = -26$ percent), the net export to GDP ratio ($nx_t = -4.8$ percent), the ratio of gross assets over GDP ($a_t = 76$ percent), and the ratio of gross liabilities over GDP ($l_t = 103$ percent). Returns and elasticity of returns to exchange rate changes are taken from table 1.3 for the relevant horizon.

Table 1.4 reveals that a return to equilibrium in one year would require an implausible depreciation of 75 percent. Such a large depreciation would turn around the trade balance from –4.8 percent to 0.18 percent. However, the main direct effect of the depreciation would be to wipe out most of the net foreign liabilities of the United States. The long-run net foreign assets would stabilize around –3.3 percent. Of course, it is rather implausible that the asset composition of international portfolios would remain constant in the face of such a major change in relative prices.

Going back to the long-run equilibrium in three years instead would require a depreciation of 26 percent per year, while a return to equilibrium in five years would require a depreciation of 18 percent per year. An extended adjustment period implies that the United States would be running current account deficits—and accumulate foreign debt—for a longer time. This has two implications. First, the long-run value of the net foreign debt remains quite substantial. In fact, we find that if the adjustment takes five years, the net foreign debt will still represent 22 percent of GDP, only slightly down from its current value of 26 percent. Second, this requires a more substantial turnaround in net exports. We find that the trade balance would have to reach a surplus of 0.46 percent each year at a three-year horizon, or 1.15 percent at five years.

A higher elasticity of exports allows for a smaller depreciation of the exchange rate. When $\eta = 1/10$, the depreciation at one year is only 53 percent and drops to 13 percent per year for a five-year adjustment. The equilib-

Table 1.4 Depreciations required to go to the long-run equilibrium

	Horizon *h* (years) =		
Annual depreciation to:	1	3	5
$\eta = 1/15$			
Required depreciation (%)	74.6	26.3	17.8
Long-run trade balance (% of GDP)	0.18	0.46	1.15
Long-run net foreign asset position (% of GDP)	–3.3	–8.7	–21.9
$\eta = 1/10$			
Required depreciation (%)	52.9	18.7	12.6
Long-run trade balance (% of GDP)	0.49	0.82	1.48
Long-run net foreign asset position (% of GDP)	–9.3	–15.6	–28.1

rium trade balance exhibits a larger surplus, and the net foreign asset debt remains comparably larger (28 percent at five years).

Our exercise is very different from Obstfeld and Rogoff (chap. 9 in this volume). They look at the effect of an unexpected drought of capital flows on the exchange rate (unanticipated forced adjustment). Unlike them, we study the effect of expected exchange rate changes on the adjustment process.

There is, of course, no theoretical reason to assume that the U.S. net foreign asset position should go back to its long-run equilibrium in one or three or five years. In Gourinchas and Rey (2005), we base our forecasts of exchange rate depreciation on historical adjustment speeds and predict smaller rates of depreciation. But the type of exercise that we have undertaken here could be seen as estimating the necessary exchange rate depreciation in the event of *exogenous* shocks on capital flows that could force the U.S. net foreign asset position to adjust suddenly.[16]

1.6 Concluding Remarks: Current Issues in Light of the Bretton Woods Debates

The main objective of this paper is to bring new data to bear on the question of the external adjustment process of the United States. We constructed a quarterly data set of U.S. external assets and liabilities at market value going back to 1952. We showed that the United States has always faced a weakened external constraint. In particular, it has consistently been able to borrow on quite favorable terms and earn a significant premium on its provision of global liquidity. Perhaps surprisingly, this ability has strengthened over time, despite the runs on the dollar of the 1970s and the demise of the fixed exchange rate system.

In this context, we find it instructive to revisit the intellectual debates of the 1960s regarding the U.S. balance-of-payments problem. We are certainly not the first ones to point out interesting parallels between the challenges of the Bretton Woods system and the current global imbalances (see Dooley, Folkerts-Landau, and Garber 2003; Eichengreen 2004). Our contribution is merely to point out what our revised estimates of the U.S. external positions have to say about both historical and current debates.

Broadly speaking, we identify three strands of analysis of the current situation with their parallels in the 1960s. The first strand puts the blame squarely on the subordination of U.S. economic policies to domestic objectives, at the expense of external adjustment. In the 1960s, many argued, the United States was unwilling to pursue the tight monetary policy that would

16. We also note that our analysis does not allow us to infer anything regarding the effect of a (possibly large) dollar depreciation on aggregate income. In that respect our analysis is very complementary to Adalet and Eichengreen (chap. 6 in this volume) and to Freund and Warnock (chap. 4 in this volume).

have been required to prevent the drain on gold reserves. Instead, the United States adopted indirect policy initiatives (interest equalization tax, offset agreements, import surcharge) that were designed specifically to free monetary policy from its external constraint. In the current context, this line of thought emphasizes the impact of the recent string of fiscal deficits (Bush tax cuts, military expenditures) on national savings (Roubini and Setser 2004).

Seen in the broader perspective that our data analysis allows, it is not clear that this can be the whole story. Since 1973, and the decoupling of the U.S. dollar from gold, the dollar exchange rates have been largely free to adjust and restore external stability—if need be—through the usual channels of adjustment. Yet what do we observe since 1973? First, a stabilization, even an improvement between 1975 and 1980, where the ratio of net assets to GDP climbs back to its 1960s level (10 percent). But this is followed by an unprecedented slide between 1980 and 2004, from 10 percent to –26 percent of GDP. Looking at the figure, the Bretton Woods era looks like a period of relatively modest balance of payments imbalances.[17] While domestic fiscal and monetary developments certainly play a role, we are struck by the secular decline in net foreign assets across the Reagan combination of fiscal deficits and tight money and the Clinton era of fiscal rectitude and surging asset prices to the current descent into fiscal deficits and lax monetary policy.

A second line of thought emphasized the unique role of the United States as the provider of the main international currency and liquidity. In 1966, Despres, Kindleberger, and Salant argued that the United States was the world banker. It provided safe low-yield assets to world savers with a preference for liquidity. In exchange, U.S. investors, with a lower taste for liquidity, saw investment opportunities in the rest of the world in the form of long-term loans. This line of thought has two modern incarnations. The first variation puts the emphasis on the central banks of developing countries and their incentive to subsidize U.S. consumption by accumulating U.S. treasury bills (Dooley, Folkerts-Landau, and Garber 2003). The second variation is very much in the spirit of the original Despres, Kindleberger, and Salant (1966) analysis. It sees the United States as a provider of safe financial assets to the rest of the world (Bernanke 2005; Cooper 2004). Following the Asian and Russian crisis, the high savings from emerging economies looked for a safe and liquid haven. The U.S. assets, especially treasuries, provided the perfect vehicle. As we show, there is substantial evidence that the United States does indeed perform the functions of a liquidity provider. This is perhaps even more the case since the liberalization

17. This is in part due to the fact that the external constraint manifested itself on a small subset of the overall external balance sheet of the United States, the Official Settlement Balance. The United States experienced a gold drain even though it was running small current account surpluses over that period. But the larger point that the overall external portfolio of the United States did not deteriorate much over that period is still valid.

of financial markets that allow equity and direct investment in emerging economies. From world banker, the United States has become, for all intents and purposes, the world venture capitalist!

Yet that analysis does not imply that the current situation can be maintained indefinitely. In fact, our analysis of the tipping point indicates that while the United States is still some ways away from making net payments on its mounting stock of net liabilities, that moment is approaching. Foreign lenders could decide to stop financing the U.S. external deficit and run away from the dollar, either in favor of another currency such as the euro or, just as dramatically, requiring a risk premium on U.S. liquid assets whose safety could not be guaranteed any longer.[18] In either case, the repercussions could be quite severe, with a decline in the value of the dollar, higher domestic interest rates and yields, and a global recession.

The previous discussion points to a possible instability, even in an international monetary system that lacks a formal anchor. The relevant reference here is Triffin's prescient work on the fundamental instability of the Bretton Woods system (see Triffin 1960). Triffin saw that in a world where the fluctuations in gold supply were dictated by the vagaries of discoveries in South Africa or the destabilizing schemes of Soviet Russia, but in any case unable to grow with world demand for liquidity, the demand for the dollar was bound to eventually exceed the gold reserves of the Federal Reserve. This left the door open for a run on the dollar. Interestingly, the current situation can be seen in a similar light: in a world where the United States can supply the international currency at will and invests it in illiquid assets, it still faces a confidence risk. There could be a run on the dollar not because investors would fear an abandonment of the gold parity, as in the 1970s, but because they would fear a plunge in the dollar exchange rate. In other words, Triffin's analysis does not have to rely on the gold-dollar parity to be relevant. Gold or not, the specter of the Triffin dilemma may still be haunting us!

Appendix A

Detailed Description of the Construction of the International Investment Position for the United States

Overview of Data Issues and Methodology

In order to evaluate the extent and the nature of U.S. external imbalances, one needs an accurate measure of the IIP of the United States. A ma-

18. For a study of the likelihood of the euro replacing the dollar as the main reserve currency, see Chinn and Frankel (chap. 8 in this volume).

jor drawback of the official balance of payments statistics is the absence of valuation in the current account measures. This implies that if one were to simply cumulate the current account to compute the net foreign asset position of the United States, one would get a biased estimate.

Data on the net and gross foreign asset position of the United States is available from two sources: the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) and the Federal Reserve Flows of Funds accounts (FFA) for the rest of the world. The BEA reports annually its *International Investment Position of the United States.* The IIP details gross and net foreign asset positions at the end of the year since 1976. In addition, the BEA reports quarterly flow data in the U.S. International Transactions (USIT) tables since 1960 for some flow series, 1982 for others.[19] The BEA data uses balance-of-payment concepts, in accordance with the IMF's *Balance of Payments Manual* (1993). Following official classifications, we split U.S. net foreign portfolio into four categories: Debt (corporate and government bonds), Equity, Foreign Direct Investment (FDI), and Other. The other category includes mostly bank loans and trade credits. The BEA data provide equity and FDI (since 1980) figures at market value and perform an exchange rate adjustment for debt. The quality of the data is good.[20]

For its part, the Federal Reserve publishes since 1952 the quarterly flows and positions for the "rest of the world" account, as part of its Flow of Funds accounts. While covering a longer sample, the FFA data presents two drawbacks. First, equity positions are the only series recorded at market value. Debt, FDI, and Other claims and liabilities are recorded at historical costs. Second, the FFA data is of poorer quality and uses National Income and Product Account (NIPA) concepts that differ subtly from their BOP equivalent. But the primary source data are often similar, except for a few items:[21] (a) the treatment of international banking facilities (IBF) and (b) the treatment of the Netherlands Antilles Affiliates. An IBF is a set of books maintained by a U.S. bank that are not subject to domestic banking regulations. They allow U.S. banks to offer offshore banking services onshore. The BEA considers that IBF are inside the United States, while the FFA consider that they are foreign residents. As to the second point, the BEA treats all transactions between parents and affiliates as part of direct investment. Instead, the FFA treats these flows as part of corporate debt liabilities.

Our approach was to supplement the BEA's IIP data for all categories of assets and liabilities, and each point in time back to 1952, using Survey of

19. For instance, equity and debt flows are available separately after 1982 only.

20. Technically, the BEA provides data on FDI at market value since 1982. However, the IMF constructed market value positions for 1980 and 1981. We use these estimates in our analysis. The Lane and Milesi-Ferretti (2001) data set includes annual data since 1973 and coincides with the BEA data after 1980.

21. See Hooker and Wilson (1989) for a detailed comparison.

Current Business reported holdings for Equity and Debt, BEA, and FFA flow data, U.S. Treasury benchmark surveys on holdings, and by constructing valuation adjustments for each subcategory of assets and liabilities. In this appendix, we describe in detail our methodology for constructing the gross asset and liability positions of the United States on a quarterly basis since 1952. In particular, we provide a reconciliation of the data treatment of the Flow of Funds and the BEA.

Denote PX_t the end-of-period t position for some asset category X. We use the following updating equation:

$$PX_t = PX_{t-1} + FX_t + DX_t, \tag{A1}$$

where FX_t denotes the flows corresponding to asset X that enters the balance of payments, and DX_t denotes a discrepancy reflecting a market valuation adjustment between periods $t - 1$ and t. When we cannot measure DX_t directly, we construct an estimate as $r_t^x PX_{t-1}$, where r_t^x represents the estimated dollar capital gain on category X between time $t-1$ and time t. Our approach, therefore, requires that we specify market returns r_t^x for each subcategory of the financial account.

Data in the final quarter of each year are mapped to the IIP data of the BEA, when available.[22] Therefore, the valuation term between the third and fourth quarters includes all adjustments not captured by our valuation method, such as change in the coverage of the series.

Reconciliation of the Flow of Funds and the BEA Data

Mapping the Flows

The material in this section draws heavily from Hooker and Wilson (1989). It is important to understand why and how the FFA and BEA data differ. First and foremost, one should realize that the BEA and FFA data are essentially compiled from the same source data. The main differences lie in the definition of the various concepts (NIPA vs. BOP), their geographical coverage, and the treatment of valuation effects. This appendix clarifies the points relevant to our analysis.

To establish a correspondence between FFA and BEA, we start from the balance-of-payment's identity:

22. The only exception is for direct investment. The reason is that when we extend the valuation adjustment used by the BEA before 1980, we end up with negative gross positions before 1970. This could come from an imperfect accounting of reinvested earnings. According to the BOP manual, direct investment income in the current account includes distributed earnings as well as the share of reinvested earnings with an offsetting entry in the financial account. This implies that reinvested earnings are included in the flow FX_t and should be excluded from the return r_t^x in equation (A1). We adjusted the valuation terms to replicate the BEA's annual adjustment from 1982 onward but chose to start both FDI gross asset and liabilities position at 0 at the beginning of our sample and update (A1) forward.

$$\text{(A2)} \qquad \mathrm{CA} + \mathrm{KA} + \mathrm{FA} + \mathrm{SD} = 0,$$

where CA denotes the U.S. current account (USIT table 1, line 76), KA the U.S. capital account (table 1, line 39), FA denotes the financial account (table 1, lines 40 and 55) and SD the statistical discrepancy (errors and omissions, table 1, line 70).[23]

The equivalent accounting identity in the FFA takes the following form.[24]

$$\text{(A3)} \qquad \mathrm{CA}' + \mathrm{KA}' + \mathrm{FA}' + \mathrm{SD}' = 0,$$

where CA′ denotes the NIPA's current account (FFA table F107, line 5 minus line 1), KA′ is the (NIPA) net capital transfers (table F107, line 8 with sign reversed), FA′ denotes NIPA's net financial investment (table F107, line 12), and SD′ denotes the (NIPA) statistical discrepancy (table F107, line 55). KA′ is equal to KA, so that we can combine (A2) and (A3) to obtain:

$$\text{(A4)} \qquad \mathrm{SD}' = (\mathrm{CA} - \mathrm{CA}') + (\mathrm{FA} - \mathrm{FA}') + \mathrm{SD}$$

The NIPA statistical discrepancy SD′ is equal to the BOP statistical discrepancy SD plus an adjustment for the difference in the definitions of the current and financial accounts in the NIPA and BOP, respectively.

Next, we decompose the financial accounts FA′ and FA as follows:

$$\mathrm{FA}' = \mathrm{FA}'_f - \mathrm{FA}'_{us}$$
$$\mathrm{FA} = \mathrm{FA}_f + \mathrm{FA}_{us},$$

where FA'_f (respectively, FA_f) represents the change in foreign-owned U.S. assets (gross liabilities) in the FFA (respectively, the BOP), and FA'_{us} (respectively, FA_{us}) represents the change in U.S.-owned assets abroad (gross assets) in the FFA (respectively, the BOP).[25] The *Guide to the Flows of Funds Accounts* (Federal Reserve Board 2000, 370–80) establishes the following correspondence between FA'_f and FA_f:

(A5) $\mathrm{FA}'_f = \mathrm{FA}_f$ + Gold and special drawing rights (SDR); (Table F107 line 14)

+ net issuance of bonds by Netherland Antillean subsidiaries (table F107, line 27b)

− change in interbank claims on foreigners (table F107, lines 15f to 15l)

23. All line references in USIT table 1 and FFA table F107 are accurate as of January 2005.

24. Note that we write this equation from the point of view of the United States, while the FFA is from the perspective of the rest of the world. So CA′ is the *opposite* of the current account recorded in the FFA.

25. This is with the BOP convention that $\mathrm{FA}_{us} < 0$ when there is a gross capital outflow.

Accordingly, gross external liabilities according to the BEA and the FFA exhibit three differences:

1. The FFA treats transactions involving Gold and SDR as changes in foreign assets, while the BEA treats them as changes in U.S. assets. In the FFA, Gold and SDR (table F107, line 14) corresponds to sales of Gold and SDR by the United States (USIT table 1, lines 42 and 43), with the sign reversed.

2. In the late 1970s and 1980s, some U.S. corporations established financial subsidiaries in the Netherland Antilles to tap international capital markets and avoid capital control and tax laws. The subsidiary would issue eurobonds and channel the funds back to the U.S. parent company. The balance of payments considers all transactions between parent and affiliates as part of direct investment and subtracts issuance of eurobonds by foreign financial subsidiaries from direct investment outflows. By contrast, the FFA treats these capital flows as direct bond issuance by the U.S. parent companies, adds them to bond liabilities, and adds them back to foreign direct investment outflows.[26] The removal of the withholding tax in 1984 eliminated the incentive to use overseas subsidiaries to issue eurobonds. The FFA practice was discontinued in the fourth quarter of 1992.

3. The FFA nets interbank claims, while the BEA reports claims on a gross basis.[27] In order to map back the FFA to the BEA, we need to subtract the "changes in net interbank claims on foreigners" (lines 15f to 15l).

Further, FA'_{us} must satisfy the key identity (A3), given SD':

$$\text{(A6)} \qquad FA'_{us} = FA'_{f} + CA' + KA' + SD'$$

The last piece of the puzzle is the definition of SD' in the FFA given by

$$\text{(A7)} \qquad \begin{aligned} SD'(\text{F107, line 55}) = {} & -CA' - KA' \ (\text{F107, line 8 with minus sign}) \\ & + SD \ (\text{F107, line 55a}) \\ & + CA \ (\text{F107, line 55b with opposite sign}). \end{aligned}$$

Combining with equation (A4), we obtain

$$FA' = FA + KA.$$

In words, the FFA net investment position includes the BEA capital transfers.

Combining (A7) and (A6), we extract FA'_{us} as

26. This assumes that the bond issue is purchased entirely by the rest of the world.

27. Net interbank claims (F107, line 15) = interbank liabilities (F107, lines 15a to e) – interbank claims (F107, lines 15f to l). An additional distinction comes from the treatment of international banking facilities, counted as domestic entities in the BOP and foreign entities in the FFA. We lump this term with the change in interbank claims on foreigners.

$$
\begin{aligned}
FA'_{us} = -FA_{us} - KA \\
&+ \text{Gold and SDR (F107, line 14)} \\
&+ \text{net issuance of bonds by Netherland Antilles subsidiaries} \\
&\text{(F107, line 27b)} \\
&- \text{change in interbank claims on foreigners (F107, lines 15f} \\
&\text{to 15l).}
\end{aligned}
$$

To summarize, the asset flow side has the same adjustments as the flow liability side, plus the subtraction of the capital account transactions.

In order to construct a measure of the U.S. international investment position comparable with existing measures, we adopt the BEA's classification. Accordingly, we adopt the following decomposition for gross assets and liabilities:

$$FA_f = FEL + FDL + FFL + FOL$$

with

$$
\begin{aligned}
FA_f &= \text{Foreign-owned assets in the United States (table 1, line 55)} \\
FEL &= \text{Equity (table 7a, line B4 and memo line 4)} \\
FDL &= \text{Debt (table 7a, line 16, 30, and memo line 3)} \\
FFL &= \text{Direct investment (table 1, line 64)}
\end{aligned}
$$

and

$$-FA_{us} = FEA + FDA + FFA + FOA$$

with

$$
\begin{aligned}
FA_{us} &= \text{U.S.-owned assets abroad (table 1, line 40)} \\
FEA &= \text{Equity (table 7a, line A4)} \\
FDA &= \text{Debt (table 7a, line 18)} \\
FFA &= \text{Direct investment (table 1, line 51).}
\end{aligned}
$$

We have similar definitions for the FFA based gross flows:

$$FA'_f = FEL' + FDL' + FFL' + FOL'$$

with

$$
\begin{aligned}
FA'_f &= \text{Net acquisition of financial assets (table F107, line 13)} \\
FEL' &= \text{Equity (table F107, line 29)} \\
FDL' &= \text{Debt (table F107, line 21, 24, and 27)} \\
FFL' &= \text{Direct investment (table F107, line 33)}
\end{aligned}
$$

as well as for FA'_{us}:

$$\text{FA}'_{us} = \text{FEA}' + \text{FDA}' + \text{FFA}' + \text{FOA}'$$

with

FA'_{us} = Net increase in liabilities of the rest of the world (table 107, line 35)

FEA' = Equity (table 107, line 47)

FDA' = Debt (table 107, line 40)

FFA' = Direct investment (table 107, line 53).

According to the Guide to the Flow of Funds (Federal Reserve Board 2000), the FFA and BOP series satisfy

$\text{FDL}' = \text{FDL}$ + net issuance of bonds by Netherland Antilles subsidiaries (F107, line 27b)

$\text{FEL}' = \text{FEL}$

$\text{FFL}' = \text{FFL}$

$\text{FEA}' = \text{FEA}$

$\text{FDA}' = \text{FDA}$

$\text{FFA}' = \text{FFA}$ + net issuance of bonds by Netherland Antilles subsidiaries (F107, line 27b)

from which we conclude that

$\text{FOL}' = \text{FOL}$ + Gold and SDR (F107, line 14) − change in interbank claims on foreigners (F107, lines 15f to 15l)

$\text{FOA}' = \text{FOA} - \text{KA}$ + Gold and SDR (F107, line 14) − change in interbank claims on foreigners (F107, lines 15f to 15l).

Appendix B presents a line-by-line description of the mapping.

The Dynamics of the External Budget Constraint

The stock data in the BEA is updated as follows:

$$PX^i_{t+1} = PX^i_t + FX^i_{t+1} + DX^i_{t+1}, \tag{A8}$$

where PX^i_t represents the position at the end of period t for series i, FX^i_t the flow during period (BEA definition) t, and DX^i_t a discontinuity reflecting a market valuation adjustment or a change of coverage in the series between $t-1$ and t. Summing across all the series, we obtain the international investment position at the end of period $t+1$:

$$\begin{aligned}
\mathrm{NFA}_{t+1} &= \sum_j PA^j_{t+1} - \sum_i PL^i_{t+1} \\
&= \sum_j (PA^j_t - \mathrm{FA}^j_{t+1} + DA^j_{t+1}) - \sum_i (PL^i_t + FL^i_{t+1} + DL^i_{t+1}) \\
&= \mathrm{NFA}_t - \left(\sum_j \mathrm{FA}^j_{t+1} + \sum_i FL^i_{t+1} \right) + \left(\sum_j DA^j_{t+1} - \sum_i DL^i_{t+1} \right)
\end{aligned}$$

In turn, the flow data satisfies

$$\begin{aligned}
-\mathrm{FA}_t &= -\sum_j \mathrm{FA}^j_t - \sum_i FL^i_t \\
&= \mathrm{CA}_t + \mathrm{SD}_t + \mathrm{KA}_t,
\end{aligned}$$

where we used the fundamental BOP equation. Substituting,

$$\mathrm{NFA}_{t+1} = \mathrm{NFA}_t + \mathrm{CA}_{t+1} + \mathrm{SD}_{t+1} + \mathrm{KA}_{t+1} + ND_{t+1},$$

where

$$ND_t = \sum_j DA^j_t - \sum_i DL^i_t,$$

is the net discrepancy. In the case where there is no change in coverage of the data, this net discrepancy corresponds to the capital gains. Further, we can write the current account as follows:

$$\mathrm{CA}_t = \mathrm{NX}_t + I_t + \mathrm{UT}_t,$$

where I_t denotes net income receipts (including interest income, distributed dividends, and FDI earnings), and UT_t represents unilateral transfers plus net compensation of employees.[28] The sum of I_{t+1} and ND_{t+1} represents the total return on the net foreign asset portfolio between t and $t + 1$, $(R_{t+1} - 1)\mathrm{NFA}_t$. We can then rewrite the accumulation equation as

$$\mathrm{NFA}_{t+1} = R_{t+1}\mathrm{NFA}_t + \mathrm{NX}_{t+1} + \mathrm{UT}_{t+1} + \mathrm{KA}_{t+1} + \mathrm{SD}_{t+1}.$$

Appendix B

Line-by-Line Description, Flows, Positions, and Return Data

The remainder of this appendix presents a line-by-line account of the construction of the U.S. international investment position of the United States, from 1952:1 to 2004:1.

28. According to the BOP manual, direct investment income in the CA includes distributed earnings as well as the share of reinvested earnings. So there is an entry in the current account and an offsetting entry in the financial account.

The following is a list of acronyms:

BEA	Bureau of Economic Analysis (Department of Commerce)
FFA	Flow of Funds (Federal Reserve)
USIT	U.S. International Transactions, BEA, BOP concepts
IIP	U.S. International Investment Position, BEA, BOP concepts
SCB	Survey of Current Business, published by BEA

Assets

Equity

Flows

- After the first quarter of 1982, data are from BEA (USIT table 7b, line A2 before the first quarter of 1998, then USIT table 7a, line A4).
- Before 1982, data are from FFA table F107, line 47 (FU263164003.Q, foreign corporate equities, including American deposit receipts [ADRs] and not seasonally adjusted [NSA]). Before the first quarter of 1974, the FFA series reports incorrectly the sum of equity and debt holdings by U.S. residents (also reported in USIT table 1, line 52). The flow series is corrected by subtracting FFA table F107, line 40 (FU263163003.Q, bonds, NSA). This error is corrected in the FFA data published after June 2004.

Levels

End-of-year positions are from BEA.

- After 1976, data are from BEA IIP table 2, line 21 (corporate stocks, including results from the U.S. Treasury's 1994 and 1997 *Benchmark Surveys of U.S. Ownership of Foreign Long-Term Securities*).
- Before 1976, data are from SCB, various lines.

Valuation Adjustment

Quarterly equity portfolio dollar capital gains are constructed using the U.S. Treasury 1997 *Benchmark Surveys of U.S. Ownership of Foreign Long-Term Securities* (Series EQR97$). Details on returns are provided in the returns section.

Debt

Flows

- After the first quarter of 1982, data are from BEA (USIT table 7b, line A13 before the first quarter of 1998, then USIT table 7a, line A18).
- Before 1982, data are from FFA table F107, line 40 (FU263163003.Q, bonds, NSA).

Levels

End-of-year positions are from BEA.

- After 1976, positions are from BEA IIP table 2, line 20 (bonds, including results from the U.S. Treasury's 1994 and 1997 *Benchmark Surveys of U.S. Ownership of Foreign Long-Term Securities*).
- Before 1976, positions are available from SCB.

Valuation Adjustment

Maturity weights are 25 percent for short term and 75 percent for long term. There is no valuation adjustment for short term. For long-term bonds, this is the weighted average dollar holding period excess return (over yields; series RN$@RW). Details on returns are provided in the returns section.

Direct Investment

Flows

- After the first quarter of 1960, data are from BEA (USIT table 1, line 51).
- Before the first quarter of 1960, data are from FFA table F107, line 53 (FU263192005.Q, U.S. direct investment abroad). Note that through the fourth quarter of 1992, FFA U.S. direct investment abroad excludes net inflows from corporate bonds issued by Netherlands Antillean financial subsidiaries. There is no discrepancy here as these bonds issues start after 1978.

Levels

Start positions are at zero in the first quarter of 1952 and cumulate forward. Note that we do not benchmark the data to the BEA IIP series (table 2, line 18) available after 1982 at market value. The reason is that applying the BEA valuation adjustment backwards from the fourth quarter of 1982 results in negative gross FDI asset position before 1973. Our estimated position for the fourth quarter of 1982 is $267 billion. The BEA reports $227 billion.

Valuation Adjustment

Quarterly direct investment portfolio capital gains are constructed using rolling weights (series RFDR$). The weights are constructed using BEA direct investment positions by country (historical cost basis) from 1966 until 2002. The final shares cover 75 percent of direct investment assets in each year. The implicit annual return in the BEA positions is regressed on this capital gain series between 1982 and 2003. The regression coefficient

(0.754367) is used to scale down the capital gain series. It is smaller than 1, as expected. The reason is that the BEA records reinvested earnings as inflows. But reinvested earnings are also part of the capital gain series. Without adjustment, we would be double counting the reinvested earnings.

Other Assets

Flows

- Before the first quarter of 1960, other asset flows are constructed to match the BEA definition. We start with other asset flows defined from FFA: FFA total assets (table F107, line 35, FU264190005.Q, net increase in U.S. liabilities of the rest of the world) minus FFA bonds (F107, line 40, FU263163003.Q, change in bond liabilities of the rest of the world to U.S. residents) minus FFA equity (F107, line 47, FU263164003.Q, net purchase of foreign corporate equities by U.S. residents [corrected, see the description of equity asset flows]) minus FFA direct investment (F107, line 53, FU263192005.Q, U.S. direct investment abroad, excluding bonds sold by Netherlands Antillean financial subsidiaries). Then we adjust the flows to map into the BEA definitions: other assets from FFA plus capital account (USIT table 1, line 39) plus change in interbank claims.
- After the first quarter of 1960, it is defined as *residual* from total BEA asset flows: total assets (USIT table 1, line 40, U.S. owned assets abroad) minus equity, debt, and direct investment flows.

Levels

After 1976, end of year positions are from BEA IIP table 2, line 5 (U.S. official reserve assets) plus line 10 (U.S. government assets, other than official reserve assets) plus line 22 (U.S. claims on unaffiliated foreigners reported by U.S. nonbanking concerns) and line 23 (U.S. claims reported by U.S. banks, not included elsewhere). Note that the levels and the flows include Gold Reserves.

Valuation Adjustment

There is none.

Liabilities

Equity

Flows

- After the first quarter of 1973, data are from sum of BEA equity (SCB before the first quarter of 1982, USIT table 7b, line B2 between the first quarter of 1982 and the first quarter of 1998, then table 7a, line B4 after) and equity held by foreign officials (SCB before the first quarter of 1982, USIT table 7b, line memo 4 between the first quarter of 1982 and the first quarter of 1998 and table 7a, line memo 4 after).

- Before 1973, FFA equity data are from table F107, line 29 (FU263064003.Q, net purchases of U.S. corporate equity by the rest of the world). The FFA data includes equity purchased by foreign official agencies (reported separately by the BEA).

Levels

End-of-year positions are from BEA.

- After 1980, positions are from IMF IIP (B8660@C111). The IMF data includes equity holdings by foreign official agencies.
- Between 1976 and 1980, comparison of the BEA IIP table 40 (corporate stocks) show that foreign official holdings are zero.
- Before 1976, positions are available from the Survey of Current Business.

Valuation

Quarterly equity portfolio capital gains (series EQRUS) are from S&P 500 (see detailed descriptions for returns in returns section).

Debt

Flows

- After the first quarter of 1982, data are from BEA flows: sum of private foreign holdings of U.S. corporate and federally sponsored agency bonds (USIT table 7b, line 10 before 1998, then table 7a, lines 16 and 30) and foreign official holdings of U.S. government securities (USIT table 1, line 57) and foreign private holdings of U.S. Treasury securities (USIT table 1, line 65) and corporate and agency bonds held by foreign official agencies (USIT table 7b, line memo 3 before 1998, then table 7a, memo 3).
- Before 1982, data are from FFA U.S. treasury securities (table F107, line 21, FU263061105.Q, treasury securities) plus U.S. agency and GSE-backed securities (table F107, line 24, FU263061705) plus U.S. corporate bonds (table F107, line 27, FU263063005.Q, includes net issues by Netherland Antillean financial subsidiaries of U.S. corporations) minus estimate of net issues of corporate bonds from Netherland Antillean financial subsidiaries of U.S. corporations. Each FFA series is constructed or corrected as follows:
  —FFA table F107, line 22 (FU263061113.Q, foreign official holdings of Treasury securities), a subcategory of F107, line 21, is incorrect before the fourth quarter of 1981. The series is remapped to BEA table 1, line 58 (foreign official holdings of U.S. Treasury securities).

—FFA table F107, line 27 is adjusted upwards before the third quarter of 1977 for discontinuity in the coverage of the series (see section appendix C for a methodological description on how we treat discontinuities in coverage).

—Net issues of corporate bonds from Netherland Antillean financial subsidiaries are estimated as the difference between minus FFA-based direct investment assets (table F107, line 53, FU263192005.Q, U.S. direct investment abroad) and BEA-based direct investment assets (USIT table 1, line 51). They are set to zero before the first quarter of 1979.

Levels

- After 1982, end-of-year positions are from IMF IIP (B8669@C111). The IMF data includes foreign official agencies holdings of corporate bonds (reported separately in BEA IIP).
- Between 1976 and 1981, data are from BEA IIP table 2, line 27 (foreign official holdings of U.S. government securities) plus line 37 (foreign private holdings of U.S. Treasuries) plus line 39 (foreign private holdings of corporate and other bonds) plus line 32 (foreign official holdings of other assets).
- Between 1971 and 1976, the same positions are available from the Survey of Current Business. No data are available before 1971.

Valuation

We assume a maturity structure of 25 percent for short term (no valuation) and 75 percent for long term. For the long-term valuation, we use the quarterly holding excess return over yields on ten-year U.S. government debt (series RN@C111); see the returns section.

Direct Investment

Flows

- After the fourth quarter of 1976, data are from BEA direct investment (USIT table 1, line 64). The FFA series (table F107, line 33, FU263092001.Q, foreign direct investment in the U.S.) is identical to the BEA series after 1960.
- Before the fourth quarter of 1976, data are from FFA series (table F107, line 33, FU263092001.Q, foreign direct investment in the U.S.), adjusted upwards for the discontinuity in coverage in the fourth quarter of 1976 (see appendix C for a methodological description on how we treat discontinuities in coverage).

Levels

Start positions are at zero in the first quarter of 1952 and cumulate forward. Note that we do not benchmark the data to the BEA IIP series (table

2, line 36) available after 1982 at market value. The reason is that applying the BEA valuation adjustment backwards from the fourth quarter of 1982 results in negative gross FDI liability position before 1973. Our estimated position for the fourth quarter of 1982 is \$144 billion. The BEA reports \$130 billion.

Valuation

Quarterly direct investment portfolio capital gains are constructed using S&P 500 capital gains series (EQRUS). The implicit annual return in the BEA positions from 1982 to 2003 is regressed on this capital gain series. The regression coefficient (0.681023) is used to scale down the capital gain series. It is smaller than 1 as expected. The reason is that the BEA records reinvested earnings as inflows. But reinvested earnings are also part of the capital gain series. Without adjustment, we double count reinvested earnings.

Other Liabilities

Flows

- After the fourth quarter of 1976, they are defined as *residual* from total BEA liabilities: total liabilities (USIT table 1, line 55) minus debt, equity and direct investment liability flows.
- Between the first quarter of 1960 and the third quarter of 1976, they are defined as *residual* from total BEA liabilities: total liabilities (USIT table 1, line 55) minus debt, equity and direct investment liability flows measured as USIT table 1, line 64. (Note that the direct investment flows are not adjusted upward for the discontinuity. Hence, we are assuming that total liabilities are mismeasured before the fourth quarter of 1976.)
- Before the first quarter of 1960, data are constructed from FFA to match the BEA definition (see A2). Start with other liabilities FFA flows defined as FFA total liabilities (table F107, line 13, FU264090005.Q, net acquisition of financial assets by the rest of the world) minus FFA bonds (F107, line 21 FU263061105, Treasury securities, F107, line 24, FU263061705, agency and GSE-backed securities, F107, line 27, FU263063005, U.S. corporate bonds, all series corrected as described previously), minus FFA equity (F107, line 29, FU263064003.Q) minus FFA direct investment (F107, line 33, FU263092001.Q). Then adjust FFA series to map into the BEA definition: other liability (FFA) minus FFA Gold and SDR (F107, line 14, FU263011005.Q, net purchases of Gold and SDR from the United States by the rest of the world) plus change in interbank claims (equal to zero before 1960).

Levels

After 1976, end-of-year positions are from BEA IIP table 2, line 30 (other U.S. government liabilities) and line 31 (U.S. liabilities reported by U.S. banks, not included elsewhere) and line 41 (U.S. currency) and line 42 (U.S. liabilities to unaffiliated foreigners reported by U.S. nonbanking concerns) and line 43 (U.S. liabilities reported by U.S. banks, not included elsewhere).

Valuation

There is none.

Returns

Most financial and exchange rate data are obtained from the Global Financial Database (GFD) and International Financial Statistics (IFS).

Assets

Equity

Total Return (EQTR97$). Equity total return is for the rest of the world. The country weights are constructed from table 1 of The U.S. Treasury's (2000) report on U.S. holdings of foreign long-term securities. The country weights represent 75 percent of total foreign equity holdings by U.S. investors. For each country, a series for dollar quarterly total stock return is constructed. The local currency returns are converted into dollars using end-of-period nominal exchange rates against the dollar compiled from IFS after 1957 and from GFD before. Before 1987, total returns series for Mexico, Brazil, and Switzerland (before 1966) are unavailable. The weights are adjusted appropriately. Table 1B.1 reports the weights by subperiod and the total return series for each country.

Capital Gain (EQR97$). The equity capital gain series uses the same country weights as table 1B.1. For each country, a series for dollar quarterly capital gain return is constructed. Local capital gain returns from GFD are converted into dollars using end-of-period nominal exchange rates. Country weights are reported in table 1B.2.

Debt

Total Return. Weighted average of the total return on long-term bonds and total return on short-term bonds. Maturity composition is 75 percent for long term and 25 percent for short term, from table 2 in the U.S. Treasury's (2003) report on U.S. holdings of foreign securities.

- Long term (R$@RW): This is the weighted average dollar holding period return on foreign long-term bonds. The currency weights are

Table 1B.1 **Country-weights, equity assets, total returns**

Country	1952–1966	1966–1987	1987–2004	Series
United Kingdom	27.43	25.44	23.61	FT-Actuaries All-Share Total Return Index
Japan	17.20	15.95	14.80	Nikko Securities Composite Total Return
France	10.72	9.94	9.23	SBF-250 Total Return Index
The Netherlands	13.49	12.51	11.61	CBS Total Return-All Shares
Germany	8.19	7.60	7.05	CDAX Total Return Index
Canada	8.93	8.28	7.68	Toronto SE-300 Total Return Index
Sweden	4.89	4.54	4.21	Stockholm SBX Benchmark Gross Index
Switzerland	0.00	7.24	6.72	Performance Index
Italy	5.24	4.86	4.51	BCI Global Return Index
Mexico	0.00	0.00	3.79	SE Return Index
Australia	3.92	3.64	3.38	S&P/ASX 200 Accumulation Index
Brazil	0.00	0.00	3.4	São Paulo IBX-50 Return Index

Table 1B.2 **Country-weights, equity assets, capital gains**

Country	1952–1954	1954–2004	Series
United Kingdom	24.44	23.61	FT-Actuaries All-Share Index
Japan	15.33	14.80	Nikkei 225 Stock Average
France	9.55	9.23	SBF-250 Index
The Netherlands	12.02	11.61	CBS All-Share Price Index
Germany	7.30	7.05	CDAX Composite Price Index
Canada	7.95	7.68	S&P/TSX 300 Composite Index
Sweden	4.36	4.21	Affarsvarlden General Index
Switzerland	6.95	6.72	Stock Indices-Composites—Switzerland Price Index
Italy	4.67	4.51	Banca Commerciale Italiana General Index
Mexico	3.93	3.79	SE Indice de Precios y Cotizaciones (IPC)
Australia	3.50	3.38	ASX All-Ordinaries
Brazil	0.00	3.40	Bolsa de Valores de São Paulo (Bovespa)

taken from table 11 of the U.S. Treasury's (2000) report on U.S. holdings of foreign long-term securities for the year 1994. Given the availability of country bond yield data, we cover about 80 percent of the long-term debt positions. The currency weights are reported in table 1B.3. Total quarterly holding period returns are calculated from the changes in yields (assuming that the yield equals the coupon and using the formula (10.1.19) in Campbell, Lo, and MacKinlay (1997, 408) converted into U.S. dollars using end-of-period nominal exchange rates compiled from IFS after 1957 and GFD before.

- Short term (RSRW$): This is the weighted average dollar holding period return on foreign short term bonds. The currency weights are taken from table 14 of the U.S. Treasury's (2003) report on U.S. holdings of foreign securities for 2001. With the short-term returns avail-

Table 1B.3 **Currency-weights, long-term debt assets**

Currency	Weight (%)	Source
U.S. dollar	59.67	Yields on U.S. government ten-year constant maturity bonds (IFS)
Yen	12.35	Seven-year Government Bond Yield (OECD)
Canadian dollar	8.64	Average yield to maturity on government bonds with life over ten years (IFS)
German DMark	9.05	Yield on federal securities with residual maturities of over nine to ten years (IFS)
UK pound	5.35	Gross redemption bond yield, at par with twenty-year maturity (IFS)
French Franc	4.94	Ten-year Government Bond Yield (GFD)

Table 1B.4 **Currency-weights, short-term debt assets**

Currency	Weight (%)	Source
U.S. dollar	85.09	Discount on new issues of three-month Treasury Bill (IFS)
DMark	4.98	Germany three-month Treasury Bill Yield (GFD)
Yen	8.01	Lending rate for collateral and overnight loans in the Tokyo Call Money Market (IFS)
UK pound	1.92	Tender rate at which nine days bills are allotted (IFS)

ability, we cover 99 percent of the short-term debt positions. Short-term local currency returns are converted into U.S. dollars using end-of-period nominal exchange rates compiled from IFS after 1957 and GFD before. The currency weights are reported in table 1B.4.

Capital Gains (RN$@RW). Same weights are [R$@RW] but use *net* returns instead of total returns, where net returns are constructed as $\ln(1 + RN) = \ln(1 + R) - \ln(1 + Y)$, where RN is the net return, R is the total return, and Y is the yield. Local net returns are converted into dollars using end-of-period exchange rates.

Direct Investment

Returns are constructed using rolling weights based on BEA's FDI historical cost positions, from 1966 to 2002. In each year, we cover 75 percent of U.S. direct investment historical cost asset positions. Some countries are excluded for some years due to the absence of stock market data (e.g., Mexico, Brazil, Switzerland and Panama in early years). For each country, total stock return (in dollars) is computed from GFD total return indices and IFS end-of-period exchange rates.

Total Return (TRFDR$).

Capital Gain (RFDR$).

Other Assets

Total Return (RSRW$). See the preceding.

Capital Gain. There is none.

Liabilities

Equity and Direct Investment

Total Return (EQTRUS). This is total return indices: Stocks—S&P 500 Composite Total Return Index (Base 1988; SPXTRQ).

Capital Gain (EQRUS). This is stock indices: Composites—S&P 500 Composite (SPXQ).

Debt

Total Return. This is the weighted average of the total return on long-term bonds and total return on short-term bonds. Maturity composition is 75 percent long term and 25 percent short term, from table 2 and table 3 in the U.S. Treasury's (2002) Survey of Foreign Portfolio Holdings of U.S. Securities.

- Long term (R@C111). This is the quarterly total return on long-term bonds, calculated from the change in yields (see formula in Campbell, Lo, and MacKinlay 1997, equation 10.1.19, page 408), assuming that the yield is equal to the coupon. Yields are calculated on U.S. government ten-year constant maturity bonds. Before the third quarter of 1985, yield data are from McCulloch and Kwon (1993), as reported by Campbell (1999). After the third quarter of 1985, they are from IFS (L61@C111).
- Short term (R$@C111). After the fourth quarter of 1963, discount is on new issues of three-months Treasury bill (IFS L60@C111). Before the fourth quarter of 1963, the Treasury bill rate is from quarterly SBBI file in CRSP, which is from Campbell (1999).

Capital Gain (RN@C111). Quarterly net return on long-term bond is defined as $\ln(1 + RN) = \ln(1 + R) - \ln(1 + Y)$, where RN is the net return, R is the total return, and Y is the yield. The yield is already included in the current account transactions.

Other Liability

Total Return (R$@C111). See the preceding.

Capital Gain. There is none.

Implicit Returns

The *implicit* returns on each asset class are constructed as follows.

- For gross assets, we use the investment income series table F107, line 7 and SCB NIPA table 9.5, line 5 (receipts of factor income) and our total valuation series for assets. We compute r^a as (investment income + valuations)/foreign asset position at the end of the previous period.
- For gross liabilities, we use the investment income series table F107, line 3 and SCB NIPA table 9.5, line 11 (payments of factor income) and our total valuation series for liabilities. We compute r^l as (investment income + valuations)/foreign liability position at the end of the previous period.
- A breakdown of the investment income at the level of each asset class is unfortunately not available over the entire period. Instead, we distributed investment income across each asset in the following way. First, we deducted from total investment income FDI-reinvested earnings. We distributed the remaining investment income across assets in proportion to their share in total assets. Thus we obtain estimates of investment income for equity, debt and other. For FDI, we add back reinvested earnings to the FDI investment income estimated as in the preceding, that is, we add reinvested earnings to (total investment income-reinvested earnings) multiplied by share of FDI in total assets. We then compute the implicit return on equity assets, say, in the following way: r^{ae} = (investment income on equity + valuation change on equity)/equity asset position at the end of the previous period. We proceed in a parallel way for each asset class for gross assets and gross liabilities.

Appendix C

Miscellaneous Data Issues

Mapping the BEA Returns for Direct Investment and the Treatment of Reinvested Earning

Denote PX_t the stock at the end of period t for series X and FX_t the flow for the same period. Assume that the returns are accrued at the beginning of the period so that the accumulation equation from quarter t to quarter t + 1 takes the following form:

$$PX_{t+1} = R_{t+1}PX_t + FX_{t+1}$$

From the constructed series PX_t and FX_t we can extract the implicit return:

$$R_{t+1} = \frac{PX_{t+1} - FX_{t+1}}{PX_t}$$

We then regress the continuously compounded annual returns $R_{t,t+4} = \ln(R_t R_{t+1} R_{t+2} R_{t+3})$ on the annual return that is used to value the BEA series, $R^{\text{BEA}}_{t,t+4}$.

How to Treat Discontinuities?

The accumulation equation assumes that ND_t represents capital gains. In some cases, the discontinuity is too big to be justified by capital gains. Instead, it represents a rebasing of the underlying series (e.g., table F107, line 26, U.S. corporate bond liabilities, or table F107, line 32, direct investment liability). The valuation equation is

$$PX_{t+1} = PX_t + FX_{t+1} + DX_{t+1}.$$

DX_t reflects both the capital gain and the discontinuity in year t. If there is a discontinuity at time T, we need to adjust both positions and flows before T. Our approach is to attribute all the adjustment at time T to the discontinuity. Define the adjustment factor $\kappa = 1 + DX_t/PX_{T-1}$. We scale all positions, flows, and previous discontinuities by κ for $t < T$:

$$P\hat{X}_0 = \kappa PX_0$$

$$F\hat{X}_t = \kappa FX_t$$

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Comment José De Gregorio

In these notes I will first discuss some salient features of the current U.S. external imbalance, with a focus on its impact on emerging markets. Then in the second section, I will discuss the relationship between exchange rate fluctuation and external adjustment, focusing on the quantitative importance of trade and valuation effects. Finally, I will present some concluding remarks.

The U.S. Current Account Deficit

Today's U.S. external imbalance is large and unsustainable as the United States cannot borrow permanently at current levels. The United States is the only major industrial country that has run a deficit above 5 percent of GDP since 1971 (Edwards 2005) and, given its weight in the world economy, the demand for foreign financing is unprecedented.[1] The origins of the imbalance, the timing of the adjustment, the policy implications, and the consequences are all sources of debate. At the core of the discussion is the required adjustment in the exchange rates for global rebalancing.

The benign view, although recognizing that such a situation cannot persist forever, would argue that the adjustment will occur with minor changes in exchange rates and no disruptions in the world economy. A more pessimistic view would argue that a sharp exchange rate correction is necessary for reallocating resources to the tradable-goods sector and for reducing domestic expenditure. This adjustment will not necessarily result in global turmoil, but, of course, it entails more risks than the benign view. Postponing action and adding to it a fiscal imbalance does not help to smooth the correction.

A number of authors have recently highlighted an additional channel through which exchange rates contribute to the external adjustment, namely *valuation effects,* also called the *financial adjustment channel* (Lane and Milesi-Ferretti 2001; International Monetary Fund [IMF] 2005; Tille 2003; Gourinchas and Rey 2005). Given that the foreign international investment position comprises many currencies, a depreciation will have valuation effects, resulting in wealth transfers across countries. This new paper by Gourinchas and Rey provides a detailed account of the foreign

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I am grateful to César Calderón, Gian Maria Milesi-Ferretti, Jorge Selaive and Cedric Tille for useful discussions, but I remain responsible for the views expressed herein.

1. Backus and Lambert (2005), looking at historical data, dispute the view that there are no precedents of this type of imbalances. However, they find large deficits during the Bretton Woods period, where under fixed exchange rates persistent imbalances were much more likely, due to persistent misalignments. Dooley, Folkerts-Landau, and Garber (2004) argue that we are now getting closer to a new Bretton Woods system because of the heavy reserve accumulation of Asian countries, especially China, to avoid an appreciation.

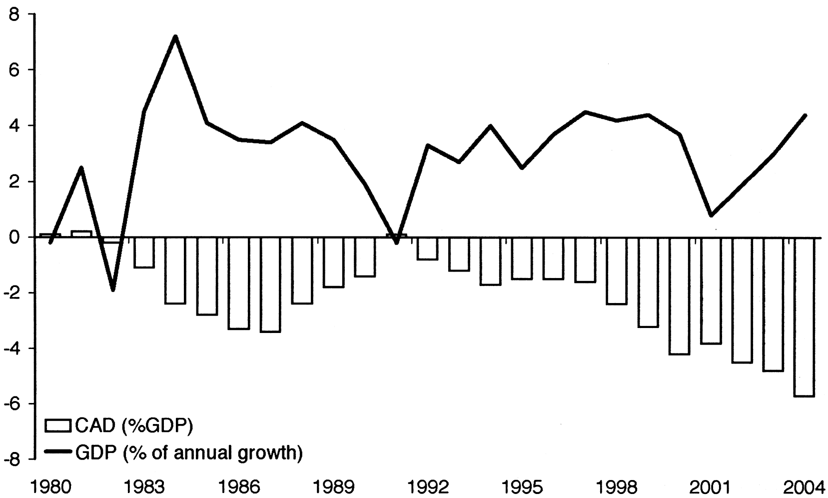

Fig. 1C.1 United States: Current account deficit and GDP growth
Source: IMF.

investment position of the United States, reporting yields across different types of assets and liabilities, identifying the impact of a depreciation of the dollar on different yields, and discussing the channels through which the exchange rate facilitates the adjustment, among many other interesting discussions and insights.

The discussion on global imbalances has also been complemented by recent research attempting to identify the main features of current account reversals, initiated by the influential work of Milesi-Ferretti and Razin (2000). Looking at U.S. history, perhaps the closest case of current account reversal took place in the mid-1980s. Despite some differences, the accumulated empirical evidence and an examination of the U.S. adjustment of the mid-1980s show three relevant features:

- One is that current account reversals come with a slowdown of economic growth (Freund and Warnock, chap. 4 in this volume). According to these authors, a 1 percentage point adjustment in the current account would result in a decline in GDP growth with respect to trend of about 0.15 percentage points over the first three years (figure 1C.1).
- Current account reversals are generally accompanied by sharp depreciations of the currencies, causing, in some cases, a currency crisis (Edwards 2005).[2] Moreover, Freund and Warnock (chap. 4 in this volume) have found that the exchange rate adjustment is larger when the

2. Here I use the broad index of the real exchange rate reported by the Federal Reserve. An increase in this index represents a real appreciation.

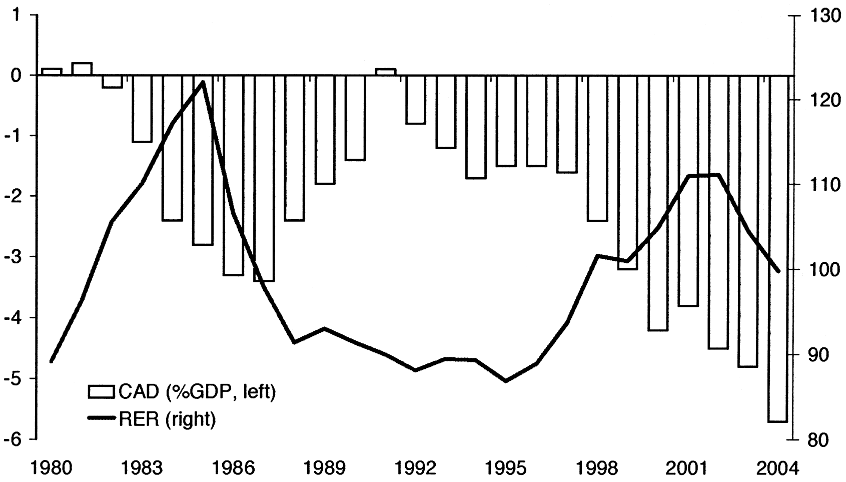

Fig. 1C.2 United States: Current account deficit and the real exchange rate
Source: IMF and U.S. Federal Reserve.

current account deficit is driven by consumption, not investment-financing. This is consistent with traditional models that predict that in the absence of investment in the tradable sector, a larger depreciation is needed to reallocate resources to restore external balance (figure 1C.2).

- The reversal of the current account deficit in the mid-1980s came with a surge of U.S. capital flows to emerging markets. Indeed, the surge of capital flows to emerging economies documented by Calvo, Leiderman, and Reinhart (1993) occurred when the demand of the United States for foreign financing declined (figure 1C.3). They suggest that this phenomenon was caused by push factors, to a large extent independent of developments in the emerging economies themselves. Figure 1C.3 shows that in recent years capital flows to emerging markets have been increasing, but mostly to Asia, particularly China, which is receiving the bulk of capital flows. In the case of China, these inflows have not financed a current account deficit but have been used primarily for reserve accumulation to ward off an appreciation of the renminbi. In contrast, emerging markets with floating exchange rates, in particular in Latin America, have seen very small net inflows as they have been running current account surpluses. Therefore, the availability of foreign financing for emerging markets should rise as the U.S. current account deficit narrows.

Sooner or later there must be a reversal. The issue is whether this reversal will be costly and what repercussions it will have on the global economy.

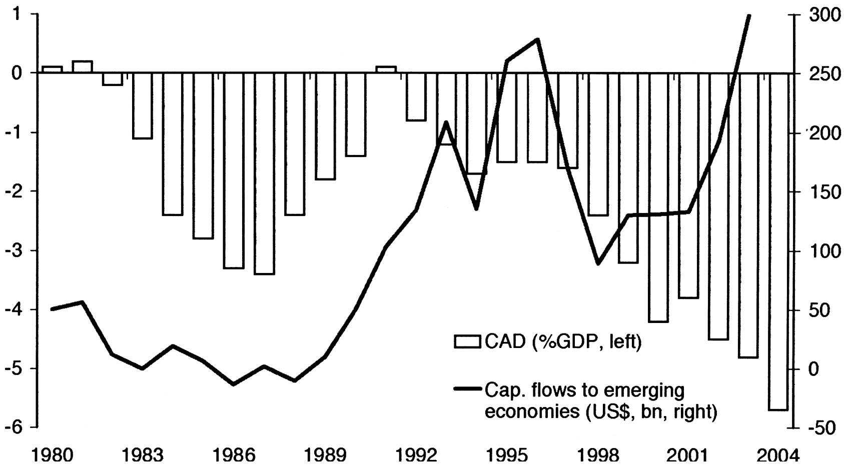

Fig. 1C.3 U.S. Current account deficit and capital flows to emerging economies
Sources: IFS and IMF.

I want to comment particularly on its impact on emerging market economies.

It is very likely that during the adjustment we will see a slowdown of growth in the United States, a depreciation of the dollar, and a surge of capital flows to emerging markets. The U.S. growth consensus forecast is already taking into account slower growth, which is falling from 4.4 percent in 2004 to 3.2 percent in 2006. However, the magnitude of the reduction should not cause major disruptions in the world economy as the United States will be growing close to its long-term potential.

A depreciation of the dollar brings up the uncertainty about which currencies will take the burden. The euro seems more unlikely, and costly, given weak economic performance in Europe. However, the adjustment may be retarded while Asian countries defend their currencies from a weakening dollar, building pressure on the rest of the currencies.

The question of whether these developments are good or bad news for emerging economies has a mixed answer. The impact of a slowdown of growth may be more than offset by the positive effect on capital flows. Regarding the depreciation of the dollar, the evidence shows that commodity prices increase when the dollar depreciates (Dornbusch 1985). Indeed, the significant gain in terms of trade experienced by commodity exporting countries has coincided with the depreciation of the dollar that has taken place since mid-2002 (see figure 1C.4).

Perhaps where we know least is interest rate adjustment. This evidence is more uncertain, in particular because of the low levels of long rates despite the large fiscal deficit of the United States. Naturally, a sharp increase

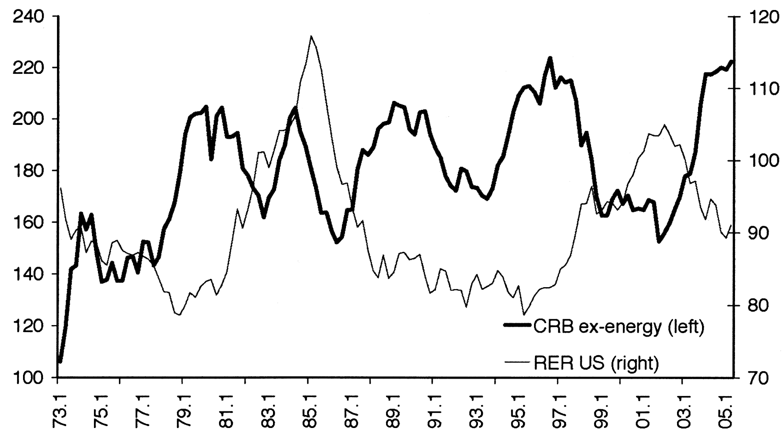

Fig. 1C.4 Real exchange rate and commodity prices (January 1973 = 100)
Sources: Commodity Research Bureau and U.S. Federal Reserve.

in interest rates could result in financial turmoil in developing countries, the more so the larger their debts.

Of course we can predict catastrophic scenarios, but they are improbable as the world economy is better prepared for significant adjustment to global imbalances. From the standpoint of emerging economies, some positive developments, such as those mentioned previously, may facilitate the adjustment. In addition, emerging economies are today in a better position than they were in the last twenty-five years to face difficulties in the external front. Inflation is under control. The external sector exhibits current account surpluses in most countries; for example, in Latin America this could be about 75 billion U.S. dollars during 2005. Fiscal deficit in Latin America is slightly over 1 percent of GDP, showing unprecedented fiscal prudence, and hence the demand for foreign financing is limited. This is also reflected in improved sovereign ratings for these countries.

The evidence reported by Gourinchas and Rey helps to better understand the channels through which an exchange rate correction in the United States contributes to external adjustment, and I will refer to this in more detail in the next section.

Valuation versus Trade Effects

Consider the following equation for the dynamics of net foreign asset (NFA) accumulation:

$$\text{(C1)} \qquad NX_t + (1 + r_t^a)A_t - (1 + r_t^l)L_t = NFA_{t+1},$$

where NX stands for net exports, A is foreign assets with a return equal to r^a, L is foreign liabilities with a return r^l, and NFA is net foreign assets

$(A - L)$. Expressing the previous equation as share of GDP we have (using lowercases to denote shares of GDP)

$$(C2) \qquad (1 + r_t^l)\text{nfa}_t = -[\text{nx}_t + (r_t^a - r_t^l)a_t] + (1 + \gamma_{t+1})\text{nfa}_{t+1}.$$

Net exports are a function of the exchange rate, where e denotes its log, and a set of other variables that for the purposes of this discussion will be omitted. As argued by many authors and carefully documented by Gourinchas and Rey most of U.S. foreign liabilities are denominated in dollars, while part of assets are denominated in foreign currency, which generates the valuation effect. However, the valuation effect must be in real terms because returns in dollars could compensate for changes in the price of the currencies. Indeed, what really matters for the valuation effects are unexpected changes in the exchange rate. For this reason, the return on foreign assets will depend on the rate of depreciation, which proxies for unexpected changes in the exchange rate.

When the dollar depreciates, there is a once-and-for-all gain in valuation. Therefore, I assume that r^a depends on the rate of depreciation, Δe. On the other hand, just for simplicity, I will assume that r^l is constant and equal to r and the rate of growth is also constant and equal to γ. Integrating forward equation (C2), considering the appropriate no-Ponzi game condition, we have the following intertemporal budget constraint.[3]

$$(C3) \qquad (1 + r)\text{nfa}_t = -\sum_{s=0}^{\infty} \frac{\text{nx}(e_{t+s}) + [r^a(\Delta e_{t+s}) - r]a_{t+s}}{(1 + r - \gamma)^s}.$$

This expression describes many exchange rates' equilibrium paths as more structure is needed to pin down a unique path.[4] But this equation shows that postponing an adjustment will require a more depreciated exchange rate in the future. The reason is that an appreciated exchange rate will result in a deterioration of the net foreign assets position, which implies that in the future more net exports will be needed.

From the perspective of Gourinchas and Rey's paper, the most important point of equation (C3) is that a depreciation has a permanent effect on net exports and a one-time valuation effect. Indeed, the estimations of Gourinchas and Rey show that a 10 percent depreciation of the dollar generates between a 2 and 3 percentage points decline in the return on foreign assets, for an average return of about 7 percent. On the side of liabilities, a 10 percent depreciation of the dollar produces an increase in the return on foreign liabilities between 1 and 1.5 percentage points, for an average return of about 4 percent. Their estimations stress some important features regarding the current U.S. foreign investment position:

3. Strictly speaking, r, the return on liabilities, also depends on the exchange rate. This will be considered when doing a numerical application below.

4. For example, asset markets equilibrium in a world of imperfect asset substitutability is a natural candidate, as done in Kuori (1983) or Blanchard, Giavazzi, and Sa (2005).

1. The United States enjoys an exorbitant privilege because $r^a > r^l$, and this difference is about 3 percentage points. Therefore, the United States can run a permanent deficit in net exports, despite having a negative international investment position.

2. From equation (1) we see that the exorbitant privilege is given by $r^aA - r^lL$, which can even become negative if external liabilities surpass assets by a large enough margin. Indeed, Gourinchas and Rey show that we are close to that point because at current rates, differential L/A must be less than 1.6, and it is currently at 1.34, which is close and approaching 1.6 while the deficit continues.

3. Another important aspect that can be seen in the budget constraint is that a depreciation of the U.S. dollar facilitates external adjustment not only via an increase in net exports but also via valuation effects. The valuation effect is due to the fact that r^a depends on the depreciation. The difference between the exorbitant privilege and the valuation effect is that the former depends on a persistent difference between the return on assets and the return on liabilities, while the valuation effect depends on unexpected changes in valuation due to changes in the exchange rate.

The effect of exchange rates on the return on foreign assets and liabilities for a number of industrial countries has been examined by Lane and Milesi-Ferretti (2005). They find that the effects of a real depreciation on foreign assets' returns for the United States is the smallest as the United States has probably the largest share of assets denominated in dollars. But on the side of liabilities, the United States is the only country where a real depreciation does not significantly affect returns, consistently with the fact that most U.S. liabilities are denominated in dollars. For the rest of industrial countries, a real depreciation increases the return on liabilities. In net terms, the United States is the country that benefits the most from a real depreciation.

In the recent experience with the widening of the U.S. current account deficit, many observers have argued that globalization facilitates the external adjustment. The budget constraint in equation (C3) also serves to illustrate this point. Increased globalization implies that, for a given net asset position (nfa), gross assets (a) are larger. In the presence of the exorbitant privilege, globalization helps the external adjustment. In the transition to a larger participation of U.S. assets in global portfolio, the United States may have massive financing available.

However, this effect has its limits. Increased demand for safe assets and global portfolio adjustment may lead to an increase in U.S. liabilities and assets. However, the increase in a is not unlimited, and it is difficult to justify that an increase in the international investment position of the United States can be sustained without a reduction in the exorbitant privilege. As Roubini and Setser (2004, 6) put it: "the U.S. should not count on being able to fool all of the people all of the time: expected persistent real depreciation of the US dollar would lead foreigners to require ex-ante higher returns on their US dollar asset holdings to minimize their capital losses."

This approach can be used to estimate the effects of a real depreciation on external adjustment, adding up the valuation and trade effects. Gourinchas and Rey estimate the required depreciation to bring the economy to the steady state in one, three, and five years. In one year, a 75 percent depreciation would be required, and as the period lengthens, the depreciation must increase because during the transition to the steady state, the economy is increasing its negative foreign asset position. While interesting, this exercise may be unrealistic as the economy will adjust over the long run to the steady state, and this should be enough to keep solvency as indicated by the intertemporal budget constraint.

We can compute constant levels for net exports and the interest rate differential that keep net foreign assets at a constant value equal to $\overline{\text{nfa}}$. We can also compute the required exchange rate depreciation to achieve this. The valuation effect operates only in the period in which the depreciation takes place, from then on the exorbitant privilege persists, but with no gains from the exchange rate, which is assumed to be constant. Solving equation (C3) for constant nx and a, a once-and-for-all valuation gain at time t, and the remaining exorbitant privilege, we have that (ignoring growth)

$$\text{(C4)} \quad r \times \overline{\text{nfa}} = \text{nx}(\bar{e}) + \frac{r}{1+r}(r^a(\bar{e} - e_0) - r)a + \frac{1}{1+r}(r^a - r)a,$$

where $\bar{e} - e_0$ is the depreciation needed to achieve a constant level of net foreign assets. The first term is net exports, the second is the valuation gain at t for a depreciation from e_0 to e, and the third one is the flow of the exorbitant privilege.

We can use this expression to compute the effects of a depreciation on external adjustment. This is just an expansion of the traditional elasticity approach to consider valuation effects. However, we need to take into account that the valuation effect is a once-and-for-all effect, and for this reason it appears in equation (C4) as the annuity of the change in returns in the period in which the depreciation takes place. The last term of equation (C4) is not affected by the exchange rate, which I assume to remain constant after the depreciation happens.

Differentiating equation (C4) with respect to e we have that a change in de will induce an external adjustment of Λ given by

$$\text{(C5)} \qquad \Lambda = \frac{\partial \text{nx}}{\partial e} de + \frac{ra}{1+r} \frac{\partial r^a}{\partial \Delta e} de.$$

Using Gourinchas and Rey's parameters, we have that $\partial\text{nx}/\partial e = 1/15 = 0.067$. On the other hand, using an interest rate of 4 percent and a ratio of foreign assets to gross domestic product (GDP) of 76 percent, we can calculate the valuation effect by using $\partial r^a/\partial \Delta e$ estimated by Gourinchas and Rey. However, we must also take into account that the return on liabilities is affected by a depreciation as well. The semielasticity of returns on assets in one year estimated by Gourinchas and Rey is 0.28, for assets being 76 percent of GDP, while the semielasticity for the return on liabilities is –0.08, for liabilities being 103 percent of GDP. Therefore, a rough estimate for the gain in returns on net assets deriving from a 1 percent depreciation, expressed with respect to assets, is $0.28 + 0.08 \times (103/76) = 0.39$. Therefore, we have that the valuation effect is $0.04 \times 0.76 \times 0.39/1.04 = 0.011$. Then a 10 percent depreciation would result in a total effect of 0.78 percent. The valuation effect accounts for only 14 percent of the total effect.[5]

An adjustment of 3 percent of GDP would require a 38 percent depreciation (3/0.078). If there were no valuation effect, the required depreciation would be 45 percent. Figures are similar to those of Blanchard, Giavazzi, and Sa (2005), Edwards (2005), and Obstfeld and Rogoff (chap. 9 in this volume).

The lesson from these simple calculations is that the valuation effect has a small impact on external adjustment. The reason is simply that it is a one-time effect. A back-of-the-envelope calculation may clarify the point. As argued in the Gourinchas and Rey's introduction, a 10 percent depreciation represents 5 percent of GDP transfer from the rest of the world to the United States. As an annuity this would be 0.2 percent of GDP, a figure somewhat larger than the 0.11 percent one obtains from the semielasticities of returns computed by Gourinchas and Rey. The reason is that, as argued by Gourinchas and Rey, the covariates of the returns reduce the effects of the depreciation. For example, a depreciation reduces the returns on assets, but this depreciation could result in an increase in the value of the stocks in dollars, for example, in the tradable sector, which would partly offset the direct gain—losses for foreign investors—from valuation.

In summary, although the valuation effects are conceptually important and may play an important role in the short run, over the long run, trade effects remain playing the lead part.

A caveat to this calculation is that these effects do not necessarily imply that welfare effects from valuation are necessary. Indeed, Tille (2004) has modeled the welfare effects from valuation and found that they are not small. The reason is that a depreciation affords greater consumption due to high net exports and gains in valuation. But in order for the trade channel to operate, an increase in net exports requires more work. In contrast, the valuation effect entails a wealth transfer that does not need extra work and, hence, has no costs from the welfare viewpoint.

5. According to Obstfeld and Rogoff (chap. 9 in this volume), the valuation effect would represent 20 percent of the total effect of a depreciation.

Concluding Remarks

In these comments I have argued that the valuation effect, although significant in the short run, is much less important from a longer-term view. Indeed, the exchange rate adjustment operates mainly through the traditional trade effect.

In the short run, and particularly from the point of view of emerging economies, the valuation effect could be more important. Short-term movements in capital flows could be partially offset by changes in valuation. This is related to the notion that one key problem of emerging economies is that they cannot borrow in their own currencies. Therefore, when the domestic currency depreciates, the return on liabilities increases in terms of local goods. The burden of liabilities rises. For industrialized countries, the valuation effect operates in the other direction, helping the external adjustment.

A typical case in point as a good example is Australia, where, according to the estimations of Lane and Milesi-Ferretti (2005), a 10 percent depreciation reduces the return on net foreign liabilities by about 2 percent, somewhat less than the 5 percent for the United States.

Whether the inability of many economies to borrow internationally in their own currencies is the original sin (Eichengreen and Hausman 1999), this discussion highlights the importance of international risk sharing. And precisely in moments where international financial markets stop lending to emerging markets, the ensuing depreciation will ameliorate the negative impact on countries that have been able to borrow in their own currencies.

From the point of view of current global imbalances, a current account reversal should occur sooner or later; a depreciation of the dollar should help, but the contribution of valuation effects will still be limited.

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2

A Global Perspective on External Positions

Philip R. Lane and Gian Maria Milesi-Ferretti

2.1 Introduction

It is a basic accounting identity in international economics that the sum of external balances (whether for stock or flow positions) must add to zero: for every debtor, there must be a creditor counterparty in the system.[1] Although much can be learned by examining the external positions of individual countries in isolation, this fundamental insight suggests that a comprehensive understanding of external imbalances can only be achieved by taking a global perspective that recognizes the asymmetric interdependence between creditor and debtor nations.[2]

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1. It is well known that this adding-up condition is wildly violated in the data, mainly due to endemic underreporting of foreign assets by many countries.

2. The global nature of external imbalances is a mainstay of academic research in this field but not always fully recognized in the policy debate. Bernanke (2005) represents an influential recent exception.

A global perspective is also warranted by a second consideration—the growing level of cross-border integration in financial markets.[3] An important consequence of financial globalization is that countries are exposed to asset price movements in other countries even if net balances are zero, with the degree of exposure an increasing function of the scale of gross cross-border asset trade. However, the structure of international balance sheets radically differs across countries along dimensions such as the mix of equity and debt, currency composition, maturity structures, and liquidity. This means that shifts in the relative prices of different assets have implications for the dynamics of external balances as individual countries have variable exposures to specific assets and, hence, experience asymmetric valuation effects from fluctuations in the financial terms of trade. Moreover, imperfect integration in goods markets means that the macroeconomic implications of even common asset price movements may be asymmetric across countries as real exchange rate movements drive a wedge between domestic and foreign real returns.

Accordingly, our goal in this paper is to develop an empirical analysis of the dynamics of external positions that takes into account the global interdependencies generated by net imbalances and the asymmetries in external capital structures. We are able to make progress on this issue by exploiting a revised and extended database on the foreign assets and liabilities held by a large number of countries over 1970 to 2003 (see Lane and Milesi-Ferretti 2006 for a description), with an update to 2004 for most G7 countries. This database allows us to trace out the dynamics of external positions for major creditor and debtor nations and identify the relative contributions of trade balances and valuation effects in generating and correcting external imbalances.

Moreover, our measures of the external stocks of assets and liabilities can be combined with balance-of-payments data on capital flows to explore the nature of global portfolio adjustment. For instance, we can address such questions as to the determinants of relative rates of return between the United States and other destinations and how international investors reallocate capital between the United States and other destinations in their foreign asset portfolios in response to shifts in relative rates of returns and their net exposure to the United States.

Last but not least, the stylized facts and evidence provided in the paper can be useful in assessing the relative merits of different views that have been put forward on the causes and consequences of widening global imbalances, which have emphasized factors such as productivity developments, shocks to portfolio preferences, bubbles in asset prices, shifts in fiscal policy, and increased desired saving in emerging markets.

3. See Lane and Milesi-Ferretti (2001, 2003, 2005) for our contributions in documenting and analyzing the financial globalization process.

The structure of the rest of the paper is as follows. In section 2.2, we provide a brief overview of trends in global imbalances over the last decade. Section 2.3 lays out an accounting framework that permits a decomposition of the dynamics of net external positions into the underlying contributions of trade balances, rate-of-return effects, and other factors. This section then provides a detailed and up-to-date empirical analysis of the dynamics of external positions for major creditor and debtor nations, with a particular focus on the factors influencing rate-of-return differentials across countries. Another contribution of this section is to provide a detailed narrative of the role of valuation effects in driving the net external positions of the United States and Japan over the longer span of 1980 to 2004.

We take a first step in section 2.4 in analyzing some features of the portfolio of cross-border assets held by foreign investors, with a particular emphasis on understanding fluctuations in the U.S. share in the foreign asset portfolio held by the rest of the world. This section also considers what recent portfolio trends can tell us about the likely future path of capital flows to the United States. Finally, we offer some concluding remarks in section 2.5.

2.2 Trends in Global Imbalances, 1994–2004

In this section, we document the main trends in global imbalances during the last decade. Figure 2.1 shows the current account balances (scaled by world gross domestic product [GDP]) for major countries and regions for the period 1994 to 2004. The picture highlights the substantial deterioration in the U.S. current account balance starting around 1997. This deterioration is mirrored by an improvement in the current account balance of emerging Asia, oil-producing Middle-Eastern countries, (especially in recent years) and, to a lesser extent, small industrial countries such as Switzerland and Scandinavian countries.[4]

Figure 2.2 shows the dynamics of the net foreign asset position.[5] The deterioration in the U.S. net foreign asset position until 2002, in line with widening current account deficits, is remarkable, but so is the fact that during 2003 and 2004 U.S. net liabilities have actually declined when scaled by world GDP, despite the large current account deficits. We investigate this issue further in the next section. At the same time, Japan, some small in-

4. A closer look at the factors underlying current account developments in emerging Asia suggests an interesting dichotomy between China and other East Asian emerging markets. While in China both national saving and domestic investment rose sharply as a ratio of GDP throughout the period, in other emerging Asian economies investment rates fell sharply in the aftermath of the Asian crisis and explain entirely the current account reversal.

5. The net foreign asset data are from the comprehensive database on international investment positions developed by Lane and Milesi-Ferretti (2006). Investment position data for 2004 are based on preliminary calculations by the authors.

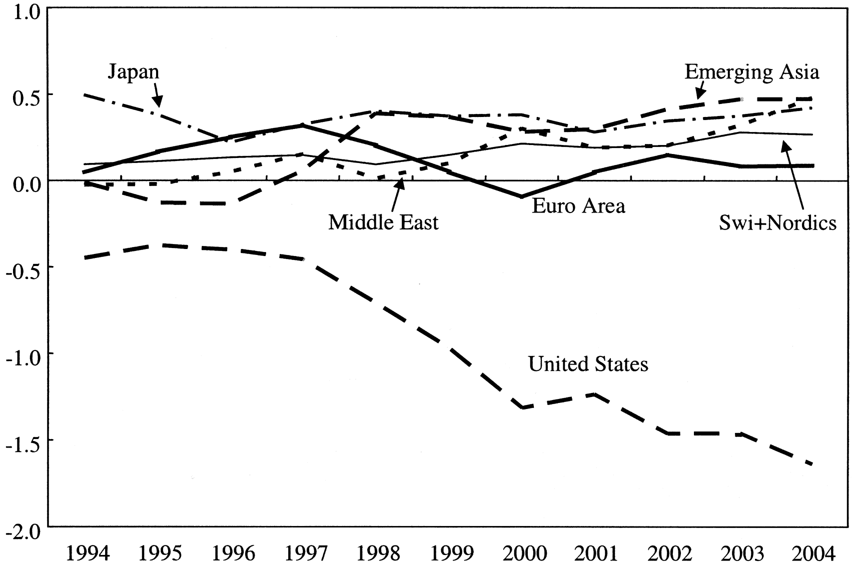

Fig. 2.1 Current account balances (percent of world GDP)

Notes: The emerging Asia group includes China, Hong Kong SAR, Taiwan Province of China, Korea, Malaysia, Singapore, and Thailand. The Swi + Nordics group includes Norway, Sweden, and Switzerland. The Middle East group includes Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Libya, Saudi Arabia, Syria, United Arab Emirates, and Yemen.

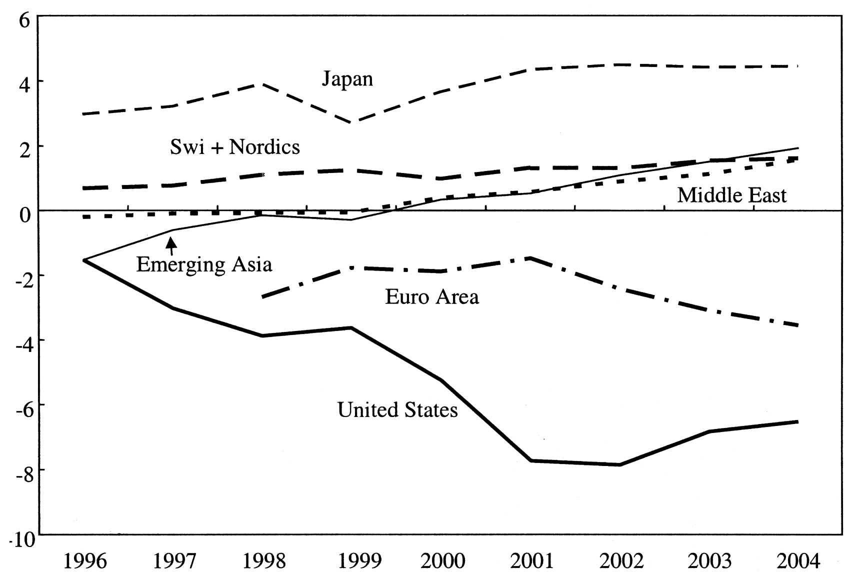

Fig. 2.2 Net foreign assets (percent of world GDP)

Notes: The emerging Asia group includes China, Hong Kong SAR, Taiwan Province of China, Korea, Malaysia, Singapore, and Thailand. The Swi + Nordics group includes Norway, Sweden, and Switzerland. The Middle East group includes Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Libya, Saudi Arabia, Syria, United Arab Emirates, and Yemen.

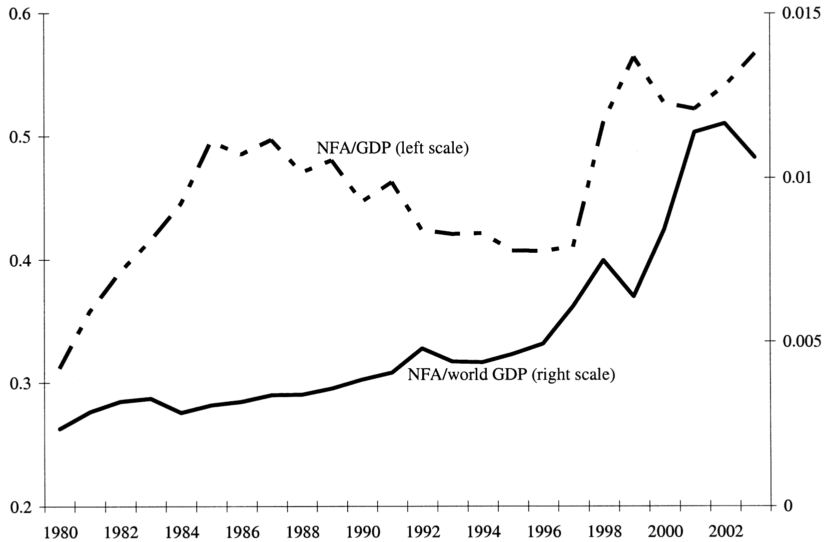

Fig. 2.3 Standard deviation of net foreign assets across countries, 1980–2003

Notes: The dashed line plots the standard deviation in the ratio of net foreign assets to GDP and the solid line the standard deviation in the ratio of net foreign assets to domestic GDP for a large set of industrial countries and emerging markets. The samples excludes transition economies (for which data are available only since the early 1990s) and extreme outliers such as small financial centers, with net financial positions equal to multiples of GDP.

dustrial countries, emerging Asia, and Middle-Eastern countries have built up significant creditor positions.

As shown in figure 2.3, the cross-country dispersion of net external positions has also increased during the last decade, whether scaled by world GDP or domestic GDP. The increase is sharper for external positions scaled by world GDP because of the increased liabilities of the United States. The point is reinforced if one examines the size of net holdings of the top five creditors and debtors: in 1994 the liabilities of the top debtors (United States, Australia, Canada, Brazil, and Mexico) were 3.5 percent of world GDP, while the assets of the top creditors (Japan, Switzerland, Germany, Taiwan Province of China, and the United Arab Emirates) accounted for 5 percent of world GDP. By 2003, the top five creditors (Japan, Switzerland, Hong Kong Special Administrative Region [SAR], Taiwan Province of China, and Singapore) had a net balance of 8.2 percent of world GDP and the top five debtors (United States, Spain, Australia, Brazil, and Mexico) a net balance of –10.3 percent of world GDP.[6]

In previous work (Lane and Milesi-Ferretti 2003, 2006), we have docu-

6. Even excluding the United States, the five other largest debtors accounted for 2.6 percent of world GDP in 1994 and 3.9 percent in 2003.

mented the spectacular growth in gross international asset trade, especially since the mid-1990s. To relate the magnitude of net positions to the size of gross asset trade, we use the Grubel-Lloyd (GL) index as a summary measure, following Obstfeld (2004). The GL index is given by $1 - |A - L|/(A + L)$, where A are external assets and L external liabilities. It takes the value 1 if the net position is zero and only gross cross-border asset trade takes place and the value 0 if asset trade occurs solely to finance net positions.

Figure 2.4 shows the unweighted-average GL index in our database as well as the index for G7 countries, defined as $1 - \Sigma_i |A_i - L_i| / \Sigma_i(A_i + L_i)$. The unweighted index is clearly trending upwards since the late 1980s, indicating that the growth in gross asset trade has been more dramatic than the increased dispersion in net positions. As for G7 countries, they have primarily engaged in gross asset trade, with smaller net positions, as indicated by the absolute values of the index close to unity. Since 1990, the index has first increased sharply with the growth in asset trade, peaking in 1999, and then declined as G7 net imbalances have widened.

The growth in cross-border asset trade suggests that rates of return on external portfolios may have increased in importance as a driver of external positions, in addition to trade balances. In particular, return differentials between external assets and liabilities—driven by factors such as differences in types of instruments, currency composition, and risk profiles—can potentially exert significant effects on the dynamics of net foreign assets. How important a role have these factors played in explaining

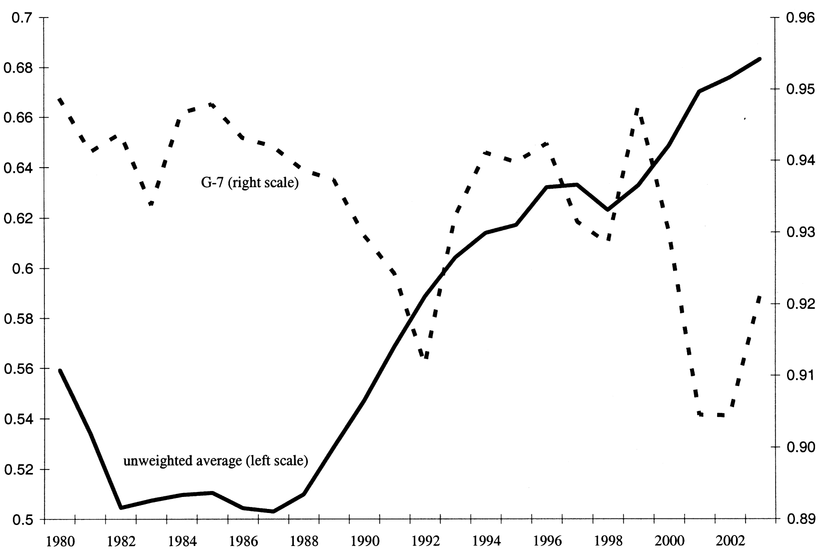

Fig. 2.4 Grubel-Lloyd index (G7 and cross-country average)
Note: See section 2.2 for a description of the construction of the Grubel-Lloyd index.

the widening dispersion of external imbalances in recent years? We turn to this question in the next section.

2.3 The Dynamics of External Positions

To explore in more detail the stylized facts described in the previous section, we first provide a simple accounting framework that relates the dynamics of net foreign assets to the trade balance, output growth, rates of return, and real exchange rates. We then use the framework to decompose the factors underlying changes in net foreign asset positions for the largest external creditors and debtors in recent years.

2.3.1 An Accounting Framework

The change in the net foreign asset position B can be written as follows:

$$B_t - B_{t-1} = \mathrm{CA}_t + \mathrm{KG}_t + E_t, \tag{1}$$

where B_t is the net foreign asset position, CA_t is the current account balance, KG_t is the capital gain or loss on net foreign assets (equal to the change in stocks minus the underlying flows), and the term E_t includes factors such as capital account transfers (the so-called capital account balance) and errors and omissions that drive a wedge between a country's current account and net inflows of capital. In turn, the current account CA_t equals the sum of the balance on goods, services, and current transfers BGST_t and the investment income balance $i_t^A A_{t-1} - i_t^L L_{t-1}$, where A and L are external assets and liabilities, respectively, and i_t^A, i_t^L are the nominal yields on these assets and liabilities.[7]

Indicating ratios to GDP with lowercase letters, we can express equation (1) as follows:

$$b_t - b_{t-1} \equiv \mathrm{bgst}_t + \frac{i_t^A A_{t-1} - i_t^L L_{t-1} + \mathrm{KG}_t}{Y_t} - \frac{g_t + \pi_t}{(1 + g_t)(1 + \pi_t)} b_{t-1} + \varepsilon_t, \tag{2}$$

where g_t is the growth rate of real GDP, π_t is the inflation rate, and the term ε includes the ratio of capital transfers and errors and omissions to GDP. The second term on the right-hand-side of equation (2) captures the effect of nominal returns on external assets and liabilities on the dynamics of the external position. To see this more clearly, define $\mathrm{kg}_t^A(\mathrm{kg}_t^L)$ as the ratio of the capital gain on external assets (liabilities), measured in domestic currency, to the outstanding stock of external assets (liabilities) at the beginning of the period, so that $\mathrm{kg}_t^A A_{t-1} - \mathrm{kg}_t^L L_{t-1} = \mathrm{KG}_t$. Then the real rate of return on foreign assets, measured in domestic currency, will equal $r_t^A = (1 + i_t^A + \mathrm{kg}_t^A)/(1 + \pi_t) - 1$, and an analogous definition will hold for the

7. We incorporate international labor income in the term BGST.

rate of return on foreign liabilities r_t^L. Using these definitions, we can rewrite equation (2) as follows:[8]

$$(3) \qquad b_t - b_{t-1} \equiv \text{bgst}_t + \frac{r_t^L - g_t}{1 + g_t} b_{t-1} + \frac{r_t^A - r_t^L}{1 + g_t} a_{t-1} + \varepsilon_t$$

This framework delivers several important insights. First, the gap between current production and current absorption (i.e., the trade balance) is only one factor in determining the aggregate evolution of the net foreign asset position: the intrinsic dynamics of net foreign assets depend on the difference between the rate of return and the growth rate, captured by the second term on the right-hand side (RHS) of equation (3), which is familiar from the standard debt accumulation equation. Second, when rates of return on external assets and liabilities differ, as captured by the last term on the RHS of equation (3), the gross scale of the international balance sheet matters in addition to the net position.

Several factors can account for differences in rates of return between external assets and liabilities.[9] In larger advanced economies, assets tend to be denominated in foreign currency and liabilities mostly in domestic currency. Consequently, an unexpected exchange rate depreciation (not reflected in ex ante interest differentials) will increase the domestic-currency rate of return on external assets and hence improve the net foreign asset position. In contrast, for emerging markets that are net debtors and whose external liabilities are primarily denominated in foreign currency, a real exchange rate depreciation raises the domestic-currency burden of foreign liabilities.[10] More generally, differential changes in asset prices (for example, in stock prices) across countries will tend to drive a wedge between returns on external assets and liabilities. We highlight the quantitative role of these factors in explaining the recent evolution of net external positions in the following section.

2.3.2 Recent Evolution: Selected Countries

We can now make use of equations (2) and (3) to show the factors contributing to the evolution of net foreign asset positions for a number of key countries over the past decade. Table 2.1 uses the decomposition highlighted by equation (2) for large industrial countries or areas for the period 1994 to 2000, and table 2.2 for the period 2001 to 2004.

During 1994 to 2000, the U.S. dollar strengthened and stock prices in-

8. The same equation can be written using real rates of return in dollars, rather than domestic currency, using the equivalence $1 + r_t^{\$} = (1 + r_t)(1 + s_t)$, where s_t is the rate of real domestic-currency appreciation vis-à-vis the U.S. dollar.

9. See also the extended discussion in Lane and Milesi-Ferretti (2005).

10. A trend toward a larger share of external liabilities denominated in domestic currency is at play in emerging markets as well, driven in particular by the increased importance of foreign FDI and portfolio equity investment.

Table 2.1 **Decomposition of change in net foreign assets (NFA), 1995–2000**

	Initial NFA position (1994)	Change in net foreign assets	Cumulative current account		Other factors		
			Cumulative trade balance	Cumulative investment income	KA, EO	Growth effect	K-gains
United States	–3.3	–13.5	–15.9	1.4	0.6	2.7	–2.4
United Kingdom	2.0	–5.7	–10.8	2.8	2.1	2.4	–2.3
France	–4.2	15.1	11.0	0.5	2.6	–0.6	1.5
Germany	9.5	–8.1	–4.4	–0.7	0.8	–0.7	–3.1
Italy	–9.4	11.8	16.8	–6.7	–6.2	1.3	6.5
Canada	–33.6	28.8	20.6	–20.4	6.3	5.5	16.8
Japan	14.4	9.9	6.6	7.3	0.8	–0.5	–4.3
Switzerland	100.3	23.1	9.5	47.7	1.8	–15.3	–20.7
Australia	–65.3	5.1	–7.0	–20.0	1.3	18.5	12.3

Notes: The decomposition reflects the one in equation (2) in the text, with all variables scaled by GDP. For example, the cumulative trade balance is equal to the sum of the trade balance to GDP ratio. The column KA, EO indicates the sum of errors and omissions and capital account transfers. See IMF (1993) for a description of these categories.

Table 2.2 **Decomposition of change in net foreign assets (NFA), 2001–2004**

	Initial NFA (2000)	Change in net foreign assets	Cumulative current account		Other factors		
			Cumulative trade balance	Cumulative investment income	KA, EO	Growth	K-gains
United States	–16.7	–5.8	–19.8	1.0	–0.9	3.9	10.1
United Kingdom	–3.7	–9.1	–15.3	7.4	0.6	1.0	–2.9
Euro area	–9.8	–5.6	3.9	–2.3	0.4	1.4	–9.0
Canada	–4.8	–5.7	18.5	–9.7	–1.0	1.7	–15.2
Japan	24.3	14.5	5.0	6.8	–1.2	0.3	3.7
Australia	–52.2	–17.2	–7.5	–11.4	–1.5	14.6	–11.4

Note: See table 2.1 notes.

creased sharply in most markets. The current account deficit in the United States started to widen in 1998, but other industrial countries saw no large change in current account balances, with Switzerland continuing to post large current account surpluses and Australia large current account deficits. As was already discussed in the previous section, external imbalances were reduced or reversed in some emerging markets, particularly so in Asia after the 1997 crisis, and from the following year in Latin America.

As shown in table 2.1, valuation effects implied some losses for the United States and the United Kingdom during 1994 to 2000 on account of their strengthening currencies and booming stock markets during this period. Canada experienced large capital gains, in part due to its positive net equity position, which benefited from rapidly rising stock prices.

As for the period 2001 to 2004, a number of interesting factors emerge from table 2.2:

- Despite running substantial trade deficits (close to 5 percent of GDP per year on average), the cumulative increase in the external liabilities of the United States has been only about 1.5 percentage points per year. While growth helped, the lion's share of the difference between the cumulative trade deficits and the deterioration in the net external position is accounted for by large capital gains (over 10 percent of GDP). In addition, despite being a net debtor throughout the period, the United States' net investment income receipts have been positive.
- The picture for Canada and the euro area is in many ways the mirror image of the one for the United States. Despite running trade surpluses during this period, both have seen a deterioration in their external accounts, primarily in light of substantial capital losses.

Tables 2.1 and 2.2 highlight the importance of capital gains and losses in driving the dynamics of net foreign asset positions. Accordingly, we probe more deeply the overall impact of rates of return on the dynamics of external positions in tables 2.3 and 2.4. The overall effect of returns is easily calculated by combining the capital gains with investment income (columns [4] and [7] in tables 2.1 and 2.2). The tables also shows the real rate of return (expressed in domestic currency) on external assets and liabilities as

Table 2.3 **Decomposition of change in net foreign assets (NFA), 1995–2000: Rates of return**

	Initial NFA position (1994)	Rate-of-return effects	Change in REER	Stock prices (foreign minus domestic)	Average real return on assets	Average real return on liabilities
United States	–3.3	–0.9	26.4	–143.0	8.8	7.9
United Kingdom	2.0	0.5	25.6	10.9	4.7	4.7
France	–4.2	2.1	–9.9	–54.5	11.0	11.0
Germany	9.5	–3.8	–12.6	–4.1	5.4	6.8
Italy	–9.4	–0.2	2.0	–16.5	7.1	6.4
Canada	–33.6	–3.6	–1.4	–41.9	8.0	6.0
Japan	14.4	3.0	–5.1	168.6	7.2	8.2
Switzerland	100.3	27.0	–4.6	–47.2	7.0	8.5
Australia	–65.3	–7.7	–12.9	85.9	11.1	5.7

Notes: The decomposition reflects the one in equation (3) in the text. The rate-of-return effects are given by the sum of investment income and capital gains in table 2.2. The change in REER equals the percentage change in the country's real effective exchange rate between end-1994 and end-2000. The stock price column indicates the difference between the percentage increase of foreign stock prices (in dollars) and domestic stock prices (also in dollars). Real rates of return on external assets and liabilities are expressed in domestic currency.

Table 2.4 **Decomposition of change in net foreign assets (NFA), 2001–2004: Rates of return**

	Initial NFA position (1994)	Rate-of-return effects	Change in REER	Stock prices (foreign minus domestic)	Average real return on assets	Average real return on liabilities
United States	–16.7	11.1	–14.8	11.6	4.8	–0.4
United Kingdom	–3.7	4.6	1.6	–6.3	0.1	–0.4
Euro area	–9.8	–11.3	31.5	4.4	–2.7	–0.5
Canada	–4.8	–24.9	16.0	–27.8	–5.3	0.5
Japan	24.3	10.5	–16.8	–0.6	5.9	5.0
Australia	–52.2	–22.8	23.8	–81.1	1.7	3.3

Notes: The change in REER equals the percentage change in the country's real effective exchange rate between end-2000 and end-2004. See table 2.3 notes.

well as financial market factors that can help explain rate of return differentials—namely, the percentage change in the real effective exchange rate and the differential between stock market price gains overseas and in the domestic economy (both measured in U.S. dollars).

To fix thoughts, consider the following numerical example. Take a country that has net external liabilities of 20 percent of GDP at the beginning of the sample period, and assume that the rate of return on external assets and liabilities is the same and is equal to 6 percent in nominal terms for the whole four-year period. In this case, returns would explain a cumulative deterioration in the net external position of around 5 percent (1.2 percent per year).

During the period 1994 to 2000 (table 2.3), all large economies made strong returns on their external portfolios, thanks in particular to booming stock prices. It is interesting to notice that while the United States made some capital losses, in light of the large dollar appreciation and buoyant domestic stock market, it still earned higher returns on its assets than on its liabilities, thanks in particular to the larger weight of equity instruments in its asset portfolio than in its stock of foreign liabilities.

Among countries that benefited from valuation effects during this period, Australia and Canada stand out. These countries enjoyed a hefty positive difference between the return on assets and on liabilities: Australia was helped by the depreciation of its currency, and Canada, as mentioned in the preceding, by its positive net equity position.

As already highlighted in table 2.2, the United States has made substantial capital gains on its net foreign asset position in the period 2001 to 2004. During these years, as shown in the second column of table 2.4, the real effective exchange rate of the dollar has depreciated by 15 percent, and foreign stock market prices have increased more rapidly than domestic prices (third column). As a result, rates of return on foreign assets (which are to a considerable extent denominated in foreign currency) have exceeded the rate of return on external liabilities by an average of over 5 percentage points.

Results for Canada and the euro area are the opposite to the U.S. case (with the United Kingdom representing an intermediate case). Both have made capital losses on their external position, both experienced a real appreciation, and both paid out higher returns on their external liabilities than the returns they gained on their external assets.

2.3.3 Return Differentials and Capital Gains: Some Historical Evidence

While differences in rates of return on external assets and liabilities are not new, two factors at play in recent years have contributed to make them both more important and more volatile. First, as documented in Lane and Milesi-Ferretti (2003, 2005), the size of gross external portfolios has grown dramatically, particularly during the past decade. As a result, a given rate-of-return differential between assets and liabilities has now a much larger effect on the dynamics of the net position, as clearly shown by equation (3). Second, the relative importance of direct investment and portfolio equity investment in international portfolios has increased, and those instruments have, on average, higher and more volatile returns than debt instruments. We document these stylized facts making use of a longer time series for the United States and Japan.

United States

For the United States,[11] capital gains and losses on external assets and liabilities are driven by stock price fluctuations and currency fluctuations. Since most of the foreign-currency-denominated assets held by U.S. residents are in the form of equity (direct investment and portfolio equity instruments), capital gains and losses are primarily determined by the difference in foreign and domestic stock market performance, measured in U.S. dollars.

Figure 2.5 plots the evolution of capital gains and losses (defined as the difference between the net external position and cumulative capital flows), together with the real effective exchange rate of the dollar, for the period 1980 to 2004. While in certain periods the correlation between capital gains and the real exchange rate is clearly very strong, the data suggest a more nuanced view.

- During the period 1983 to 1989, the comovement between the real exchange rate and capital gains was very strong. In particular, the United States made substantial capital gains on its external position between end-1984 and end-1988 (around 7 percent of GDP), thanks to two factors: (a) the impact of the sharp real effective depreciation (over 30 percent) on the dollar value of foreign assets, particularly foreign di-

11. See Tille (2003) for an interesting study of valuation effects during the period 1990 to 2002.

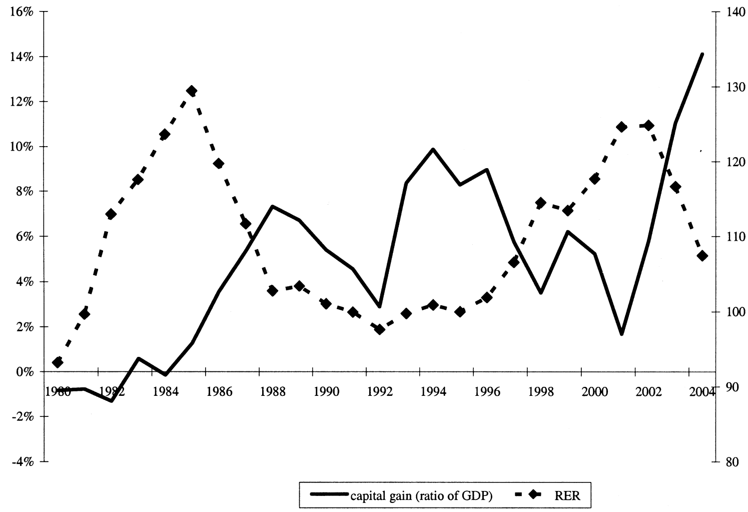

Fig. 2.5 United States: Capital gains and the real exchange rate, 1980–2004

rect investment and (b) the strong increase in foreign stock prices, above and beyond what can be explained by the dollar depreciation.[12]

- During 1988 to 1992, the United States made capital losses on its external position of around 3 percent of GDP.[13] This time the real exchange rate was broadly flat. However, stock market performance diverged strongly: U.S. markets increased sharply, while foreign markets—particularly Japan—declined. Therefore, capital gains were driven by asset prices, rather than exchange rates.
- During 1992 to 1994, the exchange rate was again broadly flat, while there was a major net capital gain (7.5 percent of GDP), arising from the strong performance of non-U.S. stock markets (up almost 40 percent) relative to the U.S. stock market (up 6 percent).
- During the period 1994 to 2001, the real appreciation of the U.S. dollar and the stronger performance of U.S. stock markets relative to overseas markets implied capital losses on external asset holdings totaling 5 percent of GDP.
- Finally, during 2002 to 2004 the weakening dollar and stronger stock market performance overseas with respect to the United States gener-

12. It is striking that these gains accrued with equity holdings abroad totaling only 8 percent of GDP at end-1984. At end-2004, equity holdings abroad amounted to 50 percent of GDP.

13. Losses may actually be understated in the data because likely underestimation of portfolio equity outflows suggests very large capital gains on U.S. foreign equity holdings, despite very weak stock market performance outside the United States. See Thomas, Warnock, and Wongswan (2004).

ated capital gains for the United States amounting to over 12 percent of GDP.

In sum, over the period the United States has enjoyed nontrivial capital gains on its external asset holdings, albeit with considerable fluctuations from period to period. This effect is in addition to the well-documented positive differential between the yield on U.S. assets and the one on U.S. liabilities and has implied that the United States has enjoyed a large positive rate of return differential between its overseas holdings and its liabilities.

Japan

For Japan, capital gains and losses on its external equity portfolio depend on asset prices in equity markets, while gains and losses on the debt portfolio depend particularly on exchange rate fluctuations as the currency composition of foreign liabilities is more skewed towards yen denomination than the currency composition of its debt assets.

During the second half of the 1980s, Japan's real appreciation and run-up in stock prices implied capital losses on its net external position (figure 2.6), while during the mid-1990s Japan did not experience sizable net capital gains or losses on its external position. A sizable cycle in capital gains and losses started in 1999, with significant losses driven by the equity portfolio—liabilities increased in value substantially, with booming domestic stock prices. These losses were reversed since, driven by gains on the equity portfolio during 2000 to 2001 (as Japanese stock price plummeted faster

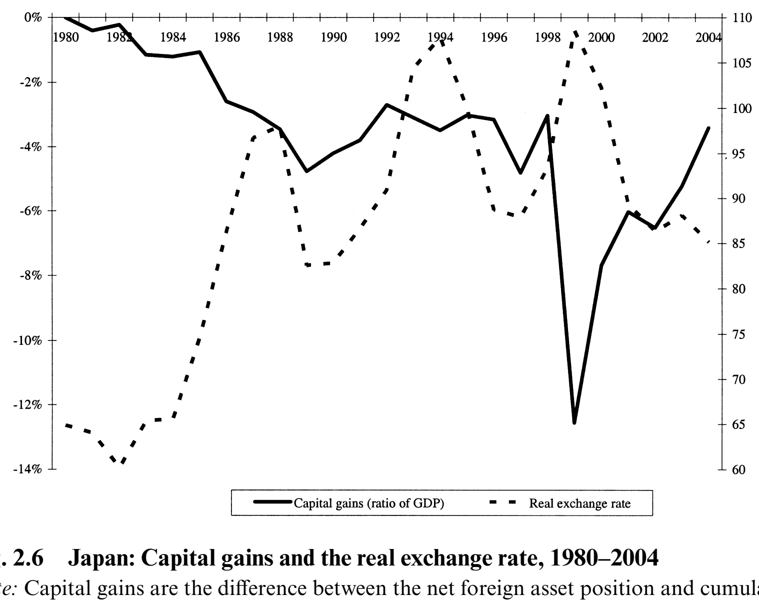

Fig. 2.6 Japan: Capital gains and the real exchange rate, 1980–2004

Note: Capital gains are the difference between the net foreign asset position and cumulative capital flows (both scaled by GDP), with an arbitrary starting value of zero in 1960.

Table 2.5 **Real domestic-currency returns on external assets and liabilities**

	Asset returns			Share of equity in total assets	Returns on liabilities			Share of equity in total liabilities
	Total	Equity	Debt		Total	Equity	Debt	
United States								
1995–1999	11.8	17.8	3.5	59	10.5	22.9	2.4	42
2000–2001	–7.9	–14.4	3.5	60	–4.9	–13.3	3.9	47
2002–2004	9.6	13.7	6.1	56	0.9	3.8	0.3	38
Japan								
1995–1999	6.2	3.1	1.9	29	10.1	22.1	–0.4	20
2000–2001	13.7	6.8	10.2	40	0.7	–24.4	3.2	29
2002–2004	2.8	–1.7	1.3	33	5.8	8.7	–2.2	26
United Kingdom								
1995–1999	4.8	11.3	2.4	28	5.4	16.0	2.5	24
2000–2001	1.7	–1.6	3.5	33	0.4	–5.5	3.2	29
2002–2004	0.4	3.6	–0.9	30	–0.3	0.4	–0.3	23
Euro area								
1995–1999								
2000–2001	0.7	–5.8	5.1	32	0.6	–5.8	4.9	45
2002–2004	–4.2	–2.2	–5.7	38	–1.0	4.0	–2.9	45

Note: Returns are constructed as the sum of investment income and capital gains, divided by the stock of outstanding assets or liabilities at the end of the previous year. Capital gains in year t are given by the difference between the change in the stock of assets and liabilities between end-year t and year $t-1$, minus the asset or liability flow during year t. They are deflated by the domestic consumer price index.

than world stock prices) and by gains on debt instruments following the yen depreciation over the next three years.

Rates of Return for Major Countries

Table 2.5 puts together capital gains and investment income data, showing the rates of return on external assets and liabilities, broken down by international financial instrument, for the last ten years. Care should be exercised in comparing returns across countries, particularly so as some countries (like the United States) measure foreign direct investment at market value, while others (like the euro area) measure investment at book value.[14] Nevertheless, table 2.5 contains some useful and interesting stylized facts.

- The share of equity instruments in total external assets and liabilities differs sharply across major financial centers; for example, the 2004

14. Ceteris paribus, returns measured at market value will be higher than returns at book value during stock market booms (for example, the periods 1994 to 1999 and 2003 to 2004) and lower during periods of stock market declines (such as 2000 to 2001). Another potential problem in measuring returns on foreign direct investment is the distortion created by tax-driven transfer pricing practices.

share of equity assets in the U.S. external portfolio is close to 60 percent, compared to under 20 percent in Japan.

- During the last decade, the United States earned a higher rate of return on its assets than on its liabilities, except for the period 2000 to 2001.[15] In general, the favorable return differential is associated with the equity premium, together with the higher weight of equities in total assets than in total liabilities.
- Japan has instead earned lower returns on its assets than on its liabilities, with the exception of the period 2000 to 2001.
- Rates of return on assets and liabilities for the United Kingdom have been lower than for the United States, primarily on account of the lower share of equities in the United Kingdom's external portfolio.

2.3.4 Summary and Discussion

The evidence in this section has highlighted that the distribution of net external positions has widened in recent years. Moreover, with financial globalization, the dynamics of positions has become heavily influenced by factors other than accumulated current account balances. A striking illustration is provided by the contrasting fortunes of the United States and Canada during 2001 to 2004: both countries experienced virtually identical declines in their net foreign asset positions (5.8 percent and 5.7 percent, respectively), even though the United States ran a cumulative trade deficit of 19.8 percent of GDP, while Canada ran a cumulative trade surplus of 18.5 percent of GDP during this period.

The wealth effects associated with capital gains and losses on international positions are imperfectly understood (Obstfeld 2004). Clearly, sharp distinctions must be drawn between valuation shocks that benefit both home and foreign investors (such as an improvement in domestic asset returns) versus those that inevitably generate asymmetries (such as the valuation effects induced by shifts in exchange rates): external valuation effects should not be viewed in isolation from aggregate (domestic and foreign) wealth dynamics.[16] Indeed, valuation effects at times simply reflect risk sharing: if a country's economic prospects improve, the value of capital will go up, and part of the benefit accrues to foreign owners of domestic capital.

Some recent contributions have attempted to incorporate international valuation effects into analyses of external adjustment (Blanchard, Giavazzi, and Sa 2005; Cline 2005; Corsetti and Konstantinou 2005; Edwards

15. The same result holds for the previous decade. The United States earned higher returns on assets in 1980 to 1984 (3 percentage points), 1985 to 1989 (7 percentage points), and 1990 to 1994 (4 percentage points).

16. Ideally, it would be desirable to express external positions relative to measures of wealth rather than GDP. However, good measures of domestic wealth are not widely available, and most proxies are highly correlated with GDP.

2005; Gourinchas and Rey 2005; International Monetary Fund [IMF] 2005; Obstfeld and Rogoff 2005; Roubini and Setser 2005) and quantitative models of monetary policy (Benigno 2001; Tille 2004). It is widely recognized in this literature that the portfolio behavior of international investors is a critical element in understanding the macroeconomic impact of valuation shocks.[17] Accordingly, in the next section, we conduct a preliminary investigation of the dynamics of international portfolios, with a special focus on the distribution of foreign asset holdings between the United States and other destinations.

2.4 Global Portfolio Dynamics

In the previous section, a recurrent theme has been that the growth in cross-border investment positions has increased the importance of valuation effects in determining the evolution of net foreign assets. There has also been some speculation that financial globalization has also increased the sustainability of external imbalances, in line with an increased capacity of the global investor pool to absorb the liabilities issued by individual countries (Greenspan 2005).

In this section, we probe this claim by investigating the relations among rate-of-return differentials, portfolio holdings, capital flows, and net foreign asset positions. In particular, we focus on the dynamics of the U.S. share in the aggregate cross-border financial holdings of foreign investors. Finally, we discuss whether there are indications that the capacity of the rest of the world to absorb U.S. liabilities is diminishing.

2.4.1 Recent Trends

Figure 2.7 shows the importance of U.S. external liabilities in total and in various asset categories relative to the rest of the world's holdings of foreign assets.

In terms of total holdings, the early 1980s represents an earlier phase of rapid growth in U.S. prominence in the foreign portfolios of the rest of the world, growing from 19.3 percent in 1980 to 28.3 percent in 1985. There was a subsequent reversal during 1986 to 1990, with the 1985 peak only being surpassed in 1996. The late 1990s saw a rapid increase in the U.S. share, peaking at 34.9 percent in 1999. Recent years have seen a substantial decline: the share of the United States in the total foreign assets held by the rest of the world had decreased to 26.2 percent in 2003. The decline has been even more spectacular for the equity category: the U.S. share has fallen from 51.2 percent in 1998 to 29.7 percent in 2003. The smallest de-

17. These authors generally build on the earlier portfolio-balance literature developed by Henderson and Rogoff (1982) and Kouri (1983), amongst others.

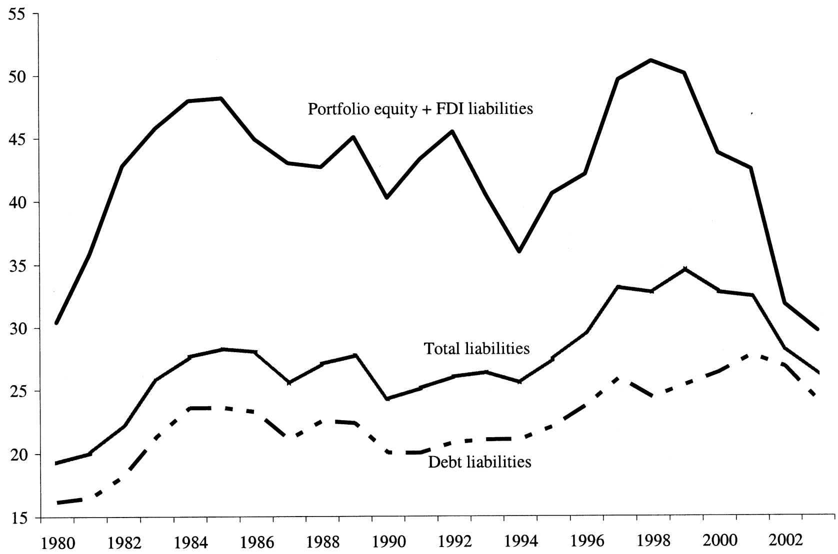

Fig. 2.7 Share of the United States in the foreign asset portfolio of international investors

Notes: Total liabilities are U.S. gross external liabilities scaled by total foreign assets of the rest of the world; portfolio equity + FDI liabilities are the sum of gross U.S. FDI and portfolio equity liabilities, scaled by the portfolio equity and FDI assets of the rest of the world; and debt liabilities are gross U.S. portfolio debt and other liabilities, scaled by total (portfolio and other) debt assets of the rest of the world.

cline has been in the debt category, falling from a 2001 peak of 27.8 percent to 24.1 percent in 2003.[18]

Of course, the recent decline in part has to do with the decline in the value of U.S. assets in recent years, between the asset price reversal in U.S. equity markets and the depreciation of the dollar since 2001. It also reflects acceleration in the scale of cross-border asset trade among other country pairs in recent years (for instance, growing cross-border trade within Europe and within the emerging market grouping), such that the United States matters less than it previously did as a financial trading partner.

Figure 2.8 provides a complementary perspective by showing the evolution of the net external position of the United States (scaled by U.S. GDP): in recent years, the trend increase in net portfolio debt has accelerated, while its traditional net positive position in equity has reemerged after the

18. The International Monetary Fund's Coordinated Portfolio Investment Survey provides an alternative source of information on the U.S. share in international portfolios. Excluding offshore centers, the 2003 U.S. share in the total portfolio holdings of the rest of the world amounted to 21.7 percent. For individual asset categories, the shares for portfolio equity, long-term debt securities, and short-term debt securities were 18.4 percent, 22.4 percent and 32.7 percent, respectively.

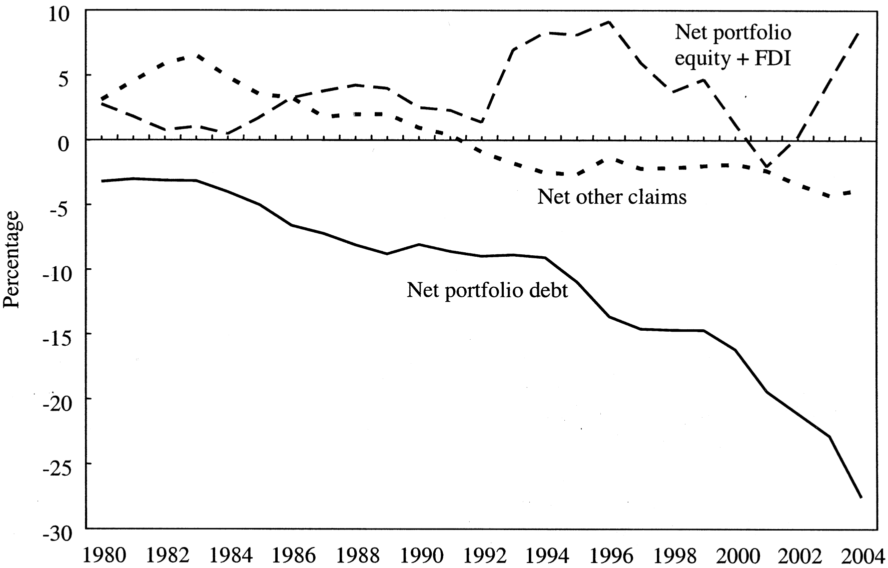

Fig. 2.8 United States: Net external position, underlying components (ratio of GDP)

Notes: Net portfolio equity + FDI equals the difference between the sum of FDI and portfolio equity assets and the sum of FDI and portfolio equity liabilities. Net other indicates the difference between the stock of other assets and other liabilities, and net portfolio debt is the difference between the sum of portfolio debt assets and reserves and the stock of portfolio debt liabilities.

temporary decline in this category in the late 1990s (in fact, the net equity position was only negative in one year—2001).

2.4.2 An Analysis of Portfolio Dynamics

Next, we examine the underlying factors driving the evolution of the share of U.S. assets in the cross-border portfolios of international investors. Define this share by

$$\theta_t = \frac{FA_t^{ROW,US}}{FA_t^{ROW,SUM}} \tag{4}$$

where $FA_t^{ROW,SUM}$ is the total value of cross-border assets held by non-U.S. investors and $FA_t^{ROW,US}$ is the value of the U.S. assets held by non-U.S. investors.[19]

19. An increase in foreign holdings of U.S. assets can be attributed to some combination of an increase in the share of foreign assets that is allocated to the United States, an increase in the ratio of foreign to total assets of the rest of the world, and an increase in the ratio of total assets to GDP for the rest of the world. Here, we focus on the first component: the share of total cross-border assets that is allocated to the United States. As such, we do not here investigate the growth in the aggregate foreign assets held by the rest of the world and its relation to the financial development and international financial integration of these countries.

Table 2.6 Rate-of-return differentials and the real exchange rate

Return differential	D(REER)	Adj. R^2	N	DW
(1) Aggregate	0.35 (3.84)***	0.18	24	2.18
(2) Debt	0.15 (1.35)	0.09	18	1.85
(3) Portfolio equity	1.45 (2.95)***	0.24	18	1.94
(4) FDI	0.77 (2.8)***	0.23	24	1.42
(5) Stocks (US minus ROW)	1.46 (3.12)***	0.31	24	1.39
(6) Bonds (US minus ROW)	0.71 (2.96)***	0.27	24	2.32
(7) Growth differential (US minus ROW)	0.02 (0.44)	–0.04	24	1.59

Notes: The dependent variable is the differential between the rate of return on assets held by nonresidents in the United States and the rate of return in the rest of the world. The explanatory variable is the rate of appreciation of the U.S. real effective exchange rate. Estimation by OLS, with t-statistics calculated using Newey-West standard errors in parentheses. See text for definitions of variables.

***Significant at the 1 percent level.

This ratio will fluctuate over time in line with shifts in the allocation of capital flows between the U.S. and other destinations and rate-of-return differentials between the U.S. and other destinations so that

$$\theta_t = \theta_{t-1}\left[\frac{(1 + R_t^{\mathrm{US}}) + \mathrm{FL}_t^{\mathrm{US}}}{(1 + R_t^{\mathrm{SUM}}) + \mathrm{FL}_t^{\mathrm{SUM}}}\right], \tag{5}$$

where rates of return R_t^{US}, R_t^{SUM} are expressed in dollar terms, and flows are expressed as a percentage of the accumulated positions $\mathrm{FL}_t = \mathrm{FLOW}_t/\mathrm{FA}_{t-1}$.

Given this partitioning, it is useful to analyze the behavior of relative rates of return and relative capital flows. With respect to the former, we begin by highlighting the key role played by the exchange rate in determining rate-of-return differentials between the United States and the rest of the world. Table 2.6 reports simple regressions of various relative return indicators on the U.S. multilateral real exchange rate. Using investment position and balance of payments data, we derive rates of return for the United States as in the previous section: namely, the rate of return in a given category is the sum of investment income plus capital gains, divided by the accumulated asset position. For rates of return in the rest of the world, we use market-based indicators, based on ex-U.S. global return indices for stocks and bonds.[20] As a robustness check, we also examine return indices for U.S. stocks and bonds in addition to the balance-of-payments (BOP)-derived returns. Finally, as a general proxy for economywide returns, we also consider the difference between U.S. and global GDP growth rates.

20. The bond and stock return data are from Global Financial Data. The stock return index is used as a proxy for returns on both portfolio equity and FDI; the bond return index is used a proxy for returns in the debt category. A weighted average of stock and bond returns is employed for the return on the aggregate holdings of foreign assets.

The results are shown in table 2.6. With the exceptions of BOP-derived debt returns and relative output growth, the simple regression of relative returns on the real exchange rate is significant in all categories: real appreciation of the dollar is associated with an increase in the return on U.S.-located assets relative to overseas returns.[21]

Although table 2.6 contains some useful information, it is desirable to probe further the comovements between changes in real exchange rates and other factors that may influence return differentials. In particular, we are interested in knowing whether return differentials comove with shifts in the outstanding portfolio positions. According to the portfolio balance literature, we might expect a negatively sloped demand schedule for U.S.-issued liabilities—the greater is the share of U.S. assets in the accumulated portfolio of foreign investors, the larger is the risk premium required to hold these assets. On the other side, as has been highlighted by Gourinchas and Rey (2005), the stability of the U.S. net external position is facilitated by a negative relation between outstanding liabilities and returns. While our reduced-form regressions cannot identify the different structural factors that determine returns, it is still instructive to establish the basic patterns in the recent data.

Accordingly, table 2.7 regresses return differentials on the lagged level of the U.S. net foreign asset position, the lagged share of U.S. assets in the aggregate cross-border portfolio of foreign investors, and the lagged share of capital flows to the United States to aggregate cross-border flows. In order to isolate the exchange rate channel, we first examine the impact of portfolio factors on exchange rate behavior; in subsequent regressions for the other return measures, the exchange rate term is held fixed such that these regressions pick up any influence of portfolio factors on the other components of returns. Accordingly, for these return categories, the specification is

$$(6)\quad (R_t^{US} - R_t^{ROW}) = \alpha + \rho \mathrm{DREER}_t^{US} + \beta_1 \mathrm{NFAY}_{t-1}^{US} + \beta_2 \mathrm{ST\_SHARE}_{t-1}^{US} + \beta_3 \mathrm{FL\_SHARE}_{t-1}^{US} + \varepsilon_t,$$

where DREER^{US} is the rate of real exchange rate appreciation by the United States against its trading partners, NFAY^{US} is the ratio of U.S. net foreign assets to GDP, $\mathrm{ST\_SHARE}^{US}$ is the share of the United States in the rest of the world's total cross-border holdings in that category, and $\mathrm{FL\_SHARE}^{US}$ is the share of capital flows to the United States in the rest of the world's total cross-border capital flows in that category.

A number of striking results emerge from table 2.7. First, the exchange

21. Here we employ the trade-weighted real exchange rate. Results were quite similar for a crude portfolio-weighted real exchange rate. That the exchange rate is significant for relative bond returns in row (6) but not relative debt returns in row (2) is consistent with poor measurement of overall returns on nonportfolio debt (e.g., bank loans).

Table 2.7 **Real exchange rate, rate-of-return differentials, and portfolio factors**

	DREER^{US} (1)	Debt return differential (2)	Equity return differential (3)	FDI return differential (4)	Stocks return differential (5)	Bonds return differential (6)	Growth differential (7)
DREER^{US}		0.19	0.82	0.83	1.4	0.79	0.05
		(3.62)***	(2.94)**	(4.0)***	(5.3)***	(3.2)***	(1.1)
NFAY$^{US}_{t-1}$	0.51	0.32	–0.12	–0.1	0.78	0.57	–0.01
	(1.92)*	(4.79)***	(0.5)	(0.4)	(2.37)**	(1.61)	(.02)
ST_SHARE$^{US}_{t-1}$	–0.34	0.62	–1.71	–0.23	–0.68	1.32	0.19
	(.39)	(2.07)**	(3.5)***	(1.0)	(4.2)***	(1.59)	(1.79)*
FL_SHARE$^{US}_{t-1}$	–0.85	0.05	–0.04	–0.64	0.03	–0.7	0.13
	(1.82)*	(.34)	(1.79)*	(2.05)*	(2.37)**	(1.4)	(1.3)
Adjusted R^2	0.24	0.3	0.41	0.26	0.52	0.27	–0.01
No. of observations	22	18	18	23	23	23	23
DW	1.55	2.41	1.76	1.78	1.82	2.5	1.79

Notes: Estimation by OLS, with t-statistics calculated using Newey-West standard errors. In column (1), the dependent variable is the percentage change in the U.S. real effective exchange rate. In columns (2)–(4), the dependent variable is the difference between the rate of return on assets held in the United States by foreign investors and the rate of return on other cross-border assets held by foreign investors. In columns (5)–(6) the dependent variable is the difference between equity (debt) returns in the United States and in the rest of the world. In column (7), the dependent variable is the difference between the growth rate in the United States and the rest of the world. RHS variables are defined as follows: DREER^{US} is the rate of U.S. real appreciation vis-à-vis its trading partners, NFAY^{US} is the ratio of U.S. net foreign assets to GDP, ST_SHARE^{US} is the share of the United States in the rest of the world's total cross-border holdings in the asset category being considered, and FL_SHARE^{US} is the share of capital flows to the United States in the rest of the world's total cross-border capital flows in the asset category being considered. The regression in column (1) also includes an AR(!) correction.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

rate tends to appreciate, the more positive is the lagged net foreign asset position and the smaller is the lagged share of the United States in portfolio flows. This pattern is qualitatively consistent with the Gourinchas-Rey finding: strong capital inflows and a high outstanding net liability position is associated with subsequent real depreciation.[22] Second, the strong influence of exchange rates on return differentials found in table 2.6 is confirmed in the broader specifications in columns (2) to (6) of table 2.7. Third, shifts in the outstanding net foreign asset position are associated with subsequent movements in debt and equity return differentials over and above the exchange rate channel. Again, the pattern is stabilizing, with relative re-

22. The Gourinchas-Rey setup involves identifying unsustainable external positions by examining the comovement of net exports and the net foreign asset position. Our specification rather takes a financial account perspective by looking at capital flows rather than the trade balance.

turns on U.S. assets declining (holding fixed the exchange rate) as the net foreign asset position deteriorates.

Moreover, as shown in columns (3) and (5), an increase in the share of the United States in lagged equity positions is associated with a decline in subsequent relative returns, reinforcing the stabilization pattern. The only coefficient that lines up with the portfolio-balance argument is that relative bond returns are increasing in the relative size of the United States in bond portfolios—but these results are not quite significant and hold constant the exchange rate channel. Finally, it is intriguing to note that an increase in the share of the United States in the foreign asset portfolio of foreign investors is associated with an increase in relative output growth in the United States (although again this result is only marginally significant).

In summary, the results in table 2.7 show considerable support for a stabilizing pattern in returns, with returns negatively covarying with portfolio exposures. Of course, these results may well be specific to this sample period and may not carry over in projecting future returns to the extent that investor attitudes to U.S. liabilities may well shift (or have already shifted).

Our next step is to explore the influence of portfolio factors on relative capital flows. Again, we adopt a portfolio-balance perspective and ask how relative capital flows adjust to lagged returns and the scale of the portfolio exposure to the United States. We look at both absolute capital flows to the United States, $\mathrm{FL}_t^{\mathrm{US}}$ (expressed as a percentage of lagged U.S. liabilities), and capital flows to the United States relative to capital flows from the rest of the world to other destinations ($\mathrm{FL}_t^{\mathrm{US}} - \mathrm{FL}_t^{\mathrm{ROW}}$). We allow for persistence in flows by including the lagged dependent variable as a regressor.

In addition, we include the lagged three-year moving average of relative returns in the United States versus the rest of the world $R_{t-1}^{\mathrm{US}} - R_{t-1}^{\mathrm{ROW}}$. To the extent that future relative returns are unpredictable, an investor that wishes to maintain a fixed U.S. weight in his or her international portfolio must offset poor relative returns in one period with a subsequent increase in relative flows. However, lagged returns may also serve as a leading indicator for future returns (with positive or negative sign), such that the sign on this variable in explaining capital flows is not easily tied down.[23] In addition, the rebalancing effect may be swamped in the data if the desired U.S. weight in the portfolio shifts over time.

To the extent that investors wish to maintain stable portfolio shares, we should generally expect that an increase in the portfolio share in one period is associated with a subsequent contraction in relative capital flows. Accordingly, we also include the outstanding portfolio position (for absolute

23. Hau and Rey (2004) provide empirical support for the portfolio-balance model, using monthly data on equity flows, equity returns, and exchange rates. Also using monthly data, Bohn and Tesar (1996) find evidence of return-chasing in the foreign equity purchases of U.S. investors. However, Portes and Rey (2005) do not find evidence of return-chasing in annual data on equity transactions for a sample of fourteen advanced countries.

capital flows to the United States, we include the lagged stock of U.S. liabilities relative to U.S. GDP, L_{t-1}^{US}; for the relative flows specification, we include the lagged share of U.S. liabilities in the total foreign asset portfolio of international investors, $\text{ST\_SHARE}_{t-1}^{\text{US}}$).

More formally, the specifications for absolute and relative capital flows are

$$\text{FL}_t^{\text{US}} = \alpha + \rho \text{FL}_{t-1}^{\text{US}} + \beta_1 R_{t-1}^{\text{US}} + \beta_2 L_{t-1}^{\text{US}} + \varepsilon_t \tag{7}$$

$$(\text{FL}_t^{\text{US}} - \text{FL}_t^{\text{ROW}}) = \alpha + \rho(\text{FL}_{t-1}^{\text{US}} - \text{FL}_{t-1}^{\text{ROW}}) + \beta_1(R_{t-1}^{\text{US}} - R_{t-1}^{\text{ROW}}) + \beta_2 \text{ST\_SHARE}_{t-1}^{\text{US}} + \varepsilon_t.$$

The results are presented in table 2.8. These regressions deliver some striking results. First, the dynamic behavior of capital flows differs substantially across asset categories. While there is significant positive serial correlation for aggregate flows and foreign direct investment (FDI) flows, the pattern is actually negative for equity flows: all else equal, high equity flows in one period are reversed in the next period.

Second, there is some evidence that a shift in returns is associated with a subsequent change in the level of capital flows. For absolute and relative debt flows, an improvement in U.S. relative returns is associated with a subsequent decline in the relative share of the United States in debt flows. In contrast, there is some evidence that capital flows are positively influenced by lagged returns for the equity and FDI categories. (However, this is only true for absolute capital flows. Lagged relative returns do not explain the relative share of flows to the United States in these categories. It seems as if high relative returns in the United States are associated with a generalized increase in capital flows in the equity and FDI categories to the United States but also to other destinations.)

Holding fixed return differentials, the evidence on the relation between outstanding portfolio positions and subsequent capital flows is mixed. For absolute and relative capital flows in the FDI category, the results do indicate that a high outstanding U.S. share is associated with a subsequent decline in FDI flows to the United States. This is also true for relative flows in the portfolio equity category, even if absolute portfolio equity flows positively comove with the outstanding level of U.S. portfolio equity liabilities. Absolute or relative debt flows to the United States do not show a systematic relation with the outstanding debt position. In part, this may reflect the role played by central banks in debt flows and the complexity of policy decisions regarding reserve accumulation.

In summary, the results from the nonstructural regressions in table 2.8 provide some insights into the dynamics of capital flows. The variation in behavior across asset categories is especially striking, with the correlates of capital flows markedly different between debt, portfolio equity, and FDI categories. However, our findings are certainly not conclusive regarding

Table 2.8 **Capital flows and portfolio factors**

	All flows to U.S. (1)	All flows to U.S. relative to ROW (2)	Debt flows to U.S. (3)	Debt flows to U.S. relative to ROW (4)	Equity flows to U.S. (5)	Equity flows to U.S. relative to ROW (6)	FDI flows to U.S. (7)	FDI flows to U.S. relative to ROW (8)
Lagged dependent	0.54	0.61	0.22	0.3	–0.83	–0.53	0.58	0.36
variable	(3.0)***	(3.0)***	(1.42)	(1.45)	(5.07)***	(2.11)*	(4.4)***	(1.99)*
Lagged returns	–0.05	–0.02	–1.4	0.09	0.2	0.11	0.17	–0.06
	(0.29)	(.4)	(3.69)***	(.34)	(5.18)***	(.09)	(2.77)**	(.6)
L^{US}_{t-1}	0.11		–0.08		1.09		–0.19	
	(1.13)		(.7)		(5.61)***		(2.42)**	
$ST\_SHARE^{US}_{t-1}$		–0.18		–0.23		–9.38		–0.2
		(.61)		(.63)		(3.4)***		(1.82)*
Adjusted R^2	0.34	0.52	0.35	–0.14	0.67	0.2	0.55	0.33
No. of observations	21	21	15	15	15	15	21	21
DW	1.62	1.64	1.92	1.3	1.84	1.93	1.9	1.99

Notes: Estimation by OLS, with t-statistics calculated using Newey-West standard errors. In columns (1), (3), (5), and (7), the dependent variable is capital flows to the United States in the respective category, scaled by outstanding U.S. liabilities. In the remaining columns, the dependent variable is the difference between capital flows to the United States and capital flows to other destinations, scaled by the respective size of outstanding liabilities. As for RHS variables, lagged returns are returns on U.S. external liabilities for columns (1), (3), (5), and (7), and the return differential between the United States and the ROW (rest of the world) for columns (2), (4), (6), (8). L_{t-1} is the outstanding stock of U.S. external liabilities in the category being considered, scaled by GDP, and ST_SHARE^{US} is the share of the United States in the rest of the world's total cross-border holdings in the asset category being considered.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

the importance of portfolio factors: more detailed investor-level data, plus a structural econometric approach, would be required for a more accurate investigation.

2.4.3 Looking to the Future

We conclude this section by examining whether there are any indications that the capacity of foreign investors to absorb U.S. liabilities is diminishing.

There are several forces pointing toward a declining appetite for U.S.-issued liabilities. First, as is shown in figures 2.9, 2.10, and 2.11, the composition of capital flows to the United States has shifted in recent years: equity (portfolio and FDI) inflows have dried up, with a much greater reliance on debt inflows than in the late 1990s. This is consistent with the evidence in the previous section to the extent that the decline in equity inflows may be attributed to the lower returns earned by foreign equity investors in the United States relative to other major financial centers. An increased dependence on debt flows increases the risk profile of U.S. external liabilities and also leaves the United States more vulnerable to sudden shifts in investor sentiment.

Second, within the category of debt flows, there has been a broadly rec-

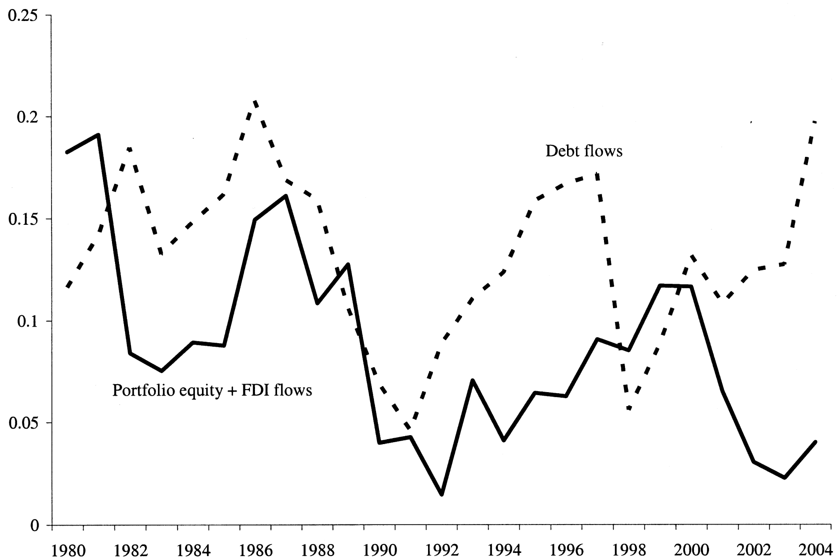

Fig. 2.9 Composition of capital flows to the United States, 1980–2004 (share of outstanding liabilities)

Notes: Equity inflows to the United States (portfolio and FDI) are scaled by the outstanding stock of U.S. equity liabilities; debt inflows (portfolio and other) are scaled by outstanding stock of U.S. debt liabilities.

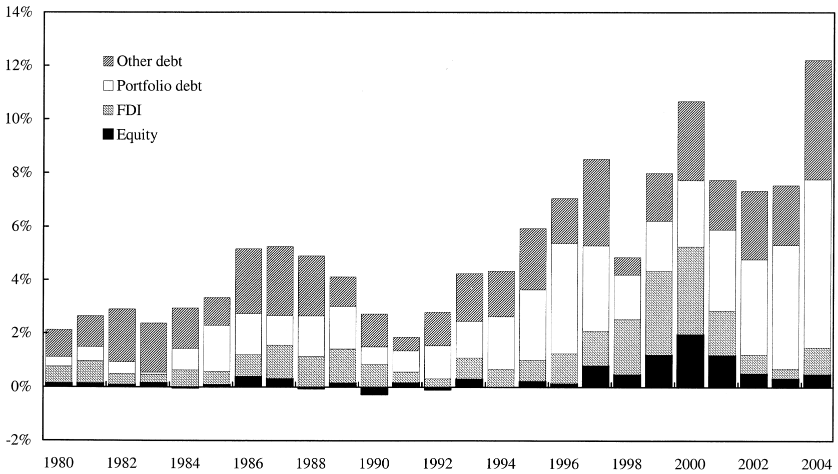

Fig. 2.10 United States: Composition of capital inflows (ratio of GDP)
Source: IMF BOP statistics.

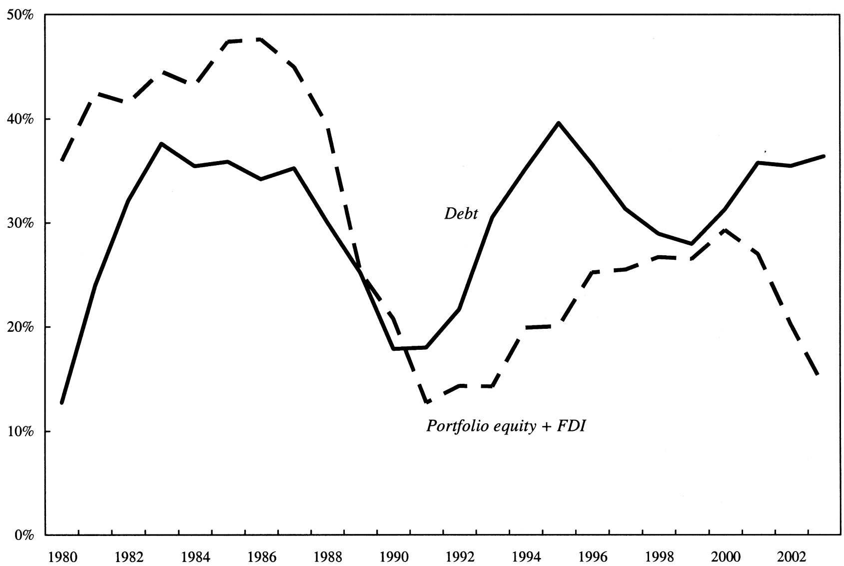

Fig. 2.11 Capital flows to the United States (percent of rest of the world's capital outflows)
Source: Lane and Milesi-Ferretti (2006).
Notes: The solid line (debt) is the three-year moving average of debt flows to the United States as a share of total debt outflows of the rest of the world. The broken line (portfolio equity + FDI) is the three-year moving average of the sum of portfolio equity and FDI inflows to the United States as a share of portfolio equity + FDI outflows of the rest of the world.

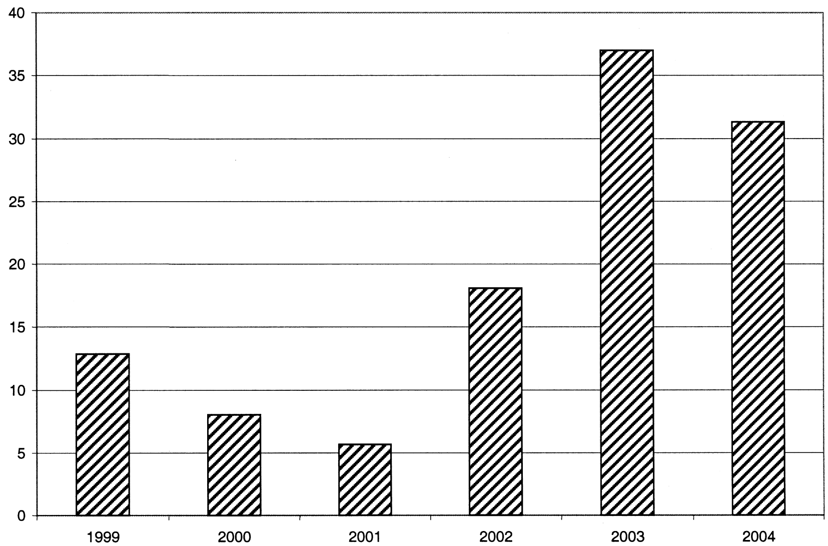

Fig. 2.12 United States: Official inflows as a percent of total debt inflows, 1999–2004
Source: Bureau of Economic Analysis.

ognized shift from private to official foreign investors, with foreign central banks emerging as the key marginal purchaser of U.S. debt issues (especially U.S. government debt). We illustrate this in figure 2.12: the ratio of official to total debt inflows average 8.8 percent during 1999 to 2001 and rose to 26.3 percent during 2002 to 2004 (official flows relative to portfolio debt inflows averaged 17.3 percent during 1999 to 2001 and 42.6 percent during 2002 to 2004).[24]

Third, there are strong reasons to believe that the recent rapid pace of reserve accumulation that has been a mainstay of demand for U.S.-issued liabilities will not be sustained. For instance, figure 2.13 shows that reserves are at a historic high for the group of developing countries and studies such as IMF (2003) have shown that the recent level of reserves far exceeds that predicted by standard models of optimal reserve holdings. The current policy debate in these countries all point to a reduction in their level of demand for U.S. debt securities via greater currency diversification in reserves, modifications of exchange rate strategies, and an improving climate for domestic investment after several years of postcrisis retrenchment, reform, and restructuring.[25]

24. These numbers are lower bounds for the importance of the official sector as significant official flows take place through indirect transactions. See also Higgins and Klitgaard (2004). Roubini and Setser (2005) make the important additional observation that the maturity structure of U.S. (government) liabilities has shortened considerably in recent years.

25. It is also understood that Japan has decelerated its official purchases of U.S. assets, ceasing to intervene in the yen-dollar market.

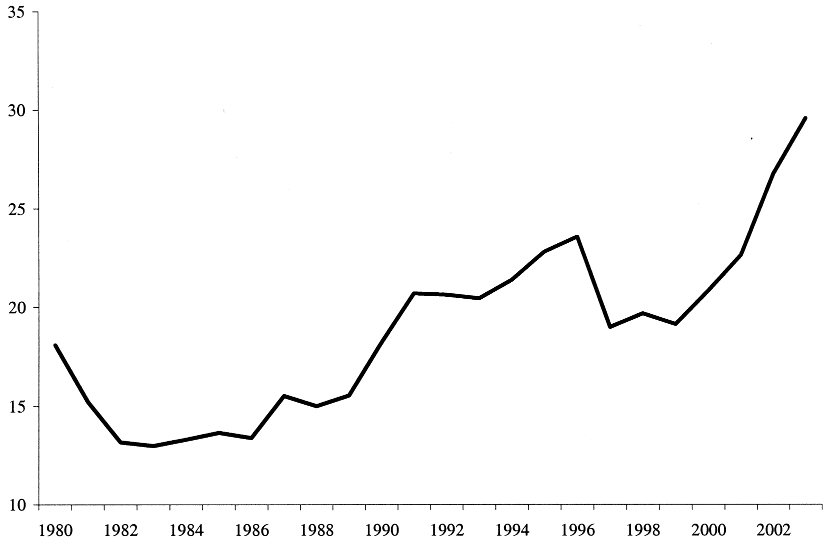

Fig. 2.13 Official reserves in percent of total foreign liabilities, developing countries

Note: Ratio of official reserves is in percent of total foreign liabilities for the group of non-industrial countries.

More generally, the evidence in this paper is that an important reason why the share of U.S. liabilities in the portfolios of foreign investors has been maintained at a relatively stable level (relative to the scale of capital flows to the United States) has been the operation of the valuation channel of exchange rate adjustment: increases in portfolio shares have been undone through exchange rate depreciation. As is extensively discussed in Lane and Milesi-Ferretti (2005), it is not a viable long-run strategy to rely on such valuation gains to ameliorate a structural reliance on net capital inflows. At some point, the vision of the United States as a safe haven and natural home for liquid holdings would be undercut by persistent portfolio losses induced by a depreciating currency, or investors will begin to require more significant risk premia on U.S.-issued liabilities.

Finally, a countervailing factor is that the growth in cross-border asset trade has amplified the importance of rate-of-return differentials. To the extent that the United States does manage to maintain a positive return differential (either due to composition effects or superior performance within given asset categories), the ongoing scaling-up of its international balance sheet progressively increases the gain from this financial transformation process. A simple numerical example helps clarify this point, using U.S. data and equation (3) as a guide. Assume that the net foreign asset position b equals minus 25 percent of GDP, the output growth rate g is 3 percent, the real rate of return on external liabilities r^L is 4 percent (its average level in the United States for the past twenty years), and gross foreign assets stand at 80 percent of GDP (roughly their end-2004 level for the United States). In this case, with no return differential between external assets and liabilities, a trade deficit of 5 percent of GDP would entail a deterioration of net foreign assets of 5¼ percent of GDP. However, with a positive differential of 300 basis points between returns on assets and on liabilities (its average level for the period 1990 to 2004), the net foreign asset position would deteriorate by only 3 percent of GDP—a gain of over 2 percent of GDP with respect to the benchmark case.[26] If gross assets were, say, 110 percent of GDP, the deterioration in net foreign assets would only be 2 percent of GDP—a gain of over 3 percent of GDP. Even a 125 basis point differential at the current level of financial globalization delivers a nontrivial gain of 1 percent of GDP.

Clearly these calculations are purely illustrative and rely on the assumption that the rate-of-return differential stays constant as the level of international financial integration increases—the payoff to an increase in the gross foreign asset position would obviously be smaller if growth in cross-border holdings were concentrated in those asset categories in which the U.S. return premium is less significant.

2.5 Conclusions

This paper has provided wide-ranging empirical evidence on the dynamics of external positions for key creditor and debtor nations. We have highlighted the key role of valuation effects in the recent evolution of external imbalances, which have moved in a stabilizing direction for the world's largest debtor, while other countries have experienced the depressing combination of substantial trade surpluses yet sharp declines in their net external positions. We have also presented some preliminary findings concerning the interrelations between relative rates of return, portfolio shares, and international capital flows.

An important message from our work is that the notion that the United States attracts foreign capital because it offers high returns to foreign investors appears, for the years of the new millennium, rather shaky. Our analysis of relative rates of return and capital flows shows that (a) U.S. residents have consistently earned higher returns on their assets than they pay out on their liabilities; (b) real dollar returns on foreign investment in the United States have on average been negative over the past four years and even more so when expressed in the currencies of most foreign investor countries; and (c) since 2000, capital flows to the United States have shifted

26. To put it differently, a 300 basis points return differential means that a trade deficit of 2 percent of GDP would be consistent with a stable net foreign asset position, despite the assumption that the return on liabilities is higher than the growth rate.

toward fixed-rate (and low-yield) debt instruments and away from equities, even during the recovery in stock market performance in 2003 to 2004. In addition, the recent accumulation of dollar assets by the foreign official sector is unlikely to persist into the indefinite future—a tightening at the margin of external demand for U.S.-issued liabilities is clearly possible although the timing of this shift is of course highly uncertain.

Finally, the United States has relied on sizable capital gains to stabilize its external position during the past few years. Looking forward, exploiting this channel again would require a continued sizable differential in rates of return between U.S. external assets and liabilities. While some positive differential may well persist and would play an increasingly important role as long as financial integration increases, logic would suggest that return differentials of the order of magnitude of those seen in the past three years cannot be sustained for a prolonged period of time—they would likely require persistent dollar depreciation, which would eventually be incorporated in inflation expectations and ex ante interest rate differentials. Notwithstanding the importance of valuation effects, the current level of U.S. trade deficits cannot be permanently sustained, and global adjustment requires the rebalancing of savings and investment flows between the United States and the rest of the world.

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Comment Richard Portes

With this paper, the authors extend further their exploration of the data on countries' international financial positions. We are all in their debt for the data themselves as well as for their efforts to discern the patterns behind international financial interactions. We have here some interpretations of the data, some descriptive statistical investigation, and some hypotheses for further research. They give particular attention to the case of the United States, the role of U.S. liabilities in world asset stocks, and the adjustment of international portfolios to the growing U.S. external indebtedness.

The paper is so rich that it is a bit difficult to digest, the more so because the data do not tell unambiguous stories. There is no clear explanation for the growing dispersion of net foreign asset positions, except to say that the international financial system is more capable of supporting them than it was a decade or two ago. That does not get us very far. Nor do we understand very well why the gross positions have grown so rapidly, so that we now have an extraordinary degree of leverage in international portfolios.

Whatever parallels one might see between the financial globalization of the past twenty years and the period 1870 to 1913, in this respect there is a great contrast. Obstfeld and Taylor (2003) pointed out several years ago that in the earlier period, net positions were close to gross positions: international lending was unidirectional, from the advanced countries to the periphery (often their colonies or former colonies), with relatively little among the advanced countries themselves. Today, however much attention focuses on emerging markets and their financial crises, the bulk of international financial interaction is, in fact, among the advanced countries. The authors interpret this as the response of sophisticated investors adjusting to return differentials, but there is as yet no strong confirmation of this hypothesis from the data, at least in a form that fits some extant model.

There are more puzzles in the data presented in this paper. Why have so many emerging market countries moved into current account surplus over the past decade? This has been attributed to a savings glut, but what we actually observe is more an investment famine; and the savings glut reflects as much the growing financial surpluses of corporations in the advanced countries as it does any deliberate, precautionary reserve accumulation by emerging market central banks. Nor can the story tell us why the emerging markets of Central and Eastern Europe in general have run deficits rather than surpluses.

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Again, why do so many observers rationalize the recent massive capital inflows into the United States on the basis of outstanding American productivity growth and the supposed resulting attractiveness of direct and portfolio equity investment in the United States? The paper shows that net portfolio equity inflow into the United States was substantial only in 2000, and even then it was only one-third of foreigners' net purchases of U.S. debt. The share of U.S. equities in foreigners' equity portfolios has fallen sharply since 1998, just when the U.S. productivity growth differential began to open up. And foreigners' returns on their holdings of U.S. equities have been relatively low, even ignoring losses on dollar depreciation during 2002 to 2004. Moreover, in recent years foreigners' acquisition of U.S. debt has shifted from private- to official-sector purchases.

The big issue, indeed the theme of this conference, is global imbalances—and there is only one that matters: the U.S. current account deficit and U.S. external debt. Is the current position sustainable? Is Alan Greenspan (2004) right to be concerned about concentration risk, or is Richard Cooper (2005) right to argue that the United States has a comparative advantage in producing marketable assets for which foreign investors have an effectively unlimited appetite? Even if they do, at what price? Will the dollar's exchange rate nevertheless depreciate, and if that is what investors expect, why should they be willing to hold increasing quantities of assets denominated in a depreciating currency? Is there an appropriate benchmark for the share of dollar-denominated assets in the portfolios of private investors? Of central banks? If there must be an adjustment to cut the weight of dollar assets in international portfolios, how will it take place—what mix of a fall in U.S. asset prices (rise in interest rates) and a depreciation of the dollar?

The paper offers some clues to the answers. The authors carefully assess the valuation effect. They rightly stress that reduction of U.S. foreign debt through dollar depreciation cannot be a long-term, continuing way of dealing with excessive accumulation of dollar-denominated assets arising from large current account deficits. They offer regressions that they interpret as evidence against the portfolio balance story and in favor of the Gourinchas and Rey (2005) version of international adjustment. But the regressions, as they are the first to acknowledge, are far from being structural or even based on a structural model. It is hard to be convinced of one or another version of the adjustment process simply by the observation that returns covary negatively with portfolio exposures (on the basis of about 20 annual data points).

One's reluctance to draw conclusions from this part of the analysis is reinforced by the apparent major differences in investor behavior across different asset classes (debt, portfolio equity, FDI). Even on equities alone, there are some conflicting results in other work (Bohn and Tesar [1996] find no evidence of portfolio balancing but some of return-chasing, whereas Portes and Rey [2005] find no evidence of the latter).

We do indeed need more theory, whether further development of the portfolio balance model (as in Blanchard, Giavazzi, and Sa [2005], extending and applying the approach of Kouri [1983]), or a structural elaboration of the Gourinchas-Rey approach. A nice feature of the Blanchard, Giavazzi, and Sa (2005) story is that it constructs a perfect foresight path along which investors are indeed willing to hold increasing quantities of depreciating assets. Moreover, it does suggest looking at the output gap, interest rate differentials, and the determinants of portfolio preferences (or home bias) as explanatory variables for net external debt. But it leaves those preferences unexplained. This leads us to ask again how best to specify benchmarks for the portfolio shares of assets denominated in different currencies. It is certainly not adequate to argue (as do Genberg et al. 2005) that these shares should correspond to the shares of world GDP denominated in different currencies (or a domain for each major currency augmented by currencies pegged or otherwise linked to it). An alternative, finance-based approach to represent the portfolio choices of central banks is proposed and implemented in Papaioannou, Portes, and Siourounis (2006). There is further work to do here as well.

This paper has, however, given us many signposts for the way to be followed by future research. Our debt to the authors will not be eliminated by any valuation effect. We should note, by the way, that valuation effects are not always long lived—what goes down can (though need not) go up. Dollar appreciation—contrary to most expectations—has made the U.S. net foreign asset position at the end of 2005 very much more negative than it was a year before.

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3

Direct Investment, Rising Real Wages, and the Absorption of Excess Labor in the Periphery

Michael P. Dooley, David Folkerts-Landau, and Peter Garber

Could the whole [development] problem be solved simply by increasing the growth rate of manufactured exports to MDCs [more developed countries], in substitution for primary products? I shall assume this cannot be done. . . . Also I think it cannot be done.
—W. Arthur Lewis, 1979 Nobel Lecture

Lewis' pessimistic outlook for industrial development in what we now call emerging markets was based on the view that developed countries allowed access to their markets only during brief periods of prosperity since "they then have many growing industries that can take the people displaced by imports" (Lewis 1979). Otherwise, they act to block access to manufactured imports from cheap labor countries to protect domestic workers. In this paper, we will argue that some emerging markets in Asia have found, perhaps by accident, a way around this fundamental obstacle to industrial and economic development. The solution has created the basic features of the current international monetary system. Along the way to making this argument, we will characterize the exchange rate and other policies designed to eliminate the vast underemployment in Asia as a solution to an exhaustible resource problem. Notably, the welcoming of foreign direct investment (FDI) is a solution to Lewis's conundrum in industrial development. Finally, we will propose a view that the main features of international finance are organized to overcome such inherent protectionism, rather than as a solution to an intertemporal consumption problem.

3.1 International Monetary Systems Are Endogenous Solutions

Whatever are the institutions and mechanisms of the international monetary system at any moment, they have emerged as solutions to a key real economic problem of the time.

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The Bretton Woods system was a top-down solution to what were perceived as the crucial problems of the Depression and World War II. A deal between the United States and the United Kingdom, its basic features were a compromise between the conflicting economic interests of the two parties. The United States viewed the competitive devaluations of the 1930s and the subsequent discriminatory trading blocs as detrimental to stability and especially harmful to U.S. trade. A creditor country with intact capital and promising exports, it was interested in currency stability and nondiscriminatory, open trading systems. The United Kingdom was determined not to sacrifice internal balance to maintain external balance. It wanted currency flexibility. With its huge sterling debt and its unbalanced war mobilization, it was interested also in maintaining controls and channeling of trade within the sterling bloc. Finally, it wanted access to official credit in large amounts if it was to maintain fixed rates. The compromise was to have fixed exchange rates but with flexibility within the rules, a gradual lifting of controls, and access to credit as a function of official quotas. This basic outline of the system lasted for the next twenty-five years.

The current system is also one of fixed or heavily managed exchange rates, with the accumulation of dollar reserves on a historically large scale, and is based on an effort to keep trade flows open. However, it is an ad hoc, bottom-up system, the sum of independent policy choices across and within countries. But it likewise has emerged to solve the fundamental real economic problem of our time: the emergence of 200 million underemployed workers into the global industrial economy.

3.2 Revived Bretton Woods

In a series of papers, we have characterized the international monetary system that has evolved to facilitate this development strategy in some periphery countries as a revival of the Bretton Woods system (Dooley, Folkerts-Landau, and Garber 2003a, 2004a,b,c). The revival has been contemporaneous with rapid deterioration of the net international investment position of the United States, and this has raised concerns about the stability of the system.

The discomfort with the current situation was already carefully set out five or six years ago (Mann 1999; Obstfeld and Rogoff 2000). The logic is that although international capital markets were much larger and more resilient than in the past, they could not support a U.S. current account deficit of 4 percent of gross domestic product (GDP) for long, let alone the current 6 percent. Moreover, even a mild withdrawal of credit from the United States—for example, a reduction in financing that required a return to current account balance—would generate a very large and sudden depreciation in the real value of the dollar. The sensitivity of real exchange rates to changes in current accounts is related to the limited integration of goods markets across countries.

A related concern then and now is that the low level of private and government savings in the United States is generating a perverse flow of world savings to the United States. Summers (2004) has recently argued, for example, that the single engine for world recovery, U.S. growth and U.S. fiscal deficits, is a recipe for disaster both for the United States and the rest of the world. The global system has perversely, from the viewpoint of the textbook theory underpinning these views, moved steadily into higher imbalances. This has increased the stridency of proscriptive calls for their end or descriptions of the dire mechanisms by which this may be achieved, as exemplified in recent papers by Goldstein and Lardy (2003, 2004a,b), Eichengreen (2004), Obstfeld and Rogoff (2004), and Roubini and Setser (2005).

This growing chasm between what we know *ought to be* and what *is* can be best summarized in parallel charts on ten-year Treasury inflation-protected securities (10-TIPS) yields and the U.S. current account balance (see figure 3.1). The long term real interest rate has been falling as the current account deficit has been growing into historically uncharted territory. Our standard theory of open economy macroeconomics been wildly wrong for five years. The data indicate that it is likely to be wrong for years more. Of course, some day the imbalances will be reduced, allowing us to resume teaching the standard stuff with some increase in confidence. Meanwhile, we will have a decade long gap during which our accepted paradigm cannot come to grips with the key macroeconomic problem defining the era.

We have argued that the reluctance of private investors to increase their net claims on the United States has, as conventional analysis suggests, contributed to appreciation of floating currencies such as the euro against the dollar, but that this has not even started to force an adjustment of the U.S. international investment position and current account flows.

The reason is no mystery; governments in Asia are providing the necessary financing. The issue now is how long this can continue. The conventional view is that the Asian governments can fill the gap for only a short interval and, when the wheels fall off, the adjustment costs for the world economy will be very heavy.[1] The mechanism for the disaster is familiar. Expectations for the large exchange rate change needed to correct current imbalances generate massive private capital flows to the periphery. Capital controls and financial repression are no match for a determined private sector. If inflows are not sterilized, the monetary base explodes and the needed real exchange rate adjustment comes through inflation. Faced with

1. See Rogoff (2003). As Rogoff puts it, flying on one engine is easy as compared to landing on one wheel.

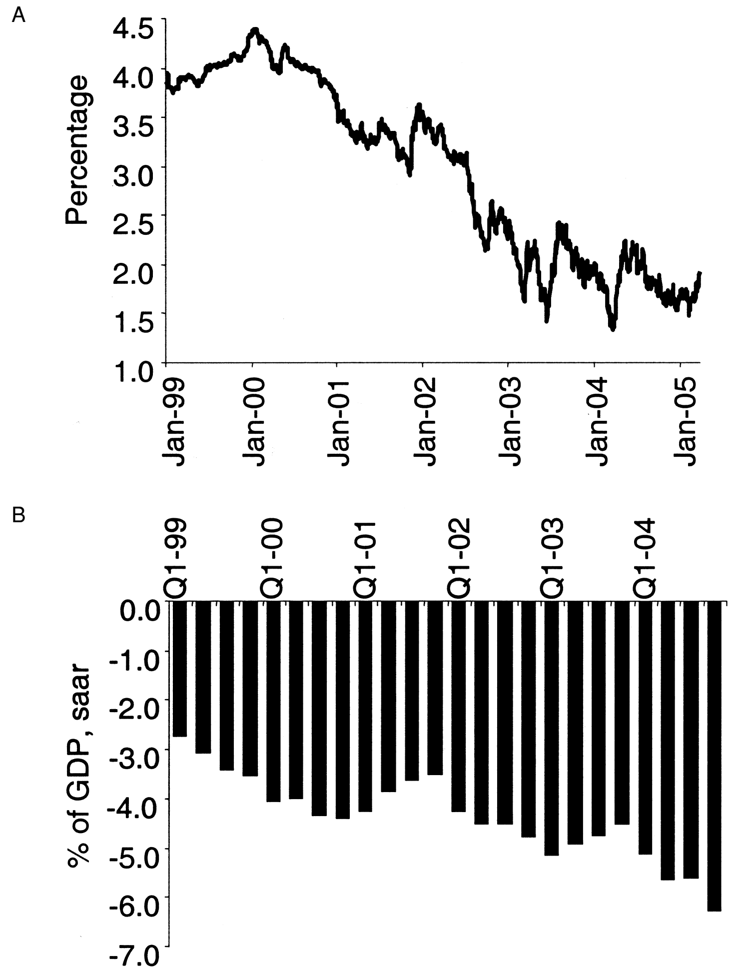

Fig. 3.1 *A,* **Ten-year TIPS yield;** *B,* **U.S. current account balance**

this unpleasant reality, central banks give up and revalue nominal exchange rates.

The conventional argument is a good description of the final days of the original Bretton Woods system. It is relevant for countries that are ready to graduate to the center. But it ignores the fact that the system lasted for two decades. To be sure, the original Bretton Woods system was not asked to finance a U.S. current account deficit until its closing days, but the periphery did benefit from rapid growth of trade and financed a substantial increase in U.S. direct and long-term investments abroad. Moreover, most governments in the periphery did not *decide* that the system was no longer in their interests. They were forced to abandon the regime by private capital flows. The erosion of the effectiveness of capital controls and domestic financial repression that made this possible *followed* the development of international trade and domestic financial markets, and this process took many years.

The current version of the Bretton Woods system presents the periphery with similar policy choices.[2] We argue in the following that expansion of the volume of trade in goods and services and the volume of two-way trade in financial assets is the backbone of a successful industrialization or development strategy. If the price to be paid for this strategy includes financing a large U.S. current account deficit, governments in the periphery will see it in their interest to provide financing even in circumstances where private international investors would not.

The catastrophic losses and abrupt price breaks forecast by the conventional wisdom of international macroeconomics arise from a model of very naive government behavior. In that model, periphery governments stubbornly maintain a distorted exchange rate until it is overwhelmed by speculative capital flows. In our view, a more sensible political economy guides governments in Asia. The objectives are the rapid mobilization of underemployed Asian labor and the accumulation of a capital stock that will remain efficient even after the system ends.

The mechanism that regulates the mobilization is a cross-border transfer to countries like the United States that are willing to restructure their labor markets to accommodate the rapid growth of industrial employment in Asia. Net imbalances like those now observed for the United States may or may not be a by-product of this system. But such imbalances are only one of the constraints on the system and for considerable periods of time may not be as binding a constraint as in conventional theories.

3.3 What Force Drives the Global System?

China has about 200 million unemployed or underemployed workers to bring into the modern labor force. For political stability, there is a need for 10 to 12 million net new jobs per year in the urban centers. A growth rate of around 8+ percent has served to employ about 10 million new workers each year. About 3 million have been in the export sector.[3]

2. This policy has been criticized as wrongheaded in that FDI should be the source of global finance for a deficit on current account although this prescription seems to have been pulled from out of the air. The principle behind this argument seems to be that the external accounts should be properly balanced as a priority over the internal balance. See Goldstein and Lardy (2003, 2004a,b). The alternative argument is that being a net capital exporter seems to work.

3. Exports generate 10 percent of value added in GDP. The export sector grows twice as fast as the rest of the economy. So 25 percent of all growth is from the export sector. Because of a lower capital-labor ratio than in the rest of the economy, the export sector accounts for about 30 percent of employment growth.

If the world can absorb politically only the output of an additional 10 million workers per year (3 million in the export sector), then simple arithmetic indicates that this surplus is a force for twenty years more in the global system. If it can absorb the surplus faster, say, at a rising absolute rate that will keep the Chinese growth rate constant at 8 percent until the surplus is eliminated; then straightforward compounding and linearity assumptions indicate that this will drive the global system ever more relentlessly for the next twelve years).

We do not take a stand on how long this force will drive the global system. But twelve to twenty years has defined an *era* for any recent international monetary system.

3.4 Political Economy of Export Led Growth

Our analysis of government behavior has some surprising implications. Perhaps the most important is the idea that there is a trade-off between objectives for intertemporal trade, objectives for net international investment positions, and objectives for growth in *gross* trade in goods and financial instruments. In the framework we develop, governments have well-defined objectives for export growth and for the pattern of international financial intermediation. Within limits, they are willing to finance net capital flows when net flows are a by-product of this development strategy. The limits are likely to be much less of a constraint on the international system than is suggested by conventional analysis. Our framework, as it existed on first writing this paper, does not, for example, explain the source of the U.S. current account deficit. But it does provide an explanation for the relative willingness of Asian governments to finance that deficit.[4]

Governments care about *gross* trade and capital flows because both generate important externalities that are not captured by private firms and investors. Domestic production of traded goods subjects firms to the discipline of international competition and world prices, a discipline not imposed by distorted domestic markets for goods and services. Domestic capital formation by foreign direct investors financed in international capital markets bypasses distorted domestic financial markets. A sensible development strategy provides strong incentives for foreign direct investors to utilize unemployed domestic labor to produce for export markets. The emerging market is, in effect, borrowing the right relative prices and financial incentives from world markets to guide capital formation during a transition to full participation in the world economy.

But, as Lewis suggested, access to import markets comes at a price. Pen-

4. We have argued elsewhere (Dooley, Folkerts-Landau, and Garber [2004b]) that the unbalanced risks accruing from FDI flows require collateral on a large scale to support the gross cross-border positions. The current account surpluses are the only means to generate the collateral.

etration of markets in industrial countries will generate a protectionist response. We do not argue that imports cause unemployment in the importing country, but it is clear to us that industrialization of the periphery requires a fundamental restructuring of the labor force in the center. While this creates tremendous aggregate benefits for both countries, established industries and their workers in the center are displaced. No country has found a workable way to compensate its own losers. So a surplus must be generated *and properly allocated* to provide additional incentives to overcome protection. In short, we believe in gains from trade but also believe that gains from trade are not enough to insure that mutually beneficial trade will automatically occur. Our conjecture is that this distortion alone is sufficient to keep labor in the periphery in domestic zero marginal product activities.

The recent reduction of private capital inflows to the United States and the appreciation of the euro and other floating currencies provide an opportunity for fixed- or managed-rate emerging markets to replace European exports to the United States without changing the rate at which U.S. labor markets absorb total imports. Even if governments weigh the same risks of financing net deficits as do private investors, governments also see benefits of accelerating their development strategies. It follows that the United States will, other things equal, be able to maintain larger increases in its net international debt over time.

3.5 Exhaustible Resources

The economics underlying the current international monetary system is best viewed through the lens of an exhaustible resource model. The exhaustible resource is the pool of Asian labor that is underemployed by industrial country standards. Left underemployed, it is politically dangerous and socially costly. Once employed, it produces a stream of product marginally valued at the global real wage and contributes to social and political stability. So the government would like to employ labor in the industrial sector as quickly as possible. The government also wants to insure that at the end of the transition period the capital stock should be capable, *when combined with domestic labor paid the world real wage,* of producing goods going forward that are competitive with those produced in other countries. *This is a crucial constraint:* make-work projects or great leaps forward will not do because the history of development has shown repeatedly that this is the way to end-game crisis and zero-value real capital.

There are two reasons that employment is increasingly costly in the rate of employment growth. First, we make the usual assumption that investment installation costs rise in the rate of investment over time, the usual bottleneck argument. It follows that a more rapid adjustment requires a greater cost of capital per worker.

Second, investors have to make transfers to offset the political power of displaced workers in the importing country. Again, it seems likely that the adjustment costs in the country restructuring its labor market are increasing in the rate of import penetration. Put another way, *a larger piece of the new product stream must be paid to the importing country* the faster is the absorption of the unemployed pool.

In the current global system, benefits are shared with importing countries by initially giving foreign capital access to Asian labor at a low domestic real wage relative to the world real wage. This gives the capitalist excess profits for some time period and provides the resources for the capitalist to utilize to keep home country import markets open. The trick is to set the real wage (real exchange rate) low enough and to adjust it gradually upward to the expected real wage in the rest of the world until the excess labor pool is exhausted, all at a minimum cost.

The optimal strategy for the government is to set the initial wage and the rate of change in the wage in order to employ fully the stock of unemployed labor at a minimum cost.

Consider first the rate of change for the real wage. An additional unit of labor employed provides a nonnegative yield to the government b. A unit of unemployed labor costs the government a yield of $-r$. The yield b can be thought of as tax revenue or political support for the government. The yield $-r$ might be transfers to the unemployed or political opposition.

The incentive with which the government sweetens the provision of labor to investors is the present value of the difference between the domestic real wage and the world real wage. Suppose the government kept this present value constant for two consecutive time periods. A constant incentive generates a constant flow of new employment. If the incentive in the first period was set slightly higher than in the second period, less unemployed labor will be carried over into the second period. The carryover is costly, so a constant incentive cannot be optimal. The government can get the same increase in employment at a lower cost by frontloading the adjustment.

Because it is in the government's interest to reduce the incentive over time, the present value of the sequence of market wages must be expected to rise. While there are some complicated interactions between marginal costs of extraction and the optimal adjustment path in any real world application, the result that the wage rises monotonically to the equilibrium level is quite general (Devarajan and Fisher 1981).

Paths AB and CD in figure 3.2 satisfy this rate of change condition. Path AB starts from w_1, a relatively high initial real wage, and increases at the optimal rate. Path CD begins with w_2 and rises at the same rate. The full solution to the Hotelling (1931) problem requires that the government sets the initial wage so that the initial stock of labor is employed when the domestic wage rises to the world wage. Clearly, a lower initial real wage path CD generates more total employment over the interval from t_0 to T_2 as com-

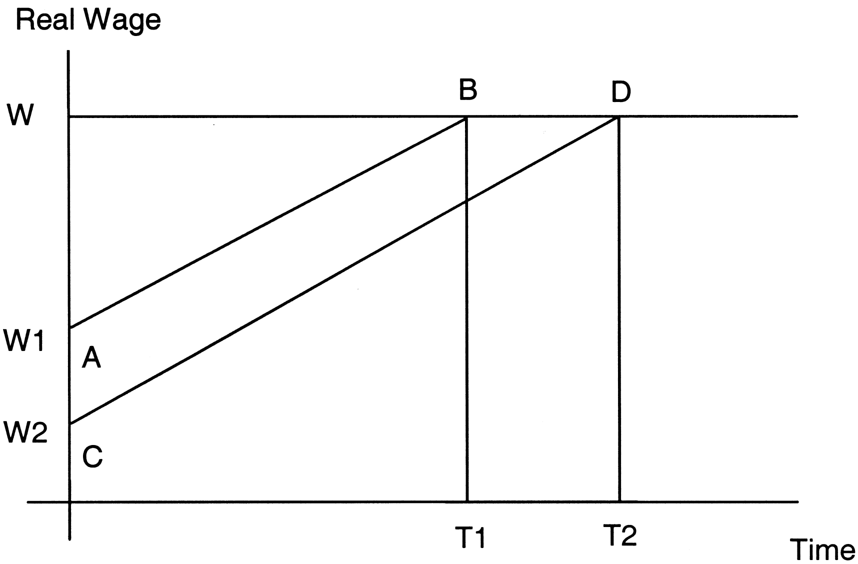

Fig. 3.2 Real wages and adjustment

pared to path AB from t_0 to T_1. It follows that the integral of employment increases as the initial wage declines and only one initial wage fully employs the initial labor supply.

It also follows that a country with a very large stock of labor to employ will want to set a real exchange rate that appears to be grossly undervalued by conventional measures.[5] Moreover, the adjustment period is determined by the equilibrium adjustment path and, other things equal, is longer the larger the initial stock of labor to be employed. Without government coordination, individual workers could not internalize the benefits from rapid capital accumulation and open export markets. They would therefore demand higher wages and live with slower employment growth and a longer adjustment period.

We can summarize this section as follows. The optimal exchange rate and inflation policy are derived conceptually from the exhaustible resource problem. For a fixed exchange rate regime, only one initial real exchange rate is optimal, and only one rate of inflation generates the optimal path for the real wage over time. The length of the adjustment period is determined, and at its end the following conditions hold:

5. It follows that the shadow exchange rate, that is, the exchange rate that would prevail if the government set the rate at its optimal level to a point in time but then withdrew from the market, would always be above the optimal exchange rate. In this sense, the optimal exchange rate might appear to be undervalued relative to the shadow rate.

- The domestic real wage equals the world real wage in the manufacturing sector.
- The initial pool of surplus labor is employed.
- The capital stock has increased to match the world capital or labor ratio in manufacturing.
- The political costs of adjusting displaced labor and capital in the importing country have been compensated. This co-opts attempts to use commercial policy to freeze out the exports that are vital to the development policy.

3.6 An Indeterminacy: Adjust Nominal Wages or Nominal Exchange Rates?

The optimal adjustment path for the real wage allows the authorities to choose a path for the nominal wage rate or the nominal exchange rate, but not both independently. In fact, Asian authorities use both techniques. For a fixed exchange rate regime, the central bank manages the inflation rate in order to regulate the dollar value of domestic wages and prices. In this case, we would expect wage inflation to be above that in the center so that domestic real wages rise over time. The alternative would be to set domestic wage and price inflation at or below that in the center and then allow the nominal exchange rate to appreciate over time but at a controlled rate.

As long as private market participants understand that policy is driven by the objectives set out in the preceding—the optimal path for the real wage rate—the *same pattern of real private capital flows and trade account* will be generated by either a fixed or managed-float exchange rate arrangement. From the balance-of-payments accounting identity, it follows that *the path of real and nominal official intervention is invariant to whether a fixed-rate or managed-float regime is chosen.* Those who argue the necessity of switching to a managed appreciation *because* of the large accumulation of official reserves are missing the basic policy problem and its resolution. Moreover, switching from fixed to managed floating, perhaps in the face of political pressure from the center, would not alter the real nature of the transition.

3.7 The Transfer to Foreign Capital

The regime set out so far encourages capital formation in export industries and makes room for this new investment in the domestic market. But it does not suggest that nonresident direct investors are the best placed to do the investing. Recall, however, that the investor has to expect that the foreign markets for exports remain open and that the political costs of displaced workers in the importing countries must be compensated.

A transparent but unrealistic example will help make the point. Suppose the right to supply capital is allocated by the government through licenses on a project-by-project basis. The gap between the domestic and world real wage would then be captured by selected capitalists.[6] Moreover, the government could lend through domestic balance sheets to the direct investor and finance this by sales of securities to the domestic market. The government can reduce the political costs to foreign governments associated with rapid export growth by allocating some of this capital to foreign investors that are adept at penetrating countries that allow the rapid growth of imports. In the present context, with the United States absorbing much of the exports, this allocation would go to those FDI investors who can push goods into the United States. This provides an economic rent until the convergence of real wages at T, which is not competed away because entry into FDI is rationed by the Chinese government.

The foreign investors then become a well-financed and effective lobby to counteract the resistance to the restructuring of the U.S. labor force away from import substitutes. The foreign investors need not be U.S. nationals in order to influence U.S. trade policy. Prasad and Wei (2005) argue that because most direct investment into China does not come directly from the United States, direct investment could not be a significant force in keeping U.S. markets open. It is difficult to identify the nationality of multilateral firms; for example, we do not believe that the Virgin Islands are the third largest direct investors in China. But more important Asian direct investors in China, including Japan, Hong Kong Special Administrative Region (SAR), and Korea Taiwan, which account for the bulk of direct investment in China, have a long and successful history of penetration of U.S. markets. Multinationals from these countries may be more skilled lobbyists than U.S.-based corporations.

Each time a worker is matched with foreign capital, the direct investor gets a benefit equal to the discounted value of the wage differential plus the normal return to capital. The excess returns are implicitly paid by the Chinese workers accepting the low but rising real wage.

But perhaps this method of local intermediation is too transparent and difficult politically. Instead, the government could sell the same domestic security mentioned previously but, rather than make a loan to a direct investor, purchase international reserves. The foreign investor then has to borrow at his own normal cost of funds and then buy yuan to make the investment. Part of the subsidy to the foreigner is then given to borrowers in reserve currency countries and part to the FDI investor in the form of rents from access to low real wage labor.

Politically, this is perhaps better because there is an arms-length relationship between the government and the financing of the foreign investor.

6. We refer to *foreign investors* and not *foreign direct investors* because in this example they are financed by Chinese saving intermediated through domestic balance sheets.

With this more competitive mechanism, we would expect that the surplus generated by access to low wages in China would be absorbed by adjustment costs. In this case, direct investors from countries with open import markets might enjoy a competitive advantage over other foreign and domestic investors because they can more effectively mobilize profits to make transfer payments to their fellow residents.

At this point we do not understand well the mechanism that allocates investment in the export sector, its profitability, or the distribution of those profits.[7] It is also quite possible that direct investment is restricted, or the risk that the regime might end prematurely requires excess profits in order to insure entry. The net profitability of direct investment is an important ingredient in the evolution of net international investments positions during the transition. Data on profitability of direct investment in China is anecdotal at best. We can make a reasonable guess about the gap between the real wage and marginal product of labor, but we do not have much information about the distribution of the implied surplus. This is an important topic for further research.

3.8 What about the Accumulating Balance Sheet Positions?

Headline numbers for reserve accumulation and the U.S. current account deficits seem to suggest that the main end-game problem is the accumulated net international investment position of the center and the periphery. But net positions are the difference between two much larger gross assets and liabilities. Just as in the original Bretton Woods System, official intervention, that is, large official capital outflows from the periphery, are largely associated with private capital inflows to the periphery. In our view, the financial intermediation and the capital gains and losses generated will substantially mitigate problems associated with the net international investment positions generated by export led growth.

At the end of the transition period, Asian governments will hold a large stock of U.S. treasury and other securities on which it has earned a relatively low but positive rate of return. It will also have incurred a large stock of liabilities to domestic claimants. But at the end of the game, both of these will carry the same international interest rate. The United States will hold a large stock of direct investment that pays the world equity rate going forward but that has paid a much higher rate during the adjustment interval.

It may be instructive to take another look at the end of the original Bretton Woods system with these two points in mind. The United States did not run large trade deficits leading up to the 1971 to 1973 crisis that ended the regime. The balance-of-payments deficit that observers focused on at the

7. See Razin and Sadka (2002) for an interesting discussion of the allocation of rents.

time was the liquidity balance, a concept that put short-term capital inflows below the line. As Depres, Kindleberger, and Salant (1966) pointed out in their celebrated letter to the *Economist,* this concept of a deficit ignores the legitimate role of financial intermediation in international financial arrangements. To be sure, financial intermediation can lead to instability and crises. But the problem is much more subtle, and the lessons from countries that have run large and persistent current account deficits may not be of much use in evaluating the new Bretton Woods.

3.9 The Key Role of Financial Repression

A key to this regime is the ability of the government to repress real wages for an extended period of time. In our framework, this is equivalent to controlling the rate of inflation and the nominal exchange rate. Given a foreign rate of inflation and an international interest rate, this requires that the link between domestic and international interest rates be broken. In our view, China has more than adequate controls on domestic and international financial transactions to make this possible.

- Purchases of international bonds are strictly controlled.
- State-owned or controlled banks provide all the claims available for domestic savers.
- The government sets the interest rate on these bank liabilities and rations bank credit to the private sector.
- Growth in the foreign part of the monetary base is determined by the current account surplus plus targeted net direct investment inflows.

In this repressed domestic financial system, growth in domestic credit from the banking system is a residual, that is, the difference between desired money base growth, (determined by the desired rate of inflation), the growth in the demand for money and the growth in the foreign part of the base.

Domestic savings not purchased by the banking system are absorbed by sales of domestic treasury or central bank securities to households and firms. Note that as long as the interest rate that clears this market is not above the return on U.S. treasury securities or other forms of investing the reserves, the government can absorb domestic savings and intermediate into foreign bonds while booking an accounting profit.

The government rations credit to the private sector by forcing the banks to buy government securities through liquidity and reserve requirements and then rations the remaining credit to the private sector at fixed lending rates. This, of course, sets up strong incentives for private lenders and borrowers to go offshore or to alternative domestic intermediaries. We assume that the government is an effective counterforce to such financial innovation for the requisite amount of time.

3.10 Internal Balance

The macromanagement problem for the government in implementing this policy is daunting but simple enough to set out. In pursing the employment objective, a distorted real exchange rate will create imbalances in the economy that require an additional policy instrument. As noted previously, the bottom line is that the government must be able to manage the domestic real interest rate throughout the adjustment period to keep the domestic economy in balance. The good news is that the problems are large but diminish over time.

To make this argument, assume the economy, aside from the 200 million, is in full employment equilibrium with effective capital controls, no initial net international investment position, and an exchange rate that balances trade. To set the problem in motion, now imagine that 200 million unemployed people appear from the provinces. As discussed previously, the path for the real exchange rate that solves the absorption problem involves a sudden real depreciation that is gradually eliminated. The exchange rate path that solves the absorption problem therefore subsidizes exports relative to imports, and the trade balance initially moves from balance to surplus.[8]

The initial current account surplus must equal the amount by which domestic (government plus private) savings exceed domestic absorption. It follows that a rise in the domestic interest rate is needed to reduce absorption relative to savings. But what happens to the interest rate that insures internal balance over time?

During the adjustment period, the trade surplus as a share of GDP will decline and may move into deficit as the real exchange rate appreciates and domestic income grows more rapidly than foreign income. A surplus on the service account will appear and grow as net asset accumulation generates net capital income. But the overall current account as a percent of domestic GDP will fall for any reasonable set of parameters. It follows that the domestic interest rate will fall over time as a smaller share of domestic absorption is crowded out by net transfers abroad. This mitigates the interest differential pressure on capital controls.

3.11 Sterilization and Inflation

The relevant capital flow problem in the face of expected revaluation is large private capital inflows. If private capital inflows augment the mone-

8. An important mitigating factor is that adjustments in commercial policy are likely to encourage imports. For example, the initial condition for China is a large gap between the effective exchange rate for imports and exports. In fact, China has not run a large overall trade surplus to date. In part, this probably reflects large declines in tariffs associated with ascension to the World Trade Organization (WTO). In part, this also arises because China has been an assembly center for the rest of East Asia, with component imports representing an imported fraction of finished exports.

tary base and, in turn, increase domestic inflation, real wage growth will be too rapid, and the transition will be too short to accomplish the government's objectives. However, if capital inflows are sterilized, and if domestic financial repression allows the government to finance reserve creation by issuing low interest domestic securities, the inflationary impact is eliminated.

This is an empirical issue. Capital controls and financial repression do not last forever, but neither does the regime we are describing. We simply observe that to date, Asian governments have been very successful in hitting aggressive inflation targets. In the case of China, for example, some observers have suggested that overheating and an inflationary spiral are already underway. In our view, that is more of a prediction than an observation. Time will tell, but we would point out that there are many reasons why inflation may have increased in recent months. In general, a growth rate of 8+ percent has not generated inflation in China. In our view, increases in reserve requirements last year, a form of sterilization, have already reduced the growth in money and credit. Moreover, this has been accomplished with no increase in administered interest rates.

If the capital account is liberalized, expectations of appreciation that are a central feature of the regime discussed in the following will generate capital inflows. Moreover, market-determined domestic interest rates would make sterilization expensive, and so inflation would be the eventual result. But we do not expect opening of the capital account or deregulation of domestic interest rates. It follows that the economic linkages between exchange rate policy and inflation clearly relevant for capital account countries do not now exist, and we do not expect them to materialize for many years.

3.12 Overheating? A Diversion into the Facts

Because many have argued that this system must end soon from inevitable overheating in China and East Asia, it is useful to consider briefly whether this phenomenon has yet materialized.[9]

We can infer that the Chinese economy is growing faster than its potential because raw materials prices are rising, energy use is rising faster than supply, and wages are rising. But growth is not fast enough to drive consumer prices higher—and almost all items in the Consumer Price Index (CPI) have free market pricing. Only food and housing prices are rising much at all—about 5 percent yoy each. Prices for clothing, furnishings, health care, transportation, and communications are falling. Nonfood CPI inflation was 0.8 percent in January, 2005, a six-month low.

As in previous episodes of high global commodity prices, raw materials

9. This view has shown up in testimony by Alan Greenspan (2005) and has been expressed most forcefully by Goldstein and Lardy (2003, 2004a,b) and Roubini and Setser (2005).

prices are rising much faster than producer prices for manufactured goods or consumer goods and margins are being squeezed. Recently, firms seem to have a little more pricing power than in the past, but lately even those downstream prices have softened. (See figures 3.3 and 3.4.)

China's price experience is hardly atypical. In the United States and else-

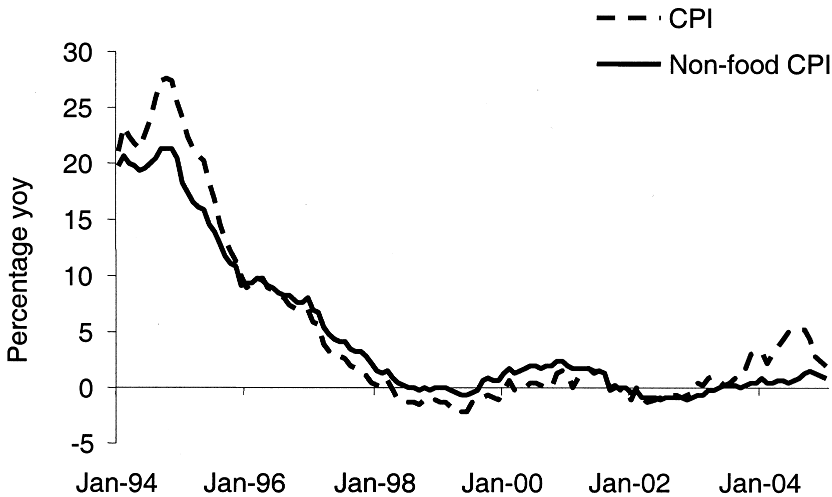

Fig. 3.3 Consumer prices in China, 1994–2005

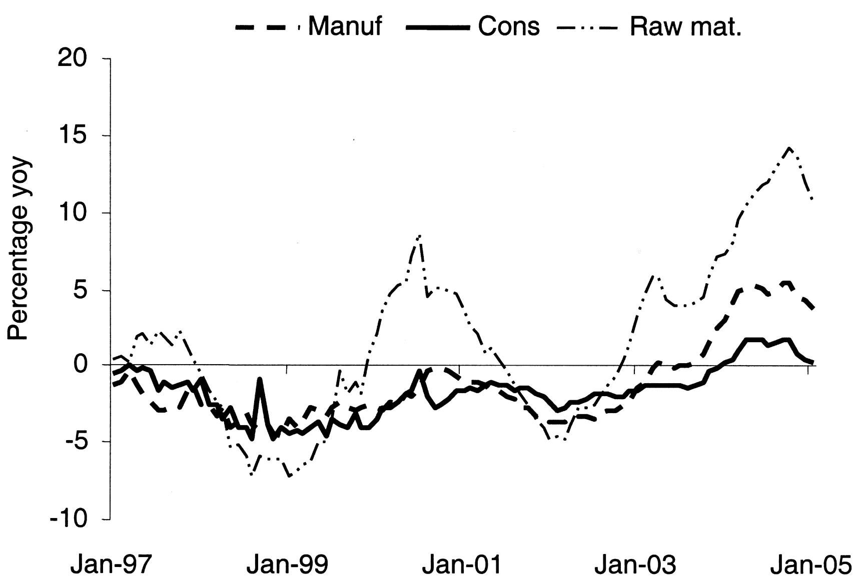

Fig. 3.4 Producer prices in China, 1997–2005

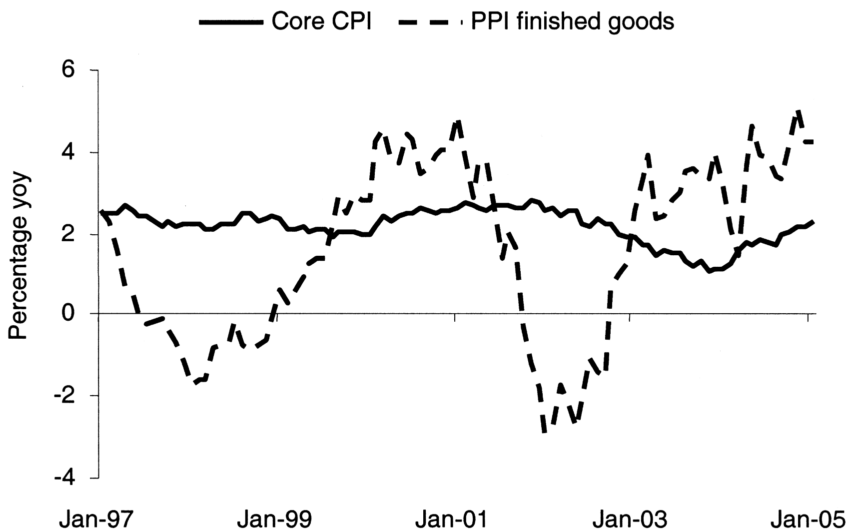

Fig. 3.5 U.S. CPI and PPI, 1997–2005

where, producer prices are also rising significantly faster than consumer prices. Higher raw materials costs are compressing margins in many industries and pose an upward risk to consumer price inflation, if firms can pass on higher costs. Compared to China, there is even stronger evidence that the U.S. economy is growing sufficiently fast relative to potential that inflation risks are mounting. Prices for all categories of consumer goods (except perhaps apparel) are rising, and nonfood inflation in the United States is above 3 percent, versus less than 1 percent in China. A good case can be made for the view that inflation going forward will be more of a problem in the United States than in China. (See figure 3.5.)

3.13 Is the Renminbi (RMB) Peg Causing Monetary Instability?

The crux of the overheating argument is that China's large external surpluses and reserve accumulation threaten monetary stability. Therefore, it is in China's own interest that the RMB be allowed to appreciate so that this source of inflationary pressure can be relieved. But money supply growth has been slowing since early 2004, while foreign exchange intervention rose to record highs. Also, going farther back, money supply growth surged in 2000 before China had to intervene much at all. In sum, this argument ignores the fact that China's money supply is not affected much by the increase in reserves: sterilization is not particularly difficult.

Reserves rose $207 billion in 2004, after rising $162 billion in 2003 (adding back in the $45 billion transferred to domestic banks). In 2004, the

People's Bank of China's (PBOC) net foreign assets rose RMB1.58 trillion ($191 billion), while net domestic assets fell RMB980 billion ($118 billion). So 62 percent of the reserve increase was sterilized. That is a much smaller amount than most other central banks in Asia, which are averaging 80 percent to 90 percent sterilization. But it is a reasonable amount. China is targeting nominal GDP growth of about 12 percent (i.e., about 8 percent growth with about 4 percent inflation, neither of which are hard targets) and wanted broad money growth of about 17 percent in 2004, the official target at the beginning of the year. Reserve money growth was 11.4 percent yoy (December to December) in 2004, and M2 growth was 14.5 percent. For 2005, the M2 growth target is about 15 percent. In the first quarter of 2005, the GDP growth rate was 9.5 percent while inflation was 2.8 percent yoy. M2 growth was 14 percent yoy at the end of March, with loan growth at 13 percent yoy, both below official targets.

From August 2002 to February 2005, the PBOC has issued RMB1.3 trillion ($157 billion) in central bank bonds to mop up excess liquidity. Foreign exchange reserves rose $367 billion during that period. These bonds accounted for 14 percent of the central bank's liabilities. Far from having to raise interest rates in order to be able to sterilize fx inflows, interest rates on banks' excess reserves have been cut twice since 2001. Bond and repo yields are volatile but essentially directionless (one-year repo ended 2004 66bps below end-2003 levels). The PBOC raised deposit rates by 25bps in October 2004 to start the process of bringing real rates back to neutral levels.

Until December 2004, the PBOC issued three-month, six-month and twelve-month bills (zero-coupon) for sterilization purposes, but almost all at the twelve-month term. These are traded, and the yield on the three-month bonds peaked at 3.5 percent in early November, which was a spike after the policy rate hike. By the end of the year, the yield was down to 3.2 percent. Following the PBOC's decision to cut the interest rate on excess reserves (by 72bps), the three-month yield is now around 2.2 percent. In December 2004, the PBOC started issuing three-year bonds. The yield on the fixed-rate bonds started at 4.1 percent, and issues at par in March had a coupon of 3.3 percent. For comparison, the yield on U.S. three-month T-bills was about 2 percent in November, 2.2 percent in December 2004, and 2.8 percent in March 2005. The yield on three-year notes was 3.2 percent in December 2004 and about 4 percent in March 2004. The PBOC would gain on the carry by holding middle-term notes.[10] (See figures 3.6, 3.7, 3.8, and 3.9.)

10. Central banks in Asia earned between 4 percent and 5 percent last year on their reserves. They tend not to buy thirty-day paper; rather, they buy two-year, five-year, and ten-year bonds, plus some subsovereign paper. Generally, the accounting cost of financing reserves is much less than interest earnings: a large part is funded by sales of central bank paper, but the rest is funded by required reserves bearing interest of less than 2 percent. So Asian central banks earn a significant positive carry.

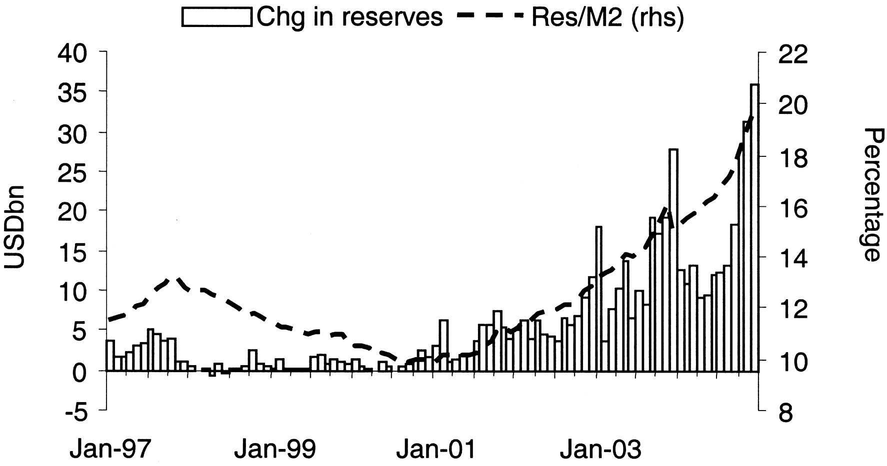

Fig. 3.6 China: FX reserves accumulation, 1997–2004

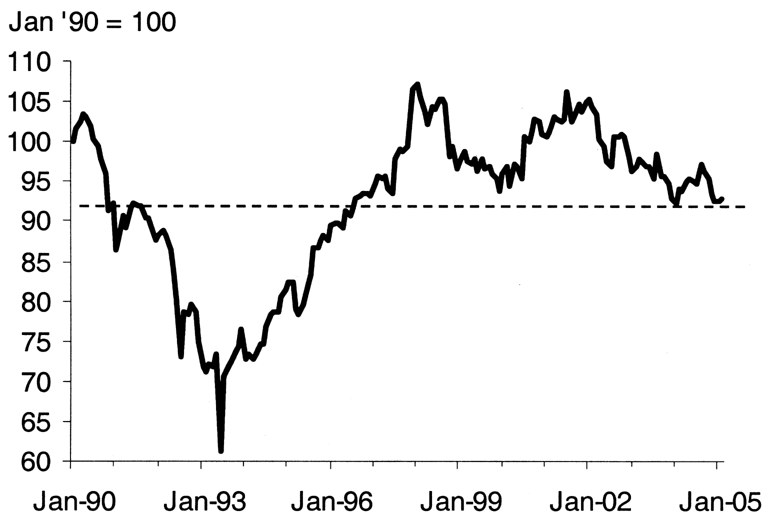

Fig. 3.7 China: RMB real effective exchange rate (dbREER)

Sources: CEIC *Financial Times* Data Service and Deutsche Bank Global Markets Research.

3.14 Is the Rest of Asia Overheating?

Most countries saw a large increase in foreign exchange reserves in 2004. Combined Asia-10 reserves rose from $1.22 trillion to $1.59 trillion. In comparison, Japan's reserves rose $85bn in the first quarter and then only $15bn thereafter as they stopped intervening.

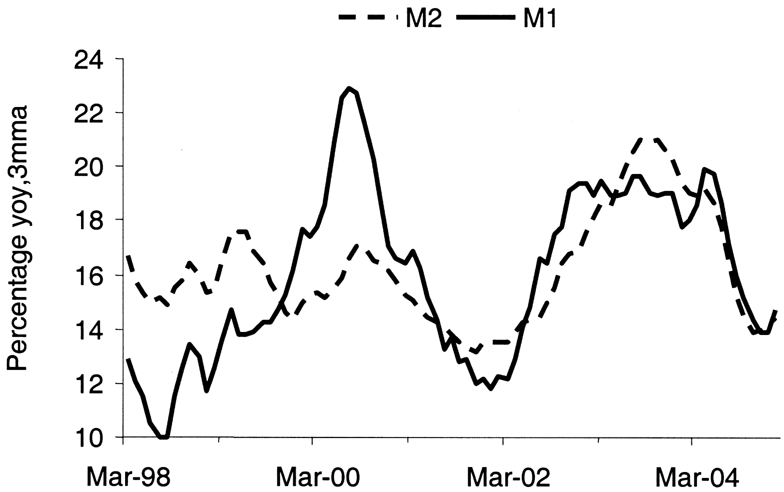

Fig. 3.8 China: Money supply growth

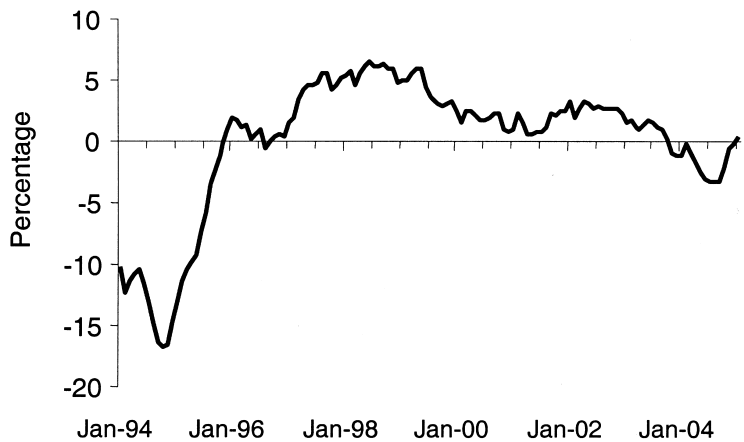

Fig. 3.9 China: Real one-year deposit rate

From the following charts, if intervention was going to be a problem, it would appear likely that this problem would be most acute in Malaysia, Singapore, China, and Taiwan. (See figures 3.10 and 3.11.)

But just as China has had no difficulty managing its reserves inflow, so, too, elsewhere we see no real (political issues in Korea aside) difficulty with intervention and sterilization. Central banks have raised interest rates more slowly than in the United States, if at all, and bond yields have remained stable (rising slightly in China and India by about 125bps), while yields fell in the United States. Korea has been the only country where in-

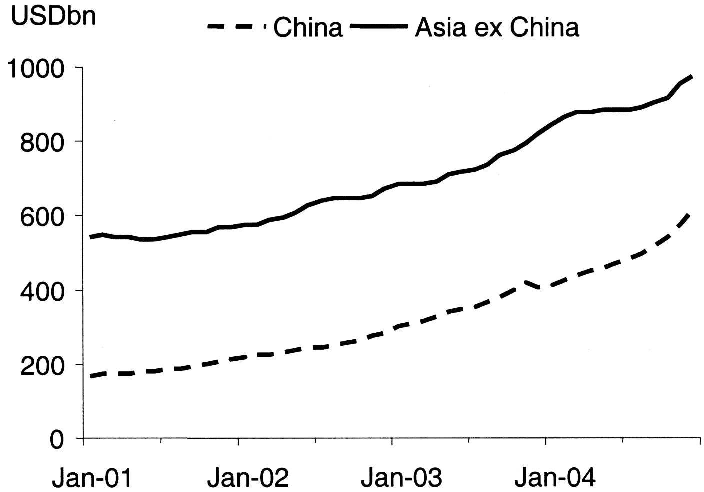

Fig. 3.10 Foreign exchange reserves in Asia

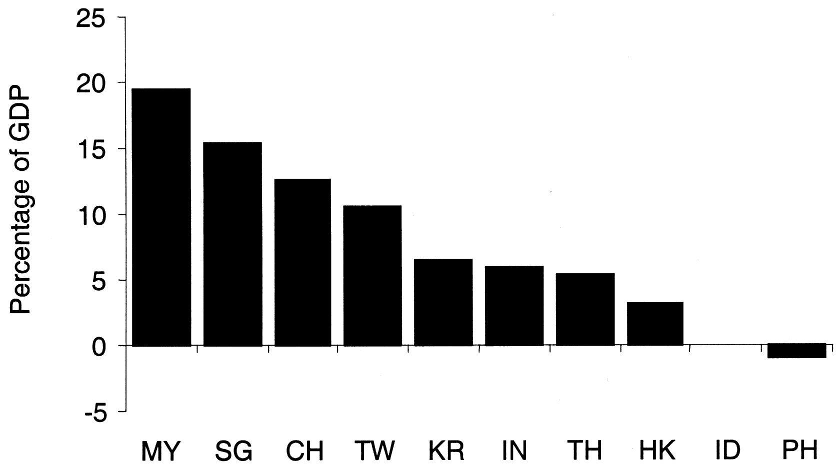

Fig. 3.11 Change in reserves in 2004

Sources: CEIC *Financial Times* Data Service and Deutsche Bank Global Markets Research.

tervention has been problematic because parliament opposed it. But even there, all of the reserve accumulation was sterilized in 2004. Monetary policy has probably been and remains too tight, not too loose. Net foreign assets of the ten Asian monetary authorities rose $359 billion in 2004, but reserve money rose only $111 billion—almost 70 percent of the reserve increase was sterilized through a reduction in net domestic assets in order to keep money supply growth under control. (See figures 3.12 and 3.13.)

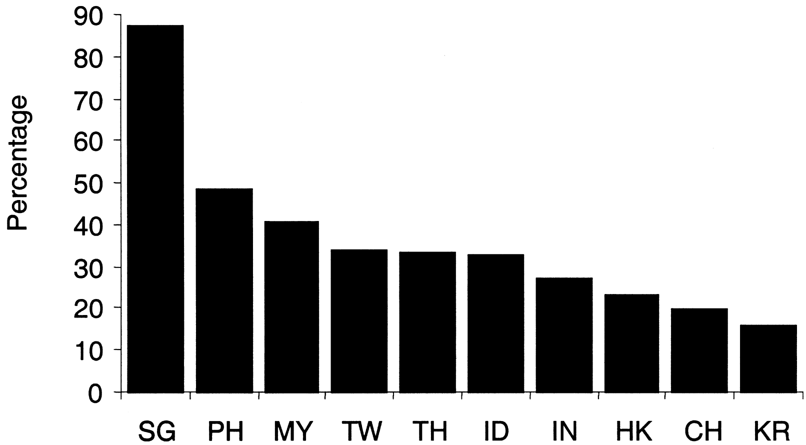

Fig. 3.12 Foreign exchange reserves/broad money

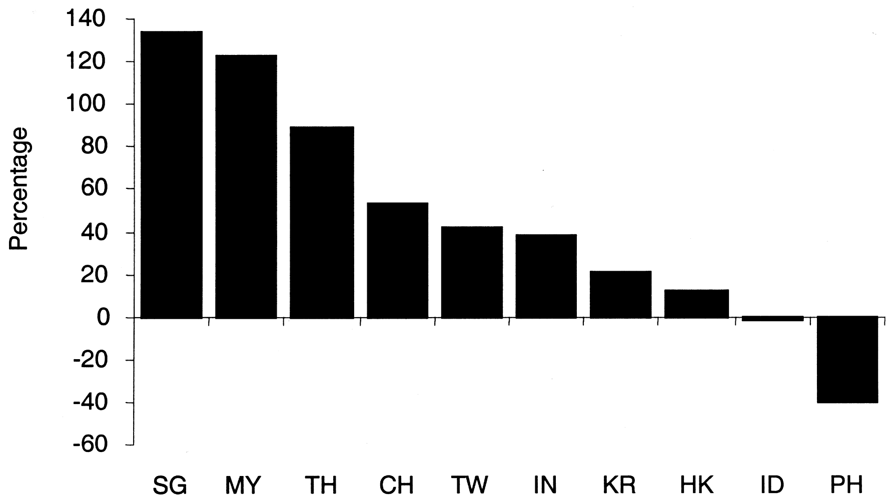

Fig. 3.13 Change in reserves in 2004/change in broad money

Sources: CEIC *Financial Times* Data Service and Deutsche Bank Global Markets Research.

3.15 Conclusions

What makes this perpetual motion machine run is, of course, the assumed zero (actually negative) product of the pool of excess labor that we are implicitly associating with the outcome of a market-determined real exchange rate and allocation of domestic and international savings. This provides a free lunch that everyone can share through current Asian policies.

With plausible rates of accumulation and returns, the transition to the new steady state need not imply a large continuing net transfer. So the system can end with a smooth adjustment. The government of China, for example, would have emplaced a more productive capital stock and will have managed to employ 200 million people in world-level wage jobs. The United States will own a nice chunk of the Chinese capital stock and will have made a fine excess return during its accumulation. There are even mutually offsetting cross-border claims against each other that can serve as escrow against confiscation.[11]

During the adjustment period, many dimensions of this development program are distorted in the periphery. But one thing that is not distorted is the knowledge that at the end of the transition, capital invested in traded-goods industries will have to compete on an equal basis with capital invested in other countries. We see no practical alternative to imposing this discipline on an emerging market and, at the same time, accelerating the absorption of a large and politically dangerous pool of labor. The feasibility of maintaining an undervalued exchange rate through monetary policy and controls on domestic and international capital markets for a long time can, of course, be questioned. But this is an empirical question. At the moment we do not see a mechanism in the case of many Asian countries for significant circumvention of their financial arrangements and regulations.

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11. For more on this argument, see Dooley and Garber (2005).

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Comment Shang-Jin Wei

This paper by Dooley, Folkerts-Landau, and Garber is the third in a four-paper series that the authors have written on international monetary sys-

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tem.[1] This is a highly successful series judged by the attention it has generated. Dooley, Folkerts-Landau, and Garber have termed their theory a revived Bretton Woods system. An alternative label one might fashion is a giant communist-capitalist conspiracy theory. Here is how the conspiracy works:

On the communist or the Chinese side,

1. There is a desire to create 20 to 30 million manufacturing jobs per year.
2. This conflicts with a second feature of the economy: an inefficient domestic financial system that could not convert the national savings into productive investment.

The strategy is (a) promoting rapid export expansion, especially into the U.S. market by welcoming FDI, especially those from the United States by (b) using a systematically undervalued domestic currency, the RMB or the yuan, and by (c) channeling the trade surpluses back into the United States, buying and accumulating low-interest U.S. securities, especially government bonds.

The use of FDI serves two purposes, according to Dooley, Folkerts-Landau and Garber. First, it bypasses the inefficient domestic system in China. Second, by offering high returns to the U.S. multinational firms, these firms can be induced to be a counterweight to the protectionist forces in the United States against the rise of imports from China.

The purpose of a supposedly deliberately undervalued exchange rate is self-evident. So is the purpose of channeling foreign exchange reserve back to the United States.

On the capitalist or the U.S. side,

1. The United States maintains a large current account deficit vis-à-vis China. The two elements of the conspiracy are that the large U.S. direct investment in China, together with the large U.S. current account deficit, are collectively termed total return swap by Dooley, Folkerts-Landau, and Garber (2004c).
2. American households find it attractive to accept or tolerate the Chinese model of growth as they are enjoying lower interest rates in terms of cheaper mortgages or are generally consuming beyond their means.
3. The U.S. government is willing to accept the Chinese model because it needs Chinese foreign exchange to finance public debt, the Iraq War, and so on.

A key prediction of the Dooley, Folkerts-Landau, and Garber hypothesis is that such conspiracy can last for another ten to fifteen years because it can maintain enough political support on both sides of the Pacific.

1. The series of papers are Dooley, Folkerts-Landau, and Garber (2003, 2004a,b,c).

Like all intriguing theories, there are certainly elements of the theory that seem to be well supported by facts.

Elements of Plausibility

1. The Chinese government desires to create 20 to 30 million new jobs each year.

2. The Chinese domestic financial system is very inefficient. In fact, in a paper with Boyreau-Debray (Boyreau-Debray and Wei 2005), I have documented various inefficiencies in the system. For example, if one were to compute marginal products of capital by province, and if one expects that capital to flow to most productive activities, then the marginal product of capital (MPKs) would be equalized in a steady state or positively correlated with MPK during the transition. Instead, we find that capital inflow across regions tends to be negatively correlated with MPK. In other words, capital in China systematically goes to less-productive regions. To understand this puzzling pattern, we have decomposed the capital inflow into those through state budget or state-owned banks and those by private investment and FDI. It turns out the peculiar negative association applies only to the allocation of capital through the state budget or state banks. Because the financial system is heavily dominated by the state, the entire system is not conducive to channel national savings into the most productive investment.

3. China welcomes FDI and, in fact, offers not just national treatment, but supernational treatment.

4. Chinese exports have been expanded at a very fast rate.

5. China channels much of its cumulative current account surplus in low-yield U.S. government securities.

Elements of Less Plausibility

1. Most FDI in China does not come from the United States.[2] Half of them come from Hong Kong. The U.S. share is about 10 percent. On the flip side, the United States has more FDI in several other countries than it does in China. Given the relative lack of prominence of U.S. companies in China, the argument that U.S. companies would serve as a very effective counterweight to the protectionist force in the United States becomes weaker than it first appears.

Hong Kong has more direct investment in China than the United States. It arguably has less recourse than the United States in the event of a Chinese default on its investment. So the need for a collateral should be bigger than the U.S. multinationals. Yes, it has run a trade surplus against China every year since 1980.

Taiwan has about as much direct investment in China as the United

2. The following discussion draws on Prasad and Wei (2005).

States. Yet, unlike the United States, it has run a trade surplus against China consistently throughout the 1990s and into this millennium.

2. What about the possibility that the United States collects the collateral on behalf of multinational firms from all countries? This may be important precisely because collaterals in Hong Kong, Taiwan, and other small economies may not be credible; the People's Liberation Army may overrun them. A necessary condition for this story to work is that in the event of a Chinese default, investors from Hong Kong, Taiwan, and other economies could go to the United States to ask for compensation in the form of getting a slice of China's foreign exchange reserve. This scenario doesn't seem very plausible. In addition, Japan, a large, developed country, has about as much direct investment in China as the United States. Yet it also runs a trade surplus.

3. While the Chinese exchange rate is likely to be undervalued today, it was not always so over the lifetime of the eleven-year-old dollar peg system. In fact, during much of the 1990s, black market data suggest that the Chinese currency were overvalued rather than undervalued. Also, during 1997 to 1999, there was tremendous pressure in China to devalue yuan. Yet the government chose not to. In any case, the Chinese did allow its currency to appreciate by 2.1 percent on July 21, 2005. These observations do not fit very well with the conspiracy theory that a deliberately undervalued exchange rate has been an integral and consistent development strategy of China.

4. The U.S. Congress does not seem to buy into the conspiracy theory as evidenced by intense recent pressure to get the Chinese to revalue their currency.

5. Dooley, Folkerts-Landau, and Garber's colleagues at the Deutsche Bank do not appear to buy into the their conspiracy theory as they are reported to speculate on possible Chinese revaluation from time to time.

Summary

The Dooley, Folkerts-Landau, and Garber hypothesis has enough plausible elements to make it intriguing to ponder. At the same time, there are important parts of the story that do not appear to fit the facts.

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II

Empirical Studies of G7 Current Account and Exchange Rate Adjustment

4

Current Account Deficits in Industrial Countries
The Bigger They Are, the Harder They Fall?

Caroline Freund and Frank Warnock

4.1 Introduction

The U.S. current account deficit was a record $668 billion in 2004, accounting for 5.7 percent of gross domestic product (GDP) and fully two-thirds of global net foreign lending. Its size, as well as the unprecedented foreign flows into U.S. bonds associated with it, have raised concerns about how the adjustment to a more balanced current account will play out. One grim scenario begins with foreigners suddenly losing their appetite for U.S. assets, and, in the process of unwinding their large U.S. positions, pushing up interest rates, depressing growth and causing a large depreciation of the dollar. Worries about such a disorderly adjustment first surfaced in 2000, when the U.S. deficit-GDP ratio crossed the 4 percent mark.

The conventional wisdom on current account adjustment is that some current account deficits are more problematic than others. Important factors are the size and persistence of the deficit, its use and financing, and the openness and indebtedness of the economy. For example, Summers (2004) notes that 5 percent of GDP is a traditional danger point for current account deficits and argues that deficits rising to finance consumption and government spending and deficits supported by short-term financing are

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of relatively greater concern. Obstfeld and Rogoff (2004) highlight the importance of goods-market integration in adjustment because the magnitude of exchange rate adjustment needed to reduce a deficit is greater when markets are not well integrated and the substitution between foreign and domestic goods is low. Roubini and Setser (2005) worry about the size of the foreign debt position and the corresponding interest payments. Concerns about delaying a U.S. adjustment abound, for example, Bergsten and Williamson (2004, 24) write "[n]o one doubts that adjustment will eventually happen. The sooner it starts, the less chance it will take a catastrophic form."

We aim to evaluate the importance of these concerns by examining the U.S. situation within the context of current account reversals that have occurred in a wide range of industrial countries. In all, we have at our disposal twenty-six current account reversals that occurred between 1980 and 2003. The twenty-six episodes vary in a number of ways and allow us to place the current U.S. situation in context; while the United States may be in what it considers uncharted waters (with respect to its own history), along many dimensions its current scenario is not atypical.

There are well-known characteristics of current account reversals in industrial countries. In particular, they tend to occur around 5 percent of GDP and involve currency depreciation and a decrease in GDP growth (Freund 2000, 2005).[1] But typical can conceal considerable deviations across episodes as some reversals are more benign than others. The main goal of this paper is to examine the extent to which aspects of the buildup of the current account deficit are associated with more severe outcomes; we attempt to uncover the set of preconditions that is associated with more benign outcomes and the set that is associated with greater pain. Specifically, we examine—in the context of twenty-six current account reversals—the extent to which variation in the size and persistence of the current account deficit, its nature (whether it is funding consumption or something more productive, such as investment), the size and composition of financing, and the openness of the economy matter for the adjustment process. We then characterize the adjustment process using three main measures: the extent of exchange rate depreciation, the slowdown in GDP growth, and the improvement in the current account balance that accompany reversals.

We begin by updating the characterization of current account reversals. To do this, we append the Freund (2000) analysis with a study of the dynamics of various financial variables through the adjustment process and incorporate data through 2003. The characterization can be summarized as follows. We verify that the main results from Freund (2000) still hold: countries tend to experience slow GDP growth and a real depreciation as the cur-

1. Several analyses have replicated and updated these results, including IMF (2002), Debelle and Galati (2005), and Croke, Karnin, and Leduc (2005).

rent account adjusts, and the adjustment appears to be spurred by real export growth as well as declining investment and consumption. Current account adjustments are generally matched by reversals in the financial account. In emerging markets, all types of portfolio investment flows—debt, equity, and banking—adjust sharply (Rothenberg and Warnock 2005), but in our sample of industrial countries, the financial account dynamics are more subtle. The most dramatic adjustment is in the banking or other flows, which decrease over 2 percentage points (of GDP) in the first two years of the adjustment. In addition, bond inflows appear to surge in the run-up to the reversal. In contrast, equity and direct investment flows do not show well-defined dynamics around the adjustment process.

Our results on the relationship between preconditions and outcomes can be summed up as follows. We find that larger deficits take longer to resolve and are associated with relatively slower income growth during recovery. There is no significant correlation between the size of the deficit and the extent of depreciation. In contrast, reversals that were preceded by a persistent deficit (a deficit that lasted for at least five years before reversing) are not associated with more depreciation or slower growth. We find that consumption and government-driven deficits tend to lead to a greater real depreciation than investment driven episodes: a 1 percentage point shift from investment to consumption (or government spending) generates an additional 0.7 percentage points in average annual depreciation during adjustment. We find relatively little evidence that the level of openness or the nature of the financing—whether it is through bond flows or more directly into productive uses, such as equity or direct investment—impact the severity of the adjustment. Deficits associated with greater bond inflows do appear to be followed by larger increases in interest rates—perhaps because the bond inflows kept interest rates abnormally low, as in Warnock and Warnock (2005)—and a sharper decrease in equity prices. Finally, the size of the external position does not appear to affect the outcome.

We also examine the 1987 U.S. adjustment episode to discern to what extent it reflected the typical case and look at the key indicators for 2004 in order to gauge where the United States stands with respect to adjustment. We find that in the 1987 episode, the extent of depreciation was very close to predicted, though adjustment was somewhat slower with less of a decrease in growth. We use 2004 values of key variables to predict the pattern of U.S. adjustment were it to begin now. The analysis suggests that were the adjustment to start in 2005, the dollar would depreciate 25 percent from its peak but only 2¼ percent annually over the next three years, as much of the depreciation occurs before the current account actually reverses.

Our work is complementary to many contemporaneous papers. The most similar in spirit is Croke, Kamin, and Leduc (2005), who employ a similar data set to analyze how experiences differed between episodes characterized by a growth slowdown and those that were not, but they do not examine how preconditions in the episodes differed. Adelet and Eichengreen (chap. 6 in this volume) also use an event study approach with a much longer historical sample (going back to 1880) for a much broader range of countries; in their study, data limitations preclude analysis of the range of preconditions and outcomes that we are able to analyze. Clarida, Gorretti, and Taylor (chap. 5 in this volume), using empirical time series analysis, examine the points at which current accounts might reverse. Obstfeld and Rogoff (chap. 9 in this volume), in a general equilibrium model, start from the assumption that the current account adjusts and then trace out the implications. Faruqee et al. (chap. 10 in this volume) examine current account dynamics in the context of the IMF's global general equilibrium model.

Our work is also related to the literature on current account reversals in emerging markets (sometimes referred to as the sudden-stop literature). But reversals in our industrial country study are distinctly different from those in emerging markets. For example, whereas we find that reversals are associated with adjustments in either growth or the exchange rate, emerging market reversals are not associated with large changes in growth (Milesi-Ferretti and Razin 1998; Chinn and Prasad 2003), perhaps because the exchange rate adjusts much more.[2] On the financial side, our industrial country results differ from those for emerging markets for two reasons. One, financial systems in industrial countries are likely more efficient intermediating funds, making the type of capital flows associated with the run-up to a reversal less important. Two, the foreign debt of industrial countries is more likely to be denominated in the home currency, ameliorating the balance sheet effect of a devaluation.

The paper proceeds as follows. Section 4.2 defines episodes of adjustment, examines empirical regularities of current account and financial account adjustment in industrial countries, and discusses persistent deficits. Section 4.3 examines whether case studies support the notion that bigger deficits (in terms of size, consumption, and debt flows) imply harder falls. Section 4.4 presents robustness analyses of the key results. Section 4.5 discusses the United States in light of the predictions. Section 4.6 concludes.

4.2 Characterizations of Episodes of Adjustment and Persistent Deficits

In this section, we define and characterize current account reversals and persistent deficits.

4.2.1 Episodes of Adjustment

We update previous results from Freund (2000) using data through 2003 and also incorporate financial variables. We document current account ad-

2. In contrast, Edwards (2001), which analyzes current account deficits in a sample of 120 countries, finds evidence that current account reversals lead to lower per-capita GDP growth.

justment from a large deficit to highlight patterns of adjustment. The following are criteria for a current account adjustment:

1. The current account deficit-GDP ratio exceeded 2 percent before the reversal.
2. The average deficit-GDP ratio was reduced by at least 2 percentage points over three years (from the minimum to the centered three-year average).
3. The maximum deficit-GDP ratio in the five years after the reversal was not larger than the minimum in the three years before the reversal.
4. The current account deficit-GDP ratio was reduced by at least one-third.

Using these criteria on data from high-income Organization for Economic Cooperation and Development (OECD) countries from 1980 to 2003, we identify 26 episodes of adjustment, listed in table 4.1. In our sample, there is considerable variation across episodes, as current account troughs occurred between 1980 (Austria and Sweden) and 1999 (Austria, again, and New Zealand); ranged from relatively small deficits (2.1 percent in France) to some that were quite large (Portugal's 16.1 percent deficit); and were associated with a wide variety in the size of net foreign asset positions (from those that were nearly balanced or even positive, to one that exceeded negative 70 percent of GDP).[3]

Figure 4.1 documents the pattern of adjustment across a range of variables, with event time 0 corresponding to the year the current account balance is most negative. Consistent with previous studies, countries tend to experience slow GDP growth (and increasing unemployment) and a real depreciation as the current account adjusts. In addition, real export growth, as well as declining investment and consumption, spurs adjustment. Adjustments are associated with worsening budget deficits and a pause in the accumulation of reserves, but little change in real long- or short-term interest rates.

We next examine financial account dynamics through the adjustment period. Absent large shifts in errors and omissions or sharp movements in the capital account (which, for most countries, is too small to adjust much), current account adjustments must be matched by reversals in the financial account, but for industrial countries we know little about which components of the financial account actually adjust. As Rothenberg and Warnock (2005) show that net amounts can mask considerable differences in inflows and outflows, figure 4.2 is designed to show, for each of the four main components of the financial account (direct investment,

3. Net foreign asset positions and gross liabilities positions are from Lane and Milesi-Ferretti (2005). Throughout our paper, using published IIP data instead of the Lane Milesi-Ferretti data set would produce similar results, but with fewer observations.

Table 4.1 **Episodes of adjustment**

Country	Trough year	Current account/GDP	NFA/GDP
Australia	1989	–5.9	–43.9
Austria	1980	–4.9	–12.8
	1999	–3.2	–19.5
Belgium	1981	–4.1	–1.9
Canada	1981	–4.2	–36.5
	1993	–3.9	–36.4
Denmark	1986	–5.3	–46.7
Finland	1991	–5.5	–34.3
France	1982	–2.1	–0.5
Greece	1985	–8.0	
	1990	–4.2	
Iceland	1982	–8.2	–46.3
	1991	–4.0	–49.6
Ireland	1981	–13.1	–60.0
Italy	1981	–2.6	–3.6
	1992	–2.4	–11.0
New Zealand	1984	–13.3	–53.4
	1999	–6.2	–71.7
Norway	1986	–6.0	–13.6
Portugal	1981	–2.8	–12.0
Spain	1981	–2.8	–12.0
	1991	–3.6	–16.1
Sweden	1980	–3.3	–7.4
	1992	–3.4	–21.1
United Kingdom	1989	–5.1	9.1
United States	1987	–3.4	–1.6
Average		–5.6	–26.4

Note: Current account and NFA (net foreign asset) are at the time of the current account trough.

equity flows, bond flows, and banking or other flows), the adjustment process for net inflows (inflows minus outflows), gross outflows, and gross inflows.

In emerging markets, all types of portfolio investment inflows dry up around the time of the current account reversal (Rothenberg and Warnock 2005). In sharp contrast, in our industrial country sample, the bulk of the adjustment in the year immediately following the current account trough comes via a sharp decrease in banking (or other) flows. In contrast, net direct investment, equity, and bond flows do not show clearly defined dynamics around the adjustment. The gross flows (depicted in the second and third columns of figure 4.2) do not provide much additional insight: the only new information that we can glean from the gross flows is that bond inflows typically surge in the run-up to the reversal and peak one to two years into the adjustment process.

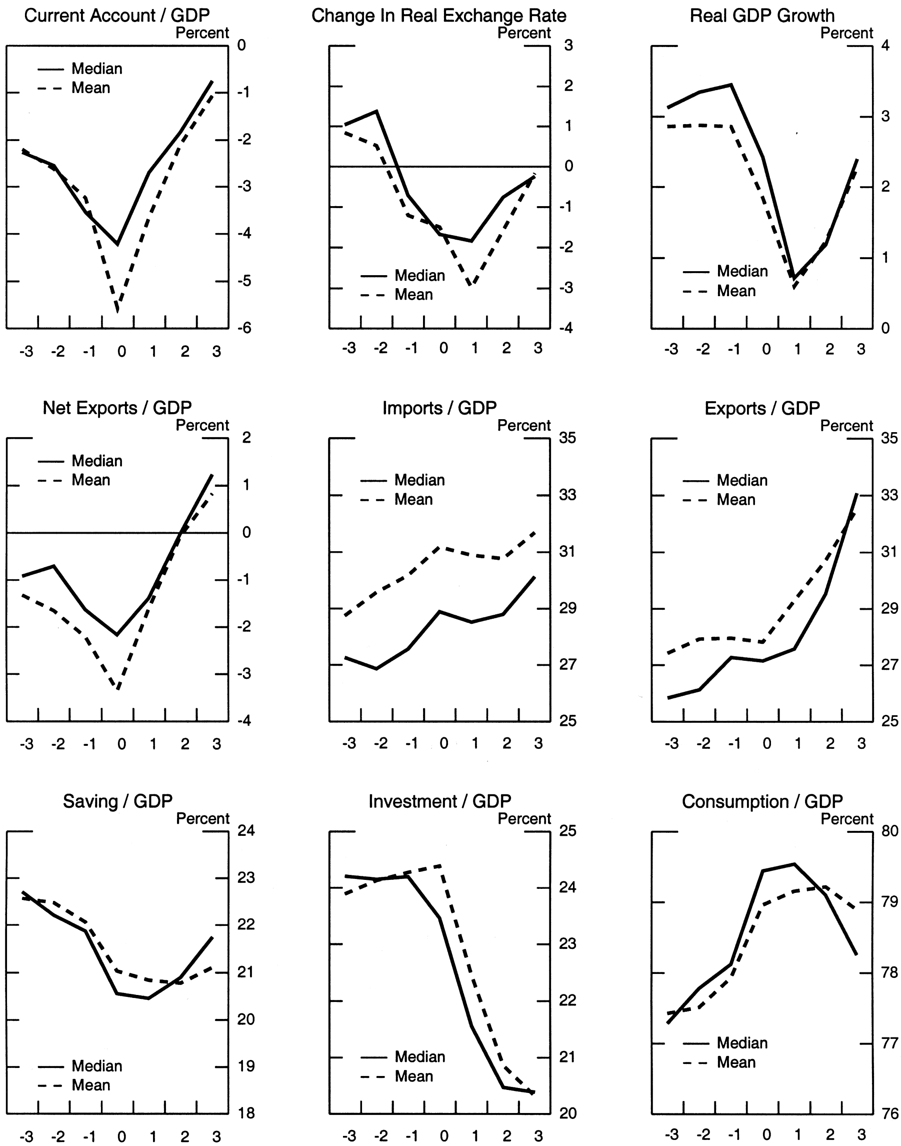

Fig. 4.1 Current account adjustment: The real side

4.2.2 Persistent Deficits

In addition to reversals, we characterize persistent deficits because much of the concern over the current U.S. episode has focused on its extended duration. Persistence is also related to the net foreign asset position (NFA; which we also consider in the following), as persistent deficits will tend to

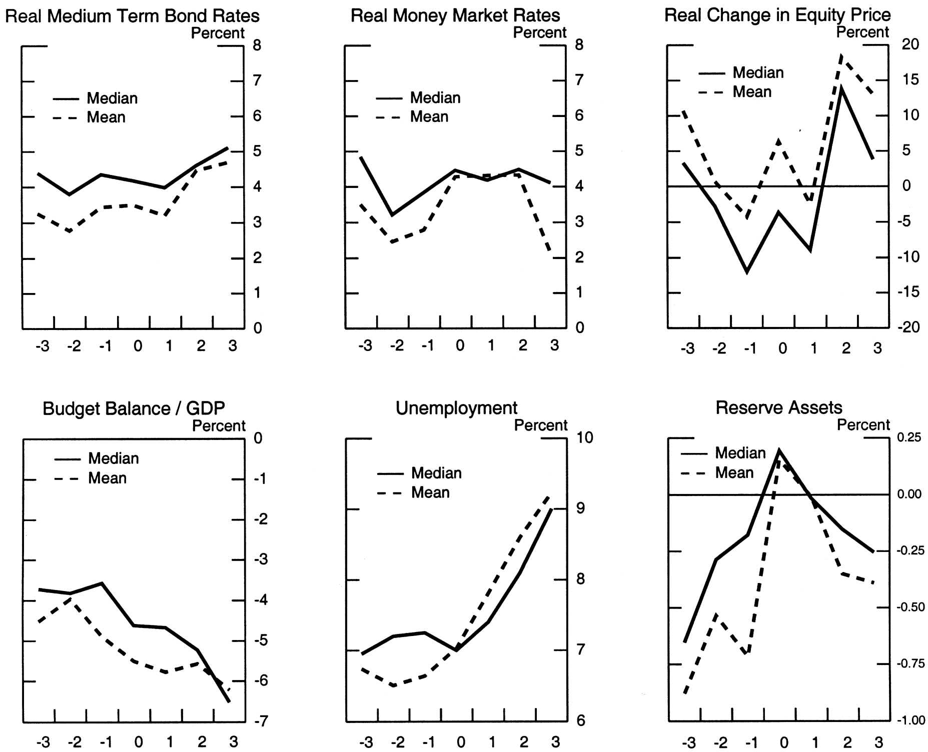

Fig. 4.1 (cont.)

decrease the NFA position.[4] Still, we think it is useful to have a separate variable that focuses entirely on duration in order to characterize these episodes and also to examine whether reversals from persistent deficits are inherently different. In addition, NFA position data are only available for twenty-four of the twenty-six episodes.

We define deficits as persistent if they satisfy the following three criteria:

1. The current account (CA)-GDP ratio was below 2 percent for five consecutive years.
2. There was no reversal (as defined in the preceding for five years).
3. The CA-GDP ratio was below two-thirds of its initial level in each of the five years.

The first criterion ensures that we are examining persistent deficits. The second ensures that the deficit is not undergoing a reversal; this criterion

4. Persistent deficits need not result in large negative NFA positions if valuation effects offset the current account deficits. In practice, this can be true for a given year as exchange rate movements can lead to large valuation adjustments. However, if there is mean reversion in exchange rates, the valuation changes may well net to zero in the medium to long run.

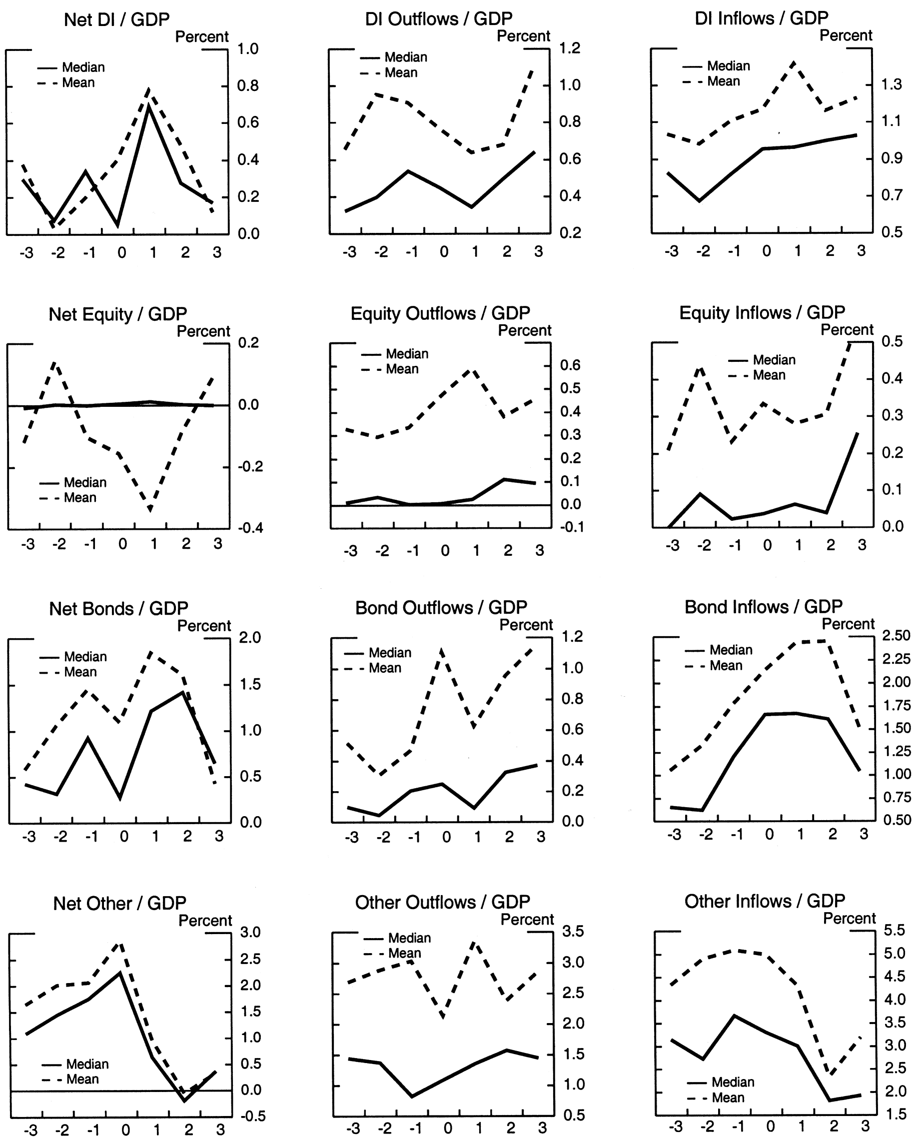

Fig. 4.2 Current account adjustment: The financial side

effectively eliminates V-shaped deficits. The third eliminates slow improvements and highly variable deficits. In all, the criteria leave us with two types of persistent deficits, those that are continuously worsening and those that are flat but deep.

We identify fourteen episodes of persistent deficits (table 4.2). Of these,

Table 4.2 Episodes of persistent deficits

Country	Year began	Length of episode	Average deficit	Average NFA
Australia	1980	10	–4.4	–32.0
	1991[a]	13	–4.2	–54.0
Austria	1976	5	–3.8	–12.8
	1995	6	–2.5	–18.1
Canada	1974	8	–3.7	–34.6
	1986	8	–3.6	–34.2
Denmark	1981	10	–3.7	–39.8
Greece	1976[b]	10	–4.5	
	1995[a]	8	–5.7	
Ireland	1976	6	–8.5	–52.7
New Zealand	1978	7	–5.6	–39.4
	1994	7	–5.3	–68.2
Portugal	1996[a]	7	–7.5	–34.4
United States	1998[a]	6	–3.9	–19.3
Average		7.92[c]	–4.8	–36.6

[a]Episode may not have ended as of 2003.

[b]Current account data begins in 1976, so episode may have actually been longer.

[c]Includes all episodes. If ongoing episodes are excluded, average is 7.7, indicating that recent episodes are somewhat longer.

ten were eventually reversed via adjustment episodes.[5] Four—Australia, Greece, Portugal, and the United States—have ongoing persistent deficits that remain unresolved. The average duration of a persistent episode is nearly eight years. Characteristics of persistent deficits are shown in table 4.3. The first column shows values for persistent-episode countries during the episode, the second column is for the same group outside of the episode, and the final column is for all other industrial countries. By definition, the current account position is, on average, worse. Key characteristics include lower-than-average savings rates, high net foreign debt, and somewhat elevated short-term interest rates. They are also somewhat less open—though this measure is highly variable and does not account for country size.[6] In contrast, investment-to-GDP and income growth are nearly identical to overall averages in the OECD. This suggests that persistent deficits are structural and that foreign investment is largely driven by opportunities that would remain unexploited in a world where capital was immobile.

5. That is, ten of our twenty-six reversal episodes were preceded by persistent deficits.

6. Countries that have run persistent deficits are, on average, very similar in size to countries that have not (real GDP in US$ is about 4 percent greater); however, the standard deviation of income is larger (about 70 percent greater).

Table 4.3 **Characteristics of persistent deficit episodes (unweighted averages)**

Variable	Persistent deficit countries, in episode	Persistent deficit countries, out of episode	Other industrial countries
CA/GDP	–4.7	–1.5	1.0
GDP growth	2.9	3.2	2.8
Savings/GDP	20.8	22.4	25.2
Investment/GDP	23.7	23.1	23.7
Real short rate	3.4	2.2	2.1
Real long rate	3.5	3.1	3.5
Net foreign asset	–0.4	–0.2	0.0
Fiscal balance/GDP	–3.6	–3.8	–3.0
Openness	55.9	60.7	73.2

Notes: Averages for all persistent episodes, including unresolved episodes. All others includes other countries and same currents during periods that do not qualify as persistent.

4.3 Are Some Reversals More Equal Than Others?

In this section, we evaluate whether large deficits, deficits that persist for at least five years, or deficits in countries with large foreign debt tend to involve more severe reversals.[7] To do so, we examine correlations between various outcomes (income growth, the extent of depreciation, the completeness with which adjustment occurred, and movements in interest rates and equity prices) with various preconditions (the size of the current account trough; whether the reversal was preceded by a persistent deficit; the extent to which it was associated with surges in consumption, investment, or fiscal deficits; the extent of openness and indebtedness to the rest of the world; and the nature of its financing). We use three measures of depreciation: the total real exchange rate adjustment during the seven years of the episode, the existence of an exchange rate crisis in that period, and the average exchange rate adjustment from year 0 to year 3. Exchange rate crises are identified using the Frankel and Rose (1996) definition, using monthly data on the local currency-special drawing rights (SDR) nominal exchange rate.[8] We use two measures of growth: average growth in the three years of recovery less average growth over the whole period and average growth in

7. The IMF (2002) examines large deficits, defined as 4 percent of GDP or more that persist for at least three years, in addition to the definition of reversals from Freund (2000). They also find that current account improvement increases as the size of the deficit increases, but less than one for one. Their focus is, however, on general characteristics of reversals, as opposed to differences between episodes with large and small deficits. The definition is different from that of general reversals so does not provide a direct comparison between episodes with large deficits and more moderate deficits.

8. A currency crisis has taken place if the nominal exchange rate depreciated by at least 25 percent over the last year and by at least 10 percent more than in the previous year.

the three years of recovery less average growth in the three years before recovery. Asset price movements are captured by the change in short-term rates, long-term rates, and equity prices (all adjusted for inflation) from three years leading into the current account trough to the three years following. Finally, we characterize deficits by the extent to which they were resolved after three years. Specifically, the variable RESOLVE is defined as the percentage point improvement in the current account GDP ratio from year 0 to year 3. The definition of current account reversals implies that RESOLVE will be correlated with the size of the deficit: to qualify as a reversal, a significant improvement in the current account must occur. Still, this variable allows us to test whether other factors are correlated with adjustment and also the extent to which the average deficit is improved. That is, a coefficient on CA/GDP at trough of –1 would imply that deficits are fully reversed after three years. A coefficient of –.5 would imply they are 50 percent reversed. Simple correlations and significance levels are presented in table 4.4. A data appendix offers more details about the variables.

4.3.1 Large and Persistent Deficits

As noted in the introduction, current thinking suggests that large and persistent deficits will involve more pain. However, the correlations presented in table 4.4 imply that the resolution of large or persistent deficits does not require a more extensive depreciation nor are they more likely to be associated with an exchange rate crisis. If anything, the correlations indicate that large and persistent deficits tend to involve less depreciation than average. (We discuss this result in more detail in the next section.) The resolution of large deficits is, however, associated with a growth slowdown that is deeper than average (table 4.4 and figure 4.3). Not surprisingly, they also involve a significantly greater adjustment in a three-year period. There is no indication that deeper or more persistent deficits are associated with larger adjustments in interest rates or equity prices.

4.3.2 Consumption- versus Investment- versus Government-Driven Episodes

If current account deficits are associated with consumption booms or large fiscal deficits, rather than a surge in the more productive investment spending, the adjustment process might be more painful. Indeed, the correlations in table 4.4 imply that deficits driven by consumption growth involve significantly more depreciation in years 0 to 3. Similarly, deterioration in the fiscal balance increases depreciation, though the coefficient is not significant at standard levels. Consumption driven deficits are also associated with an increase in relative GDP growth 3year/3year. However, further examination shows that this is due to lower growth during the period when the deficit is worsening, as opposed to higher growth in the recovery period; consistent with this, the correlation between consumption

Table 4.4 Correlation coefficients

	CA/GDP at trough	Preceded by persistent deficit	Con/GDP growth (–3 to 0)	Inv/GDP growth (–3 to 0)	Fis/GDP growth (–3 to 0)	NFA/GDP at trough	Openness	Gross liability/GDP at trough	Share of bond inflows	Share of DI/Equity inflows
GDP growth (3yr/3yr)	0.38*	0.11	0.38*	–0.84*	–0.31	–0.07	–0.09	–0.09	0.20	–0.19
	(0.06)	(0.60)	(0.05)	(0.00)	(0.12)	(0.76)	(0.66)	(0.67)	(0.34)	(0.41)
GDP growth (3yr/lr avg)	0.51*	0.16	0.05	–0.37*	–0.07	0.14	–0.18	–0.07	–0.03	0.01
	(0.01)	(0.44)	(0.79)	(0.07)	(0.72)	(0.53)	(0.38)	(0.74)	(0.89)	(0.97)
Total ER	–0.33	0.29	–0.43*	0.73*	0.32	–0.12	0.29	0.35*	–0.07	0.02
	(0.10)	(0.15)	(0.03)	(0.00)	(0.11)	(0.59)	(0.15)	(0.09)	(0.75)	(0.92)
Average ER	–0.39*	0.45*	–0.49*	0.74*	0.32	–0.29	0.21	0.27	–0.21	0.31
	(0.05)	(0.02)	(0.01)	(0.00)	(0.11)	(0.17)	(0.31)	(0.20)	(0.33)	(0.17)
Crisis	–0.28	–0.10	–0.01	–0.14	–0.05	–0.43*	–0.32	–0.21	–0.16	0.43*
	(0.17)	(0.64)	(0.94)	(0.51)	(0.81)	(0.03)	(0.11)	(0.34)	(0.45)	(0.06)
Resolve	–0.75*	0.02	0.10	0.12	0.00	–0.36*	0.30	0.02	0.02	–0.07
	(0.00)	(0.93)	(0.62)	(0.54)	(0.98)	(0.08)	(0.14)	(0.93)	(0.91)	(0.78)
Short rates	0.00	0.09	–0.21	0.07	0.26	–0.10	0.06	0.28	0.38*	0.06
	(0.99)	(0.70)	(0.35)	(0.77)	(0.25)	(0.68)	(0.81)	(0.21)	(0.09)	(0.81)
Long rates	–0.08	0.12	–0.32	0.13	0.09	–0.06	0.02	0.17	0.15	0.02
	(0.74)	(0.60)	(0.17)	(0.58)	(0.72)	(0.81)	(0.92)	(0.46)	(0.53)	(0.93)
Equity prices	–0.09	–0.25	–0.10	0.22	0.01	0.17	0.06	–0.11	–0.58*	–0.05
	(0.70)	(0.27)	(0.68)	(0.35)	(0.96)	(0.49)	(0.40)	(0.66)	(0.01)	(0.84)

Notes: At most twenty-six observations. *P*-values are in parentheses. Year 0 is the year of the current account (CA) trough. Interest rates and equity prices are adjusted for inflation. In the outcome variables (in the first column), changes are generally expressed as the difference between the three-year average following the trough and the three-year average leading up to the trough. Exceptions are GDP growth (lr avg), which is relative to the long-run average GDP growth, and average ER, which is average annual exchange rate movement from the trough to year 3. Total ER is the maximum total exchange rate depreciation from year –3 to year 3. In both cases, a currency depreciation will have a negative sign. Crisis is the presence of an exchange rate crisis at some point between year –3 and 3. Resolve is computed as the percent point improvement in the exchange rate from year 0 to year 3. NFA (net foreign asset), gross liabilities, and the shares of bond and DI/Equity flows are defined in the data appendix.

*Significant at the 10 percent level or better.

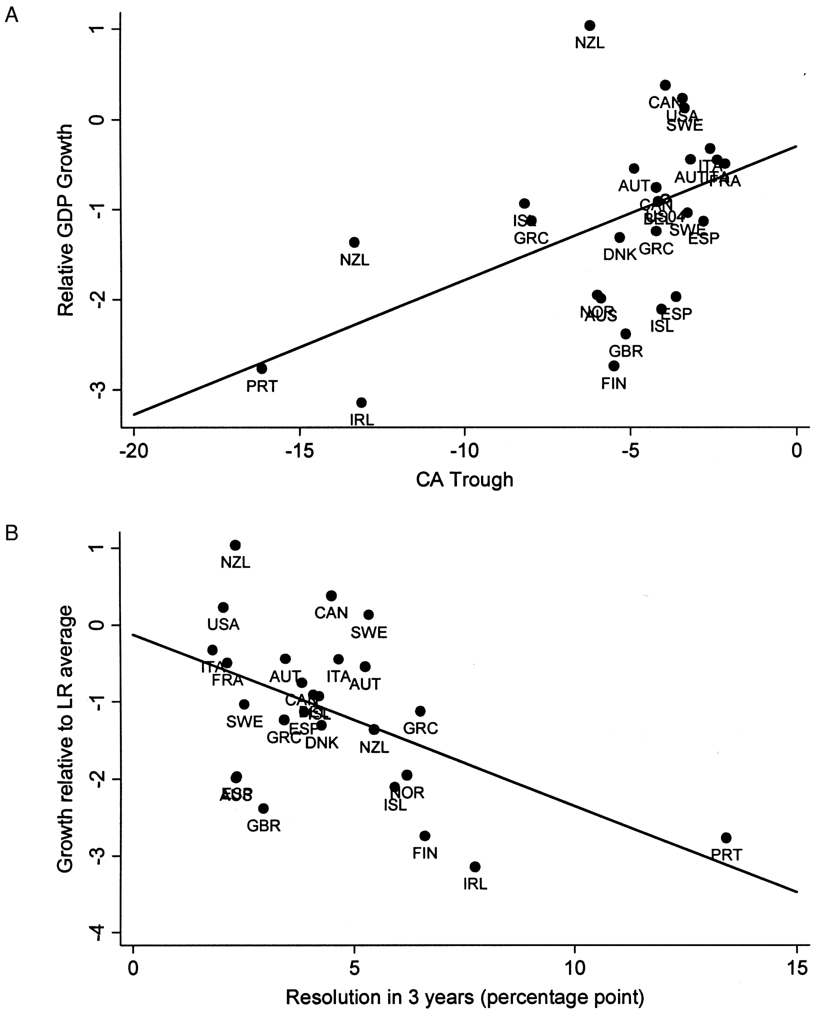

Fig. 4.3 Real side effects: *A,* Change in GDP growth vs. CA trough; *B,* Relative GDP growth vs. adjustment

growth in the preperiod and GDP growth relative to the long-run average is insignificant. Deficits driven by investment growth are associated with significantly slower income growth during recovery and significantly less depreciation than other episodes. These are likely the episodes that are most cyclical. The relationship between investment and the exchange rate adjustment is very strong (figure 4.4A). Interest rates and equity prices do not appear to be influenced by whether the current account deficit is associated with surges in consumption, investment, or budget deficits. Finally,

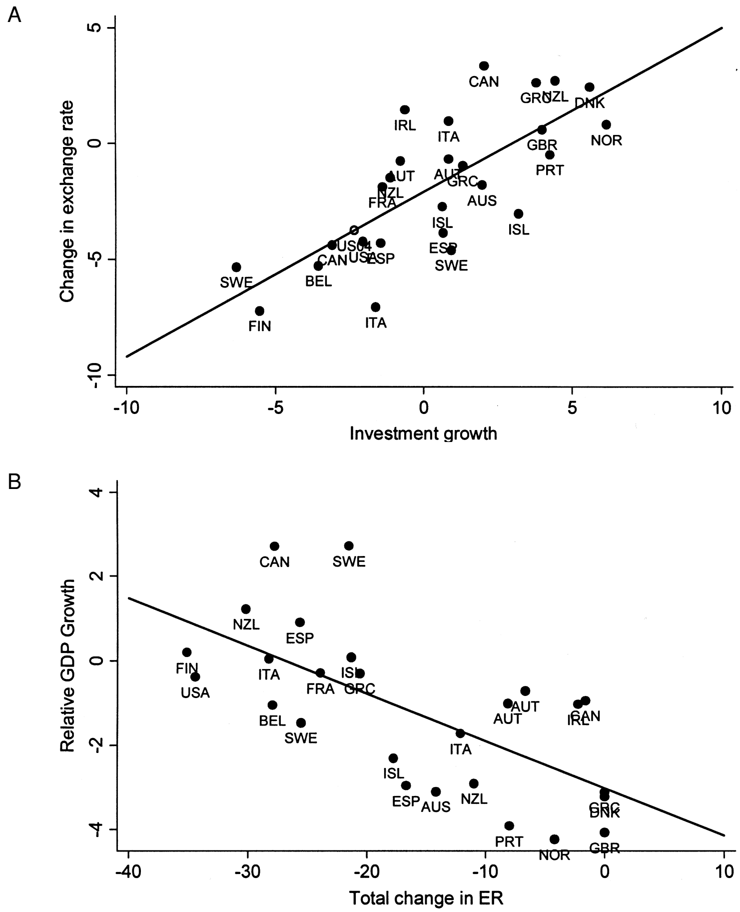

Fig. 4.4 Investment, exchange rate adjustment, and growth: *A,* Change in exchange rate (year 0 to 3) vs. investment growth (year –3 to 0); *B,* Total change in exchange rate vs. relative GDP growth

we find no evidence that the growth in the fiscal balance affects GDP growth relative to long-run average.

4.3.3 Openness

In well-integrated economies, only a small relative price change will be needed to induce consumers to switch to domestic goods, thus reducing the trade (and current account) deficit. Thus, we expect that more open economies will experience less depreciation during adjustment. Looking at the correlation between openness (measured as average openness during the three years before reversal) and exchange rate adjustment, we find very little evidence that openness affects exchange rate adjustment in industrial countries. The signs are correct, greater openness is associated with less average and total depreciation and a lower likelihood of a crisis, but openness is not significant at standard levels.

4.3.4 Large Indebtedness to the Rest of the World

It can be argued that countries that rely heavily on foreign financing are more prone to quick reversals in foreign investment and that these quick reversals can induce considerable pain. For example, if foreigners hold a sizable portion of domestic assets (either in net or gross terms), their retreat could spark a spike in interest rates, decreasing equity prices, low growth, and a sharp depreciation.

To see whether this is true in our sample, we look at two measures of the extent of indebtedness to the rest of the world. The first is the size of the NFA position relative to GDP. Here we see no evidence that countries with large net debt positions (that is, negative NFA positions) have worse outcomes with respect to their exchange rates, income growth, interest rates, or equity prices. Counter to the evidence on exchange rate depreciation, there does appear to be a higher incidence of currency crises in countries with more negative NFA positions. The correlation with RESOLVE is negative, indicating that more negative NFA positions are (weakly) associated with greater improvements in the current account balance; however, the effect of the current account trough on adjustment turns out to be the only robustly significant factor. The second measure we utilize is the size of the country's gross liabilities to the rest of the world (scaled by GDP). Here the evidence is clear: larger gross liabilities positions do not appear to be associated with significantly worse outcomes.

While we do not find evidence that a more negative NFA or gross liabilities position results in worse outcomes, simple correlations can be misleading if they are affected by outliers. In figure 4.5 we present scatter plots of the relationships between gross liabilities positions and GDP growth and currency movements. The figures show that, with or without outliers, there is no apparent relationship between the extent of foreign indebtedness at the time of the current account trough and subsequent changes in GDP or currency values.[9] If anything, larger gross liabilities positions are associated with less exchange rate depreciation.

4.3.5 Financing through Productive Means?

If the financial system does not intermediate very well, one could be concerned that large current account deficits financed by bond inflows are associated with borrowing binges that in the end bring more pain. In con-

9. If foreign debt is largely foreign-currency denominated, as in many emerging markets (Eichengreen and Hausmann 1999; Burger and Warnock 2004), the exchange rate depreciation associated with a current account reversal could lead to a painful balance-sheet effect. In our industrial country sample, this does not seem to be the case,

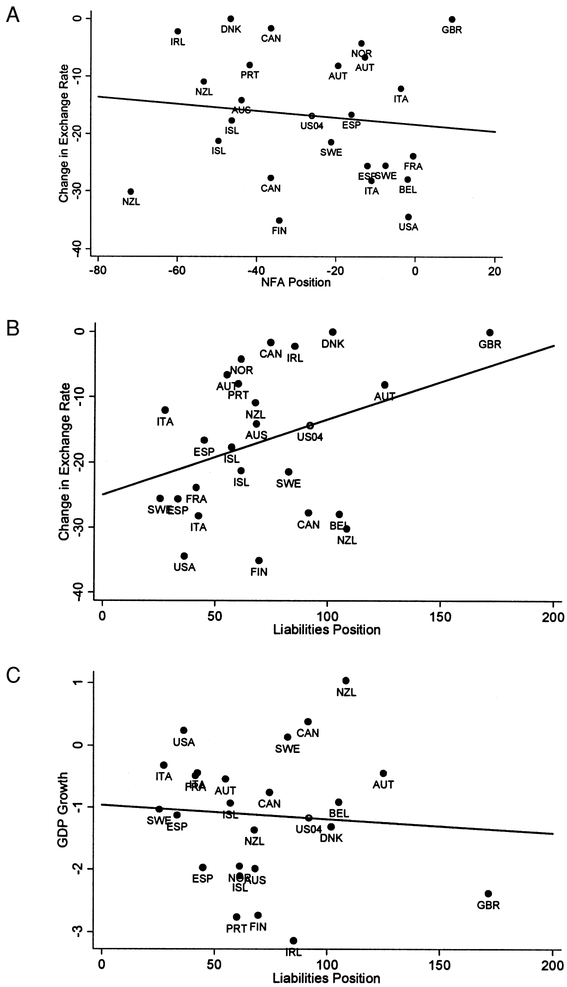

Fig. 4.5 Liabilities, exchange rate adjustment, and growth: *A,* Total change in exchange rate vs. NFA position; *B,* Total change in exchange rate vs. liabilities position; *C,* GDP growth vs. liabilities position

trast, deficits financed by more productive inflows such as direct investment or equity inflows, because they went directly into productive uses, may well adjust in a more benign fashion. However, if the financial system is adept at intermediating, the form of the inflow should not matter; the system will find the best use for the funds, whether they enter the country as direct investment or short-term bond flows.

The evidence we present suggests the latter case. We find no evidence that the type of financing impacts the outcome for GDP growth or exchange rates.[10] Deficits associated with larger bond inflows are associated with larger subsequent increases in short-term interest rates and a greater decrease in equity prices. This is consistent with the empirical evidence in Warnock and Warnock (2005), who show that the cessation of large bond inflows can lead to a substantial increase in interest rates (which, presumably, could also lead to a sharper decrease in equity prices).

4.4 Multivariate Analysis

The simple correlations of table 4.4 indicated that larger deficits are associated with a greater slowdown in growth, less exchange rate depreciation, and a greater adjustment in CA/GDP. They also imply that the use of funds matter—deficits funding investment spending tend to be associated with slower growth during recovery and less depreciation. Of course, bilateral correlations leave open the possibility that other factors are driving these relationships. Parsing out effects in a sample of twenty-six observations is difficult, but in this section we attempt to determine whether these relationships are robust or if other factors are more important. Specifically, we regress GDP growth; percentage change in the exchange rate, that is, appreciation or depreciation (ΔER); and the extent to which the current account deficit is resolved in three years on the preconditions: the size of the current account trough, whether it was preceded by a persistent deficit, the composition of spending variables, and (where relevant) openness and the NFA position.

4.4.1 Growth Effects

Table 4.5 investigates the factors that result in larger growth slowdowns. The dependent variable is relative income growth relative to the long-run average; consistent with table 4.4, the size of the current account at its trough is highly significant (column [1]).[11] The coefficient on the size of the current account deficit at its trough is 0.15, implying that a 1 percentage point increase in the current account deficit at its trough is associated with a 0.15 percentage point slowdown in annual growth during the first three years of recovery. Including other factors—persistent deficits; the magnitude of the NFA position, or investment; consumption, and fiscal growth in the prerecovery period (columns [2] and [3])—does not materially impact the size or significance of the coefficient on CA/GDP, nor are these other factors significant. In column (4), we control for average growth in the period before the deficit reached its trough (lagged average growth);

10. Perhaps paradoxically, we find that greater productive inflows are associated with an increased incidence of crisis.

11. We use GDP growth relative to long-run average because the GDP growth in the period before adjustment—the denominator of GDP growth 3year/3year—is correlated with the initial period variables, creating a bias.

Table 4.5 **Growth effects**

	(1)	(2)	(3)	(4)	(5)	(6)
CA/GDP at trough	0.15**	0.16**	0.20**	0.15**	0.14	0.48**
	(4.00)	(2.81)	(3.06)	(3.90)	(1.38)	(4.79)
Preceded by persistent deficit		0.81				
		(1.41)				
CON/GDP growth (–3 to 0)		0.01				
		(0.09)				
INV/GDP growth (–3 to 0)		–0.05				
		(–0.64)				
FISBAL/GDP growth (–3 to 0)		–0.03				
		(–0.71)				
NFA at trough			–0.01			
			(–0.86)			
Average GDP growth (–3 to 0)				0.01		
				(0.05)		
Constant	–0.30	–0.57	–0.37	–0.30	–0.33	0.87
	(–1.13)	(–1.28)	(–1.28)	(–1.13)	(–0.81)	(2.07)
R^2	0.26	0.40	0.31	0.26	0.06	0.38
No. of observations	26	26	24	26	23	20

Notes: Dependent variable: GDP growth 0 to 3 relative to long-run average. Robust *t*-statistics are in parentheses. Column (5) excludes countries with deficits exceeding 10 percent of GDP. Column (6) excludes countries with deficits exceeding 6 percent of GDP.

**Significant at the 5 percent level.

growth in the previous period is not significant.[12] Finally, in columns (5) and (6), we test whether the relationship between growth slowdown and the size of the deficit owes to a few large deficit countries. Excluding potential outliers (see figure 4.3)—countries with deficits that exceeded 10 percent or, alternatively, those that exceeded 6 percent—does not materially reduce the magnitude of the coefficient on CA/GDP, although when only the three countries with extreme current account deficits are excluded, the coefficient is no longer significant.

The results in table 4.5 indicate that the relationship between the size of the current account deficit and the subsequent growth slowdown is rather robust. We caution, though, that while larger deficits are correlated with slower subsequent growth, this does not necessarily imply that larger deficits depress growth. It could be that the large deficit may be the result of a more amplified business cycle: strong growth exacerbates the deficit and the ensuing slowdown as the deficit narrows is more severe. However, as noted, even when we control for growth in the period when the deficit ex-

12. We measure income growth before the reversal analogously to income growth after the reversal, as three-year average GDP growth *before* the adjustment relative to long-run GDP growth.

Table 4.6 **Decomposing growth effects**

	INV/GDP			CON/GDP		FIS/GDP		NX/GDP	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CA/GDP at trough	0.51**	0.67**	0.95**	–0.03	–0.62**	–0.44**	0.17	–0.45**	–0.01
	(3.77)	(2.16)	(3.87)	(–0.15)	(–2.42)	(–2.16)	(0.38)	(–2.77)	(–0.05)
CON/GDP growth				–0.49**	–0.34**				
(–3 to 0)				(–2.51)	(–2.17)				
INV/GDP growth	–0.22	–0.17	–0.08						
(–3 to 0)	(–1.63)	(–1.25)	(–0.71)						
FISBAL/GDP						–0.42	–0.36		
growth (–3 to 0)						(–1.53)	(–1.11)		
NX/GDP growth								–0.15	–0.13
(–3 to 0)								(–1.16)	(–0.71)
Constant	–1.10	–0.47	0.48	0.50	–2.14	–3.21	–0.69	1.35	–3.23
	(–1.70)	(–0.40)	(0.53)	(0.40)	(–1.76)	(–2.49)	(0.34)	(1.76)	(–3.40)
R^2	0.61	0.42	0.47	0.25	0.37	0.27	0.19	0.44	0.05
No. of observations	26	23	20	26	23	25	22	26	23

Note: Robust *t*-statistics are in parentheses.

**Significant at the 5 percent level.

panded, the size of the deficit is still highly significant (table 4.5, column [4]). It could be that greater growth before the deficit reversed tends to generate larger deficits, but the correlation between prereversal income growth and CA/GDP at trough is close to zero and insignificant (not shown). Thus, stronger growth as the deficit worsened is not correlated with the size of the deficit, but weaker growth as the deficit improved is correlated with its size.[13] Finally, if business-cycle effects were the main driver of the episode, the correlation between GDP growth (3year/3year) should be highly correlated with the extent of adjustment, with deficits that show a larger resolution, experiencing a greater slowdown relative to the previous three years, and therefore a more extreme business cycle. However, the correlation between these variables is near zero and insignificant. In contrast, GDP growth relative to long-term GDP growth is correlated with the extent of adjustment (figure 4.3). Thus, while the business cycle clearly plays a role in these adjustments, it does not fully explain why larger deficits are associated with slower real income growth.

We note, too, that the correlations in table 4.4 suggest that the interest rate channel is absent: bigger deficits are not associated with bigger increases in interest rates or with interest rates that are high relative to long-run averages. Still, we find that larger deficits are associated with significantly lower investment during the current account recovery. Table 4.6

13. We also find that the size of the deficit at its trough is uncorrelated with movements in unemployment (not reported).

records results when we decompose the growth effects. Specifically, we regress investment growth (year 0 to 3) on lagged investment growth (year –3 to 0) and the current account trough to see if there is evidence of strong investment growth that reverses (column [1]). Prereversal investment growth is insignificant, while the current account trough remains highly significant, with a coefficient of 0.5. The correlation is highly significant even when we exclude outliers (columns [2] and [3]). Thus, we cannot rule out a depressing effect of the current account deficit on investment growth. This is consistent with previous work showing that much of the adjustment from a large current account deficit comes through investment (Freund 2000, 2005), and, of course, larger deficits require larger adjustments.

In contrast, the effect of the current trough on other components of GDP growth is not robustly significant (columns [4]–[9]). Cyclical effects with respect to consumption are very strong—countries that had a consumption boom as the current account deficit worsened tend to have a decline in consumption during the reversal. The size of the deficit is correlated with consumption when outliers are excluded, but the sign implies that countries with larger deficits had, if anything, *less* of a decline in consumption. This implies that the welfare effects of large deficits may be limited, depending on the extent to which GDP declines during adjustment.

4.4.2 Exchange Rate Effects

Tables 4.7 and 4.8 report results when average exchange rate adjustment (from year 0 to year 3) and total exchange rate adjustment are the dependent variables, respectively. For average exchange rate adjustment, a number of the variables displayed a significant correlation (table 4.4). When all of these variables are included in the regression, we find that there are robust effects from being preceded by a persistent episode and from the extent of investment growth before reversal (table 4.8). In particular, both the presence of a persistent deficit and the extent of investment growth before the reversal reduce the extent of depreciation that is required to accommodate adjustment. We also control for the exchange rate adjustment as the deficit worsened (column [3]) and removing potential outliers (columns [4] and [5]). The result is very strong and suggests that a 1 percentage point increase in investment as a share of GDP as the deficit is expanding leads nearly 1 percentage point less average annual depreciation during the current account recovery. In addition, the presence of a persistent deficit reduces average depreciation by about 3 percentage points annually. As shown in figure 4.4, the correlation between investment growth in the preperiod and average exchange rate movement is very strong.

Investment growth in the period when the current account is worsening also reduces the extent of *total* depreciation (table 4.8). In particular, a 1 percentage point increase in investment is associated with a total depreciation that is about 2.5 percentage points smaller. The result is robust to

Table 4.7 Exchange rate effects

	(1)	(2)	(3)	(4)	(5)	(6)
CA/GDP at trough	0.05	–0.09	0.05	0.06	0.46	0.37
	(0.59)	(–0.79)	(0.57)	(0.64)	(1.99)	(0.93)
Preceded by persistent deficit	3.28**	3.75**	3.23**	3.22**	3.35**	3.10**
	(3.76)	(3.48)	(3.65)	(3.40)	(3.02)	(2.35)
CON/GDP growth (–3 to 0)	0.16	0.17	0.16	0.15	0.19	0.19
	(0.83)	(0.95)	(0.84)	(0.74)	(0.78)	(0.71)
INV/GDP growth (–3 to 0)	0.85**	0.71**	0.85**	0.85**	0.92**	0.92**
	(5.99)	(3.44)	(5.68)	(5.74)	(6.46)	(5.86)
FISBAL/GDP growth (–3 to 0)	–0.17	–0.06	–0.17	–0.17	–0.14	–0.13
	(–1.97)	(–0.36)	(–1.82)	(–1.89)	(–1.33)	(–1.27)
NFA at trough		0.03				
		(1.54)				
Average exchange adjustment (–3 to 0)			–0.04			
			(–0.34)			
Openness				0.00		
				(0.27)		
Constant	–3.54	–3.63	–3.53	–3.66	–1.91	–2.17
	(–4.10)	(–4.09)	(–3.92)	(–3.42)	(–1.53)	(–1.18)
F-test predcon = predinv	16.38	5.22	15.06	13.45	10.38	9.84
	[0.00]	[0.04]	[0.00]	[0.00]	[0.01]	[0.01]
F-test – predfis = predinv	21.38	25.34	19.75	20.75	26.21	20.39
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
F-test – predfis = predcon	0.00	0.18	0.00	0.01	0.03	0.03
	[0.96]	[0.68]	[0.97]	[0.94]	[0.85]	[0.86]
R^2	0.73	0.74	0.73	0.73	0.74	0.74
No. of observations	26	24	26	26	23	20

Notes: Dependent variable: average annual real exchange rate adjustment, year 0 to 3. Robust *t*-statistics are in parentheses. *P*-values are in brackets.

**Significant at the 5 percent level.

controlling for the total exchange rate adjustment in the period before the exchange rate reversed (column [2]), to including other variables (columns [3] and [4]), and to removing outliers (columns [5] and [6]). If we regress total exchange rate adjustment on a constant alone, the coefficient is –16.3 (not reported), implying that, on average, a total real depreciation of about 16 percent is required for adjustment.

In both specifications, we can reject that the coefficients on consumption growth and fiscal deterioration are equal to the coefficient on investment growth. We cannot reject that consumption and fiscal deterioration have the same effect on exchange rate movements. This implies that deficits driven by consumption or fiscal deterioration are associated with significantly more depreciation than those driven by investment.

When total exchange rate adjustment is the dependent variable, the presence of a persistent deficit is not statistically significant (column [4])

Table 4.8 **Total exchange rate adjustment**

	(1)	(2)	(3)	(4)	(5)	(6)
CA/GDP at trough				0.34		
				(0.78)		
Preceded by persistent deficit				5.84		
				(1.14)		
CON/GDP growth (–3 to 0)				0.36		
				(0.41)		
INV/GDP growth (–3 to 0)	2.58**	2.40**	2.33**	2.83**	2.75**	2.86**
	(5.69)	(4.79)	(4.31)	(3.71)	(5.26)	(5.52)
FISBAL/GDP growth (–3 to 0)				–0.24		
				(–0.49)		
NFA at trough			0.01			
			(0.10)			
Openness				0.08		
				(0.89)		
Total exchange adjustment		–0.20	–0.18	–0.08		
before currency reversal		(–1.19)	(–0.92)	(–0.38)		
Constant	–17.60	–14.74	–14.91	–22.31	–18.11	–16.96
	(–10.77)	(–4.48)	(–3.49)	(–2.54)	(–11.37)	(–10.27)
F-test predcon = predinv				6.62		
				[0.02]		
F-test – predfis = predinv				12.84		
				[0.00]		
F-test – predfis = predcon				0.01		
				[0.92]		
R^2	0.53	0.55	0.54	0.63	0.59	0.64
No. of observations	26	26	24	26	23	20

Notes: Dependent variable: total real exchange rate adjustment. Robust *t*-statistics are in parentheses. *P*-values are in brackets. Columns (5) and (6) exclude countries with current account (CA) GDP rations less than –10 and –6, respectively.

**Significant at the 5 percent level.

though the sign still implies that persistent deficit countries experience less depreciation. The somewhat contradictory results on persistent deficits with respect to average and total exchange rate adjustment imply that being preceded by a persistent deficit does not affect total depreciation but does affect depreciation in the recovery period. In the persistent episodes, depreciation begins somewhat earlier, with stronger *j*-curve effects.

We do not find strong evidence that openness affects the extent of depreciation that accompanies reversals.[14] When average exchange rate adjustment is the dependent variable, the coefficient is close to zero and insignificant. When total exchange rate adjustment is the dependent

14. We also try controlling for the size of the economy by regressing openness on ln(GDP) and using the residual, but the results are similar.

Table 4.9 Adjustment effects

	(1)	(2)	(3)	(4)	(5)
CA/GDP at trough	–0.51**	–0.55**	–0.59**	–0.36	–0.53
	(–3.42)	(–2.81)	(–3.76)	(–1.95)	(–1.63)
Preceded by persistent deficit			–1.32		
			(–1.21)		
CON/GDP growth (–3 to 0)			0.05		
			(0.26)		
INV/GDP growth (–3 to 0)			–0.18		
			(–1.25)		
FISBAL/GDP growth (–3 to 0)			0.10		
			(1.18)		
Openness			0.01		
			(0.78)		
NFA at trough		0.01			
		(0.56)			
Constant	1.66	1.77	1.11	2.33	1.76
	(2.24)	(2.49)	(1.22)	(2.89)	(1.44)
F-test CAtrough = –1	10.67	5.30	6.61	11.94	2.20
	[0.00]	[0.03]	[0.02]	[0.00]	[0.16]
R^2	0.56	0.55	0.65	0.15	0.17
No. of observations	26	24	26	23	20

Notes: Dependent variable: resolve, percentage point resolution of CA/GDP after 3 years. Robust *t*-statistics are in parentheses. *P*-values are in brackets.

**Significant at the 5 percent level.

variable, the coefficient has the expected sign: greater openness reduces depreciation, but it is not significant. It could be that the trade-GDP ratio is a bad measure of the extent of openness at the margin. Alternatively, the small sample size could be an issue.[15] In addition, countries now in the European Union make more than half of the sample and may have similar levels of integration. Finally, overall openness may not be what is relevant, but rather the price elasticity of imports and exports and their various components (Mann and Plück, chap. 7 in this volume).

4.4.3 Adjustment

Table 4.9 reports results on adjustment effects. Only the size of the deficit matters for the extent to which it is resolved after three years. We find that for each 1 percentage point increase in the current account trough, three years into recovery, the current account is about .5 percentage points larger. The coefficient on CA/GDP at trough is significantly different from

15. If we exclude Belgium, with an openness measure exceeding 120 percent, the coefficient on openness is highly significant, provided only investment growth (year –3 to 0) and openness are included in the regression.

negative one (except when we exclude deficits exceeding 6 percent of GDP), indicating that larger deficits remain significantly larger after 3 years. Thus, large deficits are not as completely resolved as small ones after three years.

4.4.4 Summary of Results

The results show that larger deficits are associated with slower income growth during the current account recovery period and take somewhat longer to resolve. Growth effects are more severe because more adjustment is required when the current account deficit is greater. Indeed, as we have shown, growth (relative to long run) is negatively correlated with the extent of adjustment (figure 4.3). Although deeper deficits are associated with slower growth, they do not appear to require more depreciation. Once we control for other variables, exchange rate movements are not significantly different in countries with deeper deficits. In part, this may be because nominal exchange rate adjustment is limited in some industrial countries, either because of managed systems, fixed exchange rates, or because key trading partners fix exchange rates. Restricted exchange rate adjustment in turn leads to more extreme current account deficits and lower income growth during current account recovery. Income growth is forced to accommodate adjustment precisely because depreciation is not more severe. Indeed, there is a strong inverse correlation between the extent of exchange rate adjustment and the slowdown in GDP growth (figure 4.4B). There is a tradeoff: adjustment comes through either exchange movements or GDP growth. If exchange rates movements are limited, the current account position worsens further, and the GDP hit is more extreme.

We also found that the resolution of persistent deficits and of deficits with large negative NFA positions is broadly similar to others, in terms of total exchange rate adjustment and growth effects. Investment-driven current accounts require less exchange rate adjustment than episodes driven by consumption or government spending. This implies that investment channels resources into exports that can eventually service the debt. Finally, we found that financing does not matter significantly for the adjustment process, suggesting that markets are efficient at intermediating funds.

4.5 Implications for the United States

In 1987, the U.S. deficit was driven largely by consumption—from 1984 to 1987 consumption grew 2.5 percentage points, while investment declined by 2 percentage points. Table 4.10 reports predictions, based on the significant variables in the preceding regressions, and actual effects. It also reports predictions that are based on the assumption that the U.S. current account deficit begins its reversal this year; that is, predictions that use 2004 values of the initial conditions for the United States. For the 1987

Table 4.10 **U.S. adjustment**

	Total exchange rate adjustment	Average exchange rate adjustment[a] (year 0 to 3)	Relative growth[b]	3 year adjustment[c]
1987 predicted	–22.91	–4.28	–0.81	3.40
1987 actual	–34.41	–4.25	0.23	2.05
2005 predicted	–23.66	–2.25	–1.05	4.20

[a]Included variable is investment growth, year –3 to 0.

[b]Included variables are preceded by persistent deficit and investment growth, year –3 to 0.

[c]Included variable is current account trough.

episode, the model performs reasonably well on exchange rate adjustment—total depreciation was somewhat higher than predicted, and average depreciation during the recovery was right on target. The model predicted slower growth and a larger adjustment than actually occurred.[16] Despite the large current account deficit, the model predicts roughly the same total depreciation now and less depreciation from year 0 to year 3. The reason is that investment growth has been somewhat stronger and it is a persistent deficit, and persistent deficits tend to involve less depreciation during recovery.

Figures 4.3, 4.4, and 4.5 also show the predicted values for the United States—again, under the assumption that the reversal begins this year—with an open circle labeled US04. From those simple bilateral relationships, which do not take into account other factors, we see that were the U.S. current account deficit to begin a reversal this year, we would expect the following: a slowdown in GDP growth (panel A of figure 4.3 or panel C of figure 4.5) and a real exchange rate depreciation of about 4 percent going forward (panel A of figure 4.4) and 17 percent from its peak (panel A of figure 4.5 or panel B of figure 4.5). Of course, most of these bilateral relationships are not at all tight, so wide (sometimes very wide) confidence intervals—most of which would encompass zero—must be placed around these point estimates.

Finally, a striking feature of figures 4.3, 4.4, and 4.5 is that the United States is in no way an exception when placed with other current account reversal episodes. That is, the United States is typically found in the middle of the scatter plot and is never an outlier. There is, however, one aspect in which the United States is an outlier. Figure 4.6 shows that U.S. gross liabilities scaled by rest-of-the-world GDP—essentially, what portion of rest-of-the-world wealth ends up in the United States—are far larger than any other country's gross liabilities. There are two things to note about this fig-

16. Using time series data over the same period and analyzing thresholds of adjustment, Clarida, Goretti, and Taylor (chap. 5 in this volume) also find that U.S. adjustment is slow relative to other countries.

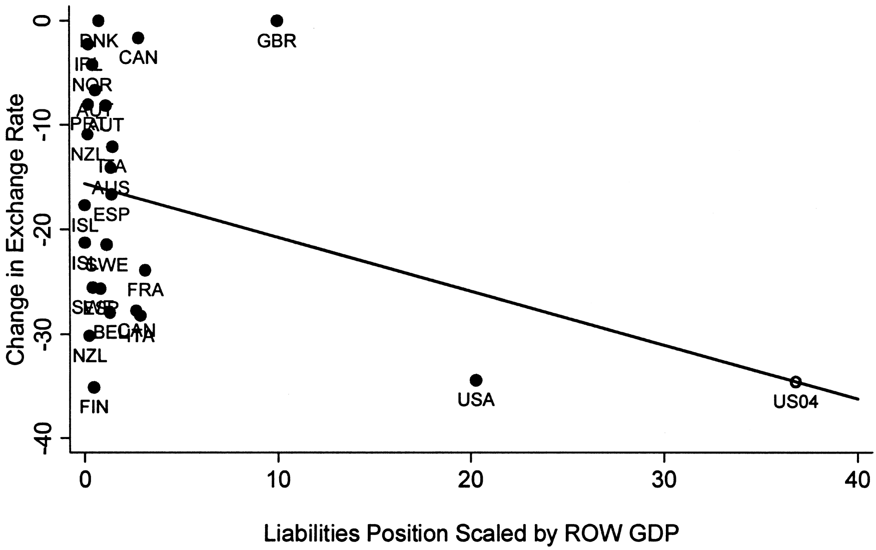

Fig. 4.6 Total change in exchange rate vs. liabilities position scaled by ROW GDP

ure. First, the fitted line is meaningless because the confidence band on the point estimate would be enormous, and the fitted line would not be downward sloping if we excluded the United States. Second, while the United States might look like an outlier on this graph, and perhaps to an economist, portfolio theory would suggest that the United States should have an even greater gross liabilities position. Because the United States is roughly half of global capital markets, simple portfolio theory would predict that U.S. liabilities should be roughly 50 percent of rest-of-the-world wealth, not the 37 percent we see today.

While looking at previous episodes offers some useful insights into how a U.S. adjustment might occur, there are several reasons to believe the United States is a special case. The main one is the size of the United States and, thus, the large capital inflows necessary to finance the deficit. In addition, currency management by trade partners, who would suffer from a sharp U.S. adjustment, has limited exchange rate movements. The status of the dollar as the reserve currency also has important implications for adjustment. Finally, the fact that debt is denominated in U.S. dollars makes depreciation less costly to domestic residents.

4.6 Conclusion

We have shown that large deficits are associated with a significant slowdown in income growth though, if anything, they involve less depreciation. We think these facts are related. In countries where exchange movements are limited, either because of managed systems, fixed exchange rates, or key partners fix exchange rates, the current account will deteriorate more than if the exchange rate were flexible. Moreover, because of restricted exchange adjustment, growth will be forced to do much of the work of adjustment. Indeed, there is a very robust inverse correlation between income growth and the total exchange rate adjustment during the recovery.

In contrast, persistent deficits do not lead to a more severe adjustment. Our results suggest that they may be slightly less disruptive in terms of exchange rate movement, with depreciation beginning earlier in the episode and being somewhat more limited. In general, persistent-deficit countries are characterized by a low savings rate.

We also find that deficits driven by investment growth are more benign in terms of exchange rate adjustment than deficits driven by consumption or fiscal spending. This is intuitive as these are the economies where the accrued debt can be more easily serviced. There is only weak evidence that the level of openness reduces the magnitude of exchange adjustment.

On the financing side, we find that the nature of the inflows while the current account deficit is worsening does not impact the outcome. That is, whether the financing of the deficit comes through inflows of equity, direct investment, bonds, or bank deposits has no apparent bearing on the adjustment process, possibly because financial systems in industrial countries intermediate these flows rather well. Finally, the size of the foreign liabilities position seems to be uncorrelated with the adjustment process.

Appendix

Data

Average Exchange Rate Adjustment (–): Average exchange rate adjustment from year 0 to 3, including year 0 exchange rate adjustment. Depreciation is negative.

CA/GDP at Trough: Minimum current account deficit before reversal.

CRISIS: An indicator variable that is one if there was an exchange crisis in that year, as defined by Frankel and Rose (1996).

GDP Growth 3yr/3yr: Three-year average GDP growth after reversal (year 0 to 3) relative to three-year average GDP growth before reversal.

GDP Growth 3yr/LT: Three-year average GDP growth (year 0 to 3) relative to average GDP growth from 1980 to 2003.

Total Exchange Rate Adjustment (–): Total exchange rate adjustment from exchange rate peak to trough between year –3 and 3. A currency depreciation is negative.

CON/GDP Growth: Percentage point growth in consumption in the three years before the reversal.
FIS BAL/GDP Growth: Percentage point growth in the fiscal balance in the three years before the reversal.
INV/GDP Growth: Percentage point growth in investment in the three years before the reversal.
OPENNESS: Average (imports + exports)/GDP in the three years before the reversal.
Preceded by Persistent: An indicator variable that is one if the reversal was preceded by a persistent deficit.
RESOLVE: The percentage point improvement in the current account in three years (year 0 to year 3).
NFA/GDP: Lane and Milesi-Ferretti (2005) data, equals gross assets minus gross liabilities (scaled by GDP). Defined at the trough of the CA balance.
Gross Liabilities/GDP: Lane and Milesi-Ferretti (2005) data, defined at the trough of the CA balance.
Share of Bond Inflows: Bond inflows divided by overall financial account inflows, averaged over years –3 to 0.
Share of DI/Equity Inflows: Direct investment and equity inflows divided by overall financial account inflows, averaged over years –3 to 0.

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Comment Assaf Razin

There are two major channels through which the current account deficits turn into surpluses: the intertemporal budget adjustment channel and the financial adjustment channel. According to the first channel, unsustainable current account deficits need to be reversed eventually in order to satisfy the country's intertemporal budget constraint. The second channel works as follows. Part of the current account adjustment can take place through a change in the returns on domestic assets held by foreigners, relative to foreign assets held by domestic residents. In the presence of stochastic asset returns and interest rates, unexpected capital gains and losses on gross external asset positions could significantly alter the need to run future trade surpluses or deficits.

In the 1990s, a number of papers have assessed current account sustain-

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ability, taking into account a number of other macroeconomic and financial indicators such as the level of saving and investment, the level of the real exchange rate, the burden of external liabilities, the size of short-term debt relative to reserves, and, more generally, financial-sector exposure and vulnerability. (See, e.g., Milesi-Ferretti and Razin 1996, 1998, 2000.) These studies are also related to the more formal literature on early warning indicators that attempt to predict currency crises.

In a similar vein, the present work by Freund and Warnock addresses key side effects of current account reversals in industrialized economies. They find that larger preexisting deficits take longer to adjust and are associated with significantly slower income growth (relative to trend) than smaller deficits during the current account improvement phase. They also find that consumption-driven current account deficits involve significantly larger depreciations than deficits that serve to finance investment spending. They also bring out interesting evidence that economies that run persistent deficits (and, therefore, have large net foreign debt positions) are accommodated by a more pronounced exchange rate adjustment, or slower growth, during the transition to a balanced current account position.

Methodology and Findings

Freund and Warnock characterize deficits by the extent to which they were resolved after three years. Specifically, the variable RESOLVE is defined as the percentage point improvement in the current account GDP ratio from year 0 to year 3. This variable allows them to test whether other factors are correlated with the current account adjustment and also the extent to which the average deficit is improved. That is, a coefficient on CA/GDP at trough of –1 would imply that deficits are fully reversed after three years, whereas a coefficient of –.5 would imply they are 50 percent reversed. Their findings are as follows.

Growth Equation

The regression equation is

$$\begin{aligned}\text{Growth} = {} & a(\text{CAtrough}) + b(\text{Preper}) + c(\text{Predcon}) \\ & + d(\text{Predinv}) + e(\text{Predfis}) + \text{ERROR}.\end{aligned}$$

They find that only the coefficient a is significant.

Depreciation Equation

The regression equation is

$$\begin{aligned}\text{Depreciation} = {} & a(\text{CAtrough}) + b(\text{Preper}) + c(\text{Predcon}) \\ & + d(\text{Predinv}) + e(\text{Predfis}) + \text{ERROR}.\end{aligned}$$

They find that only the coefficients *c* and *e* are significant.

Resolution Equation

The regression equation is

$$\text{Resolve} = a(\text{CAtrough}) + b(\text{Preper}) + c(\text{Predcon}) + d(\text{Predinv}) + e(\text{Predfis}) + \text{ERROR}.$$

They find that only the coefficient *a* is significant.

Consumption and Investment Growth Rates

The correlations in table 4.4 imply that deficits driven by consumption growth involve significantly more depreciation in years 0 to 3. Similarly, deterioration in the fiscal balance increases depreciation, though the coefficient is not significant at standard levels. Consumption driven deficits are also associated with an increase in relative GDP growth. Deficits driven by investment growth are associated with significantly slower income growth during recovery and significantly less depreciation than other episodes.

Large Indebtedness to the Rest of the World

Freund and Warnock find no evidence that countries with large net debt positions (that is, negative net foreign asset positions) have worse outcomes with respect to their exchange rates, income growth, interest rates, or equity prices. Contrary to the evidence on exchange rate depreciation, there does appear to be a higher incidence of currency crises in countries with more negative net foreign asset positions. The correlation with RESOLVE is negative, indicating that more negative NFA positions are (weakly) associated with greater improvements in the current account balance. The second measure they utilize is the size of the country's gross liabilities to the rest of the world (scaled by GDP). Here the evidence is clearer: larger gross liabilities positions do not appear to be associated with significantly worse outcomes.

A caveat in the analysis is that it does not address the issue of heterogeneity across countries, especially as regards policy credibility. What is at stake here is the possibility that self-selectivity be the main determinant in the regression: when the probability of current account deficit is high (the current account trough variable), the country's macroeconomic policy credibility is low. At the same time policy credibility affect the future resolution of the current account imbalance (the RESOLVE variable). Controlling for country fixed effects or including instrumented macropolicy variables are ways to address this self-selection issue.

Identifying Alternative Mechanisms

Freund and Warnock have essentially only a first-pass look at the analysis of current account reversals. They are not able to identify specific mechanisms that are underlying the current account adjustment process. Here is a list of key mechanisms behind current account adjustments.

Return Differentials across Assets and Liabilities

Lane and Milesi-Ferretti (2004, 2005) and Gourinchas and Rey (chap. 1 in this volume) document that a given rate-of-return differential between assets and liabilities exerts a larger effect on the dynamics of the net position when the volume of gross external portfolios grows. This has been indeed the trend particularly during the past decade. The relative importance of direct investment and portfolio equity investment in international portfolios has increased, and those financial instruments have on average higher and more volatile returns than debt instruments.

Resource Transfer through Depreciation

Almost all of U.S. foreign liabilities are in dollars, where 70 percent of U.S. foreign assets are in foreign currencies. Gian Maria Milesi-Ferretti and Phillip Lane (2004, 2005) calculate that between 2002 and 2004, more than 75 percent of the increase in America's net foreign indebtedness caused by the current account deficit was offset by changes in the value of external assets and liabilities as a result of the dollar's fall. Thus a big external deficit does not necessarily imply a commensurate rise in net indebtedness to foreigners.

Exchange Rate Regimes and Sudden Stops

The heterogeneity of exchange rate regimes in the sample used by Freund and Warnock has not been adequately exploited in their analysis. Financial crises theory suggests that the way expectations by market participants are coordinated may trigger a financial crisis in a situation characterized by a latent threshold state of the economy. A financial crisis occurs if the latent variable is below a certain threshold. Above the threshold, financial crises are avoided, and the economic performance is strong. The estimated probability of sudden stops proxies the latent threshold state variable. (See Razin and Rubinstein 2005.) There are good reasons to expect that the crisis threshold is also directly affected by the policy regime itself. For example, a peg is expected to lower the crisis threshold, and thus increase the crisis probability, for any given combination of country-specific and world economy shocks. Likewise, capital market liberalization tends to raise the crisis probability. In other words, the adoption of a peg is expected to have a direct positive effect on growth, through the trade

Table 4C.1 **The effect of sudden stop crisis and dollarization (foreign liabilities – money supply ratio) on growth**

Variable	(1)	(2)	(3)
Foreign Liabilities – Money Supply Ratio (FLM)	0.001	–0.001	0.000
	(0.042)	(0.042)	(0.042)
Sudden Stop Crisis	–0.881	–0.781	–0.250
	(0.384)	(0.378)	(0.431)
Growth at $t-1$		0.173	0.172
		(0.021)	(0.021)
Interaction			
Sudden Stop Crisis · FLM			–2.384
			(0.931)
Country fixed effect	Yes	Yes	Yes
No. of observations	2,228	2,228	2,228

Table 4C.2 **The effect of sudden stop crisis on dollarization (foreign liabilities – money supply ratio)**

Variable	(1)	(2)	(3)
Crisis at $t-2$	–0.034		–0.034
	(0.020)		(0.020)
Peg at time $t-2$	0.042		0.010
	(0.024)		(0.028)
Capital controls at $t-2$	–0.013		–0.009
	(0.028)		(0.028)
The probability of having currency crisis this year^		–0.200	–0.176
		(0.070)	(0.083)
Country fixed effect	Yes	Yes	Yes
No. of observations	1,176	1,176	1,176

adjustment channel, and an indirect negative effect, through a crisis-probability channel. Similarly, the adoption of capital account liberalization is expected to have a direct positive effect on growth, through capital market efficiency channels, and an indirect negative effect, through a crisis-probability channel.

Debt Dollarization

Razin and Rubinstein (2006) bring out evidence for the role of balance sheets in sudden-stop episodes. They use the ratio of the country's foreign currency liabilities to its money supply (FLM) as a proxy for the country's foreign currency exposure to fluctuations in the real exchange rate. Table 4C.1 provides estimates of the influence of a policy-regime switch on debt polarization. Column (1) indicates that the policy regimes (a switch to peg, and the imposition of capital controls) do not have a direct effect on polarization. Column (2) indicates a significant effect of the crisis probability, as a single explanatory variable, on polarization. Column (3) indicates that policy regimes do not directly affect polarization, but only indirectly affect polarization through the probability of sudden stops. Table 4C.2 demonstrates how debt polarization influences growth. Columns (1) and (2) of table 4C.2 indicate that the polarization measure (FLM) does not have direct influence on growth, once one controls for the actual realization of sudden stop crises. A crisis, as expected, reduces growth in a significant way. In column (3) of table 4C.2, the *interaction* between polarization and the realized sudden stops is added. The coefficient of the interaction term is negative and highly significant. This means that although polarization does not have an independent influence on growth, the interaction between polarization and sudden stops tends to reduce the growth rate drastically.

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5

Are There Thresholds of Current Account Adjustment in the G7?

Richard H. Clarida, Manuela Goretti, and Mark P. Taylor

5.1 Introduction

The sustainability and adjustment of current account imbalances among the world's major industrialized countries is a subject that is receiving considerable attention among policymakers, financial market practitioners, and academics. At more than $600 billion and nearly 6 percent of U.S. gross domestic product (GDP), the U.S. current account deficit attracts the most focus, but there are also material current account imbalances in other deficit countries, such as the United Kingdom, and in surplus countries, such as Japan and Germany.

Some respected experts have expressed concern that current account imbalances of this magnitude and persistence indicate that the global economy is operating in a danger zone in which disruptive and volatile reactions in currency, bond, and equity markets are likely to result. For example, C. Fred Bergsten (2002, 5) has argued that "research at both the Federal Reserve Board and the Institute for International Economics reveals that industrial countries, including the United States, enter a danger zone of current account unsustainability when their deficits reach 4–5 percent of GDP. . . . At these levels, corrective forces tend to arise either sponta-

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neously from market forces or by policy action." Other observers have made a similar point, arguing that there is a threshold current account imbalance beyond which current account adjustment must ultimately take place, even if evidence of adjustment is scarce or nonexistent before the threshold is reached. This point of view is represented clearly in a recent survey paper on this subject prepared by the Federal Reserve Bank of Kansas City (Holman 2001):

> While there is considerable uncertainty about the precise threshold . . . a current account deficit greater than 4.2 percent of GDP is unsustainable. This estimate, based on the 1980s and early 1990s, represents the average threshold at which current account deficits in several industrialized economies started to narrow after trending up for a sustained period. (16)

Existing empirical work on this subject is suggestive but is not in fact specifically aimed at answering the question, Are there thresholds of current account adjustment? or exploring its implications. Influential papers by Milesi-Ferretti and Razin (1998) and Freund (2000) employ a careful and informative methodology to pull together a set of empirical regularities about how adjustments of large current account deficits have taken place in previous episodes that meet certain ex ante criteria. For example, in order for a current account deficit adjustment episode (called a *reversal*) to be included in the Freund sample, it must meet the following four criteria:

1. The current account deficit exceeded 2 percent of GDP before the reversal.
2. The average deficit was reduced by at least 2 percent of GDP over three years (from the minimum to the three-year average).
3. The maximum deficit in the five years after the reversal was not larger than the minimum deficit in the three years before the reversal.
4. The current account was reduced by at least one-third.

These are very similar to the criteria introduced by Milesi-Ferretti and Razin (1998) in their study. Their motivation for focusing on the adjustment of large current account deficits that meet these criteria is explained as follows:

> In the definition of reversal events we want to capture large and persistent improvements in the current account imbalance, that go beyond short-run current account fluctuations as a result of consumption smoothing. The underlying idea is that "large" events provide more information on determinants of reductions in current account deficits than short run fluctuations. (12)

The work of Milesi-Ferretti and Razin (1998), Freund (2000) and—using a somewhat different methodology—Mann (2002) has had an impact on the way that policymakers discuss current account adjustment, especially in the context of the record U.S. deficits recorded in recent years. For example, Federal Reserve Chairman Greenspan (2003), citing Freund's work has said:

> [W]hat do we know about whether the process of reining in our current account deficit will be benign to the economies of the United States and the world? According to a Federal Reserve staff study, current account deficits that emerged among developed countries since 1980 have risen as high as double-digit percentages of GDP before markets enforced a reversal. The median high has been about 5 percent of GDP.

While much can be and has been learned by studying past episodes of adjustment of large current account deficits (as defined by the criteria used by Milesi-Ferretti and Razin [1998] and Freund [2000]), there remains a number of unresolved empirical questions pertaining to the modeling, estimation, and interpretation of the current adjustment process among the large industrialized countries. These questions include the following:

- Does the process of adjusting to current account deficits differ from the process of adjusting to current account surpluses? (*Does sign matter?*)
- Does the process of adjusting to large current account imbalances differ from the process of adjusting to smaller current imbalances? (*Does size matter?*)
- If so, is there a way to estimate how large is "large," and does this estimate differ from country to country? (*Does one size fit all?*)
- Is the absence of evidence about the adjustment of a large current account imbalance evidence in favor of the sustainability of said large imbalance? (*Is the absence of evidence evidence of sustainability?*)

It is the aim of this paper to provide an empirical framework that can be used to begin to answer questions such as these. We will argue that, for any particular country, all four of these issues are, in fact, intrinsically related to one another and to the specification of the econometric model that best describes that country's current account dynamics. If the current account, suitably scaled by net output (GDP net of investment and government purchases), is a linear, stationary stochastic process with a constant unconditional mean, as is often assumed in empirical work, then the answers to these four questions are straightforward: no, no, moot, and yes.

An immediate implication of stationarity is that any current account or net output ratio not equal to the unconditional mean is unsustainable by the definition of a stationary stochastic process. This applies to surpluses as well as deficits. However, as an empirical matter, the dynamic process by which the current account adjusts to its unconditional mean depends crucially on whether the process is linear or nonlinear. In particular, if the process is linear, adjustment is symmetric above and below the long-run equilibrium, and the speed of adjustment is independent of the magnitude of the displacement from long-run equilibrium (the unconditional mean). For a linear, stationary current account-net output process, there is nothing to be gained by just focusing on the adjustment of current account deficits and excluding the data on adjustment to surpluses (all relative to the unconditional mean current account to net output ratio which may be either positive or negative). Moreover, there is no reason to focus on the adjustment to large deficits as providing different or more information than episodes of adjustment to small deficits (relative to the unconditional mean) as all episodes provide the same information. Finally, as should be obvious by now, for a linear stationary stochastic process, there is no particular threshold beyond which markets or shifts in policy force a reversal and below which adjustment is absent.

By contrast, if the stationary stochastic process that governs the current account adjustment to its long mean is nonlinear, then both the "sign" and "size" of the current account imbalance *do* matter for the adjustment process, and the size of the current account imbalance beyond which adjustment takes place may well be country specific (as alluded to by Chairman Greenspan and as is suggested by the empirical work cited previously). Finally, if the stationary stochastic process is nonlinear, absence of evidence of adjustment of a large current account imbalance is not evidence of the absence of the ultimate adjustment of the imbalance.

There is a tractable and testable nonlinear time series model that conveniently exhibits all of the features of the current account adjustment process that have been the focus of recent discussions and that nests as a special case the linear stationary stochastic process model for the current account that is often assumed in empirical work. It is the threshold autoregression model introduced in Tong (1978) and studied extensively by Hansen (1996, 1999a,b). For a stationary stochastic threshold model with mean μ and thresholds $\underline{\delta}$ and $\overline{\delta}$, there is no tendency for ca = current account/net output – μ to adjust to its mean of 0 unless it has crossed either the threshold $\underline{\delta}$ or the threshold $\overline{\delta}$. In the regime with $\underline{\delta} < \text{ca} < \overline{\delta}$, deficits or surpluses (relative to μ) persist, and there is no tendency for imbalances to revert. However, the absence of evidence of mean reversion in this regime is not evidence that deficits or surpluses relative to μ are sustainable as, by stationarity, the only sustainable current account imbalance is equal to the unconditional mean.

In a threshold model, a necessary condition for adjustment to commence is for ca to cross either the deficit threshold $\underline{\delta}$ or the surplus threshold $\overline{\delta}$, parameters that can be estimated from the data, not imposed ex ante. In the deficit adjustment regime, $\text{ca} < \underline{\delta}$, and $\text{ca}_t = \underline{\rho}\text{ca}_{t-1} + \varepsilon_t$. Adjustment continues until ca reaches $\underline{\delta}$ at which point any further adjustment is driven by shocks to ε_t. In the surplus regime adjustment regime, ca > $\bar{\delta}$, and $ca_t = \bar{\rho}ca_{t-1} + \varepsilon_t$. Adjustment continues until ca reaches $\bar{\delta}$ at which point any further adjustment is driven by shocks to ε_t. Evidently, in a threshold model, the sign and size of the ca imbalance can matter, thresholds can differ across countries, and the absence of evidence of adjustment is not the evidence of absence of future adjustment of the ca imbalance.

The plan of the paper is as follows. In section 5.2, we review some basic empirical predictions of the modern workhorse model of the current account, the rational expectations, intertemporal approach model developed in Sachs (1981, 1982), estimated by Sheffrin and Woo (1990), and recently extended by Kano (2003). The basic prediction of this model, once one allows for permanent shocks to the level of net output as in Campbell and Deaton (1989), is that the ratio of the current account to net output (GDP less investment less government purchases) should be a stationary stochastic process with an unconditional mean determined by the relationship between the real interest rate and the per capita rate of growth. We also argue that a general equilibrium, two-country version of the Weil (1989) infinite horizon, overlapping generations model of the current account—a model in which the global real interest rate and the net foreign asset or liability position of each country is endogenously determined—also has the prediction that the current account to net output ratio is constant in steady state and determined by underlying parameters such as rates of time preference, the steady-state rate of global growth, and the relative size of the two countries. In our paper, we will follow most of the empirical work in this area and take the stationarity of the current account to net output ratio as given. The question at the heart of the present paper is whether the stationary stochastic process that describes the current account to net output ratio in the G7 countries features linear or nonlinear adjustment to the unconditional mean. We conclude section 5.2 by presenting, for each G7 country, the results of a nonparametric statistical test of the null hypothesis of a linear adjustment of the current account to net output ratio against the alternative of nonlinear adjustment, using quarterly data for the sample 1979:1 to 2003:3. This is an application of a test for nonlinearity developed by Terasvirta (1994). For the G7 countries in our sample, we find statistically significant evidence against the null of linear adjustment of the current account to net output ratio and in favor of the alternative of nonlinear adjustment.

In section 5.3 of the paper, we estimate for each G7 country a threshold autoregressive model of the current account to net output ratio, allowing for country-specific thresholds of current account surplus and deficit adjustment in each country (as suggested, for example, by Chairman Greenspan's comments) and also allowing for country specific means for the ratio of the current account to net output (as suggested, for example, by the general equilibrium version of the Weil model reviewed in section 5.2). Our main findings in this section are as follows. For most of the G7 countries, we find significant evidence of threshold effects in current account adjustment. We also find that we cannot reject the null hypothesis of a random walk for the current account imbalance in each country when that ratio does not exceed (in absolute value) the country-specific surplus and deficit thresholds (relative to the country specific mean) estimated for that country. For most of the G7 countries, unless the current account imbalance is too large—as suggested by Milesi-Ferretti and Razin (1998)—there does not appear to be a systematic tendency for adjustment to occur. A further advantage of our approach is that we can estimate from the data how large a current imbalance has to be before this imbalance triggers an adjustment, and we can allow these estimated thresholds to differ across countries. In fact, we find substantial cross-country variation in the surplus and deficit thresholds that trigger current account adjustment in each country. We also find evidence of cross-country and cross-regime variation in the autoregressive dynamics estimated during adjustment regimes for each country.

In section 5.4, we investigate what happens to the probability distributions of nominal exchange rate changes, stock price index changes, and long-term interest rate differentials during the various current account adjustment regimes that we estimate for each country in section 5.3. The motivation is to determine whether crossing the current account adjustment threshold is itself associated with shifts in the probability distributions for exchange rates, stock prices, and interest differentials. We specifically account for—and allow for current account regime-specific shifts in—autoregressive conditional heteroscedasticity as well as for shifts in the mean by estimating generalized autoregressive conditionally heteroskedastic (GARCH) models for nominal exchange rate changes, stock prices changes, and interest differentials. We also in this section explore, for the United States, whether the expectation of a future adjustment in the current account imbalance is associated with a present shift in the probability distribution of exchange rates, stock prices, or interest differentials. We proxy this by including in the GARCH models two dummy variables (one for deficits and one for surpluses) that represent the distance between the current account imbalance and its country-specific mean when the imbalance is between the thresholds.

In section 5.5, we draw on our empirical results to take stock of the present U.S. current account deficit. Our empirical results indicate that compared to other G7 countries, the United States over our sample exhibited relatively wide thresholds within which current account adjustment is absent and relatively slow speeds of adjustment once these thresholds, especially the deficit threshold, are crossed. Moreover, the present U.S. current account deficit substantially exceeds—and has for some time—our estimated thresholds of current account deficit adjustment for the United States. We explore several possible explanations. The first is that the threshold model, while a useful description of current account adjustment for other G7 countries, does not apply to the United States and that the present deficit of nearly 6 percent of GDP is, in fact, sustainable. The second explanation is that there are thresholds of current account adjustment for the United States, but that adjustment has been delayed over the past several years, due to unusual circumstances that were not in evidence during the sample over which the models were estimated, 1979 to 2003. These circumstances could include (a) the low level of global real interest rates (which support higher levels of investment and lower levels of saving in the United States than would be the case with historically average or above average real interest rates); (b) the more muted and less uniform decline in the dollar than occurred, for example, during the 1985 to 1987 Plaza-Louvre episode (reflecting the intervention activities of Asian central banks); (c) the fact that the United States continues to run a substantial surplus in dividends, interest, and profits on its stock of foreign assets compared with the dividends, interest, and profits that it pays out on its much larger stock of foreign liabilities; and (d) the adjustment in the net foreign liability position of the United States that occurs as a result of dollar depreciation (which in 2003 offset almost 80 percent of that year's current account deficit). We review and evaluate these potential explanations for the absence of adjustment to date in the U.S. current account deficit even though it has passed well beyond thresholds that would have triggered adjustments in other G7 countries.

Section 5.6 provides some concluding remarks.

5.2 A Test for Nonlinear Current Account Adjustment

5.2.1 Theoretical Considerations

In our empirical work, we shall be modeling the dynamics of G7 current account adjustment. However, it is important to take a stand as to exactly what it is to which G7 current account imbalances are adjusting. In this paper, we draw on the implications for long-run current account equilibrium of the workhorse intertemporal model of the current account (Sachs 1981; Sheffrin and Woo 1990, via Campbell 1987). This model can be written $\mathrm{CA}_t = -E_t\,\Sigma(1 + r)^{-i}\Delta Z_{t+i}$, where $Z_t = Y_t - I_t - G_t$ is the level of net output. The intertemporal approach models have been estimated and tested many times, and their high frequency implications—that current account dynamics are fully described by the discounted sum of future changes in net output—are usually rejected. However, we argue that the intertemporal model, properly specified to allow for stationarity in long-run growth rates, contains an important insight about the long-run behavior of the current account. It would seem preferable to model $\Delta \log Z_t = \Delta z_t$ as stationary. Following Campbell and Deaton (1989), it is straightforward to show (Kano 2003) that the log-linear approximation of the intertemporal approach model is given by $CA_t/Z_t \approx E_t \Sigma(1 + r - g)^{-i}\Delta z_{t+i}$, where g is the unconditional mean of Δz_t. Note that if the log difference of net output is stationary, it is the current account to net output *ratio* that is stationary, not simply the current account itself. This seems like a more sensible long-run equilibrium condition than to assume that the current account itself is stationary.

The intertemporal approach model is partial equilibrium and is usually studied for the special case in which r is equal to the rate of time preference. However, the basic prediction of that model—that the ratio CA/Z is constant in the long run—also holds in the steady state of a two-country version of Weil's (1989) infinite horizon overlapping generations model. As shown in Obstfeld and Rogoff (1994, 188), the Weil model with discount factor β implies that the steady-state current account to net output ratio is constant and given by $CA/Z = (n + g)\theta$, where n is the rate of population growth, g is the rate of net output growth, and θ is the endogenous ratio of net foreign assets to net output given by the solution to $\theta[1 - (1 + r)\beta/(1 + n)(1 + g)] = [(1 + r)\beta - (1 + g)]/(1 + n)(1 + g)(r - g)$. Now imagine two such economies trading goods and bonds with one another that differ in two respects: size and the discount factor. Let $\beta_1 < \beta_2$, and suppose that country 2 is larger than country 1. It is easy to show that in the steady state of a two-country version of the Weil model, the β_1 smaller country will run a steady state current account to net output deficit and the larger, more patient β_2 country will run a steady-state current account to net output surplus. Based on these considerations, we shall assume that for each G7 country, the ratio CA/Z is stationary and allow for country-specific means in the CA/Z ratio.

5.2.2 Testing for Nonlinearities in G7 Current Account Adjustment

This paper is an empirical study of G7 current account adjustment, based on quarterly data for the period 1979:1 to 2003:3 (the data available when we began our study in the fall of 2003). We choose our starting date to begin six years after the advent of floating exchange rates and the initial globalization of the international capital market that occurred at that time and in conjunction with the first oil shock. The data in the analysis are obtained from the International Financial Statistics Database by the International Monetary Fund (IMF). All variables are seasonally adjusted and expressed in national currency. According to national account statistics, the current account variable is estimated as the sum of net exports and net primary income from abroad (NPIA); net output is obtained by subtracting government consumption expenditure and gross fixed capital formation (investment) to GDP.

Table 5.1

Country	Terasvirta linearity tests (marginal significance level)
Canada	0.369
France	0.029
Germany	0.035
Italy	0.136
Japan	0.027
United Kingdom	0.184
United States	0.069

We test for nonlinearity in G7 current account or net output adjustment following the nonparametric test for nonlinearity developed by Luukkonen, Saikkonen, and Terasvirta (1988) and Terasvirta (1994). These authors propose a Lagrange Multiplier test for a third-order Taylor approximation to the regression function of the form $\text{ca}_t = \beta_{00} + \Sigma_{i=1}^{P}(\beta_{1i}\text{ca}_{t-1} + \beta_{2i}\text{ca}_{t-i}\text{ca}_{t-d} + \beta_{3i}\text{ca}_{t-i}\text{ca}_{\text{t-d}}^2 + \beta_{4i}\text{ca}_{t-i}\text{ca}_{\text{t-d}}^3) + \varepsilon_t$. This artificial regression allows to identify general nonlinearity through the significance of the higher order terms. The main advantage of this type of test is that it can be carried out by simple ordinary least squares (OLS) and that—despite being designed for smooth transition regressions—is sensitive to a wide range of nonlinearities (Granger and Terasvirta 1993) although there is reason to suspect that the power of the test may be weak against some nonlinear alternatives. The results of this test are reported in table 5.1.

Hence, evidence of nonlinear adjustment is indicated at the 5-percent significance level for France, Germany and Japan and at the 7-percent level for the United States.

Using the multivariate bootstrap test procedure developed by Hansen (1997), the null hypothesis of linear adjustment in all countries is rejected at the 14-percent level. Given the possibly poor power characteristics of these tests, therefore, we felt encouraged to investigate the estimation of nonlinear models more directly.

5.3 Estimating and Testing Thresholds Models of G7 Current Account Adjustment

In this section of the paper, we estimate and test for each G7 country a threshold autoregression model of the current account to net output ratio using the univariate approach developed in Hansen (1996). We allow for and estimate country-specific means, country- and regime-specific thresholds, and country- and regime-specific dynamic adjustment once the current account has crossed either of the thresholds. Letting $\text{ca} = \text{CA}/Z - \mu$, we write the equilibrium threshold autoregressive (TAR) model as

$$\text{(1)} \qquad \text{ca}_t = \overline{\rho} \times 1(\text{ca}_{t-d}, \overline{\delta}) \times \text{ca}_{t-1} + \underline{\rho} \times 1(\text{ca}_{t-d}, \underline{\delta}) \times \text{ca}_{t-1} + [1 - 1(\text{ca}_{t-d}, \overline{\delta})] \times [1 - 1(\text{ca}_{t-d}, \underline{\delta})] \times \text{ca}_{t-1} + e_t,$$

where $1(\text{ca}_{t-d}, \underline{\delta})$ is an indicator function that takes on a value of 1 when $\text{ca}_{t-d} > \overline{\delta} \geq 0$ (and zero otherwise), and $1(\text{ca}_{t-d}, \underline{\delta})$ is an indicator function that takes on a value of 1 when $\text{ca}_{t-d} < \underline{\delta} \leq 0$ (and zero otherwise). This approach postulates that the persistence of the current account imbalance in a country may depend upon whether the current account imbalance has crossed a surplus threshold of $\overline{\delta} \geq 0$ or a deficit threshold of $\underline{\delta} \leq 0$. We note that a special case of the threshold model is the case in which $\overline{\delta} = \underline{\delta} = 0$ and $\overline{\rho} = \underline{\rho} < 1$, in which case it collapses to a linear stationary AR(1) process. We experimented with a threshold TAR(2) specification but found in general the second lag terms to be insignificant and thus confine our presentation to the TAR(1) models. We also select a delay parameter d of two quarters as this maximizes the fit of the regression in each case.

The threshold model can potentially identify three regimes of current account adjustment: a surplus adjustment regime; a deficit adjustment regime; and an inertia regime $\overline{\delta} < \text{ca}_{t-2} < \underline{\delta}$, in which the current account appears to follow a random walk. In a more general, smooth threshold transition autoregressive (STAR) model (e.g., Taylor, Peel, and Sarno 2001), the speed of adjustment does not increase discontinuously at the threshold; rather, the further way is the current account to GDP ratio from its long-run mean, the faster the current account imbalance adjusts. Interestingly, when we experimented with estimating smooth transmission models, we found they did not capture G7 current account dynamics in a sensible way. As we shall report next, there does in fact appear to be important, discrete threshold effects that influence current account adjustment.

Before presenting the results, we will discuss some issues involved in the estimation and testing of these models for a system comprised of the G7 countries. The ca variables for the G7 group are first demeaned, in order to allow for the existence of long-run deficit or surplus means for each country rather than a zero ca balance. A nonzero mean proves to be applicable for all G7 countries, with the single exception of Italy. In particular, we detect a structural break in the German series in 1991, corresponding with the German unification and the resulting change in the country national accounts; we account for the break by allowing two different means in the current account for the pre- and postunification periods.

The two asymmetric thresholds in the TAR model are selected jointly by minimization of the overall sum of squared errors. The estimation method involves a double grid search over ca. Following Hansen (1997), the range for the grid search is selected a priori to contain ca observations in between the 15th ($\underline{\text{ca}}$) and the 85th percentile ($\overline{\text{ca}}$). This reduction in the grid range is needed in order to avoid sorting too few observations in one regime for extreme values of the thresholds. As a result, the appropriate ranges are defined as $\overline{R} = [\mu, \overline{\text{ca}}]$ and $\underline{R} = [\mu, \underline{\text{ca}}]$, for $\overline{\delta}$ and $\underline{\delta}$ respectively.

As the minimization process for a three-regime or two-threshold TAR process is numerically intensive, we rely on the estimation methodology proposed by Hansen (1999a) for multiple thresholds. This consists of a three-stage grid search, where the second-stage estimation of the two-threshold model is made conditional on the first-stage, single-threshold estimate of δ (either $\overline{\delta}$ or $\underline{\delta}$), the third stage being used as a refinement.

Furthermore, final estimates of slope parameters and standard errors for the G7 group of countries are obtained by seemingly unrelated regression (SUR) estimation, in order to allow for potential correlation between the disturbances of the different ca equations due to common unobservable factors.

Once the thresholds have been selected, according to standard asymptotic theory, (1) is linear in the parameters. As with any simple dummy-variable regression, it can be estimated by linear methods. However, statistical inference in a TAR model bears the difficulty that the thresholds $\overline{\delta}$ and $\underline{\delta}$ may not be identified under the null hypothesis in question (Davies 1987). In this case, the usual chi-square distribution needs to be replaced by an approximated empirical distribution obtained by bootstrapping the residuals (Hansen 1997). In particular, artificial observations are calibrated using the restricted estimates and are then used to obtain new estimates of the restricted and unrestricted model (for an application, see Peel and Taylor 2002). The percentage of bootstrap samples—we run 1000 replications—for which the simulated likelihood-ratio statistics exceed the actual one forms the bootstrap approximation to the p-value of the test statistic under question.

The estimation and testing results are presented in table 5.2. First, the test results: when we test the null hypothesis a single threshold for all countries versus the alternative hypothesis of two thresholds, we reject the null hypothesis in favor of the alternative. This is consistent with three regimes for each country—a surplus adjustment regime, a deficit adjustment regime, and an inertia (absence of adjustment) regime. Second, when we test the hypothesis that the current account follows a random walk inside the inertia regime against the alternative that it follows a mean reverting autoregressive process inside the inertia regime (a more general formulation of the threshold model), we are unable to reject the null of a random walk inside the inertia regime. In summary, the statistical tests find evidence of nonlinear current account adjustment and also identify significant thresholds beyond which current account adjustment takes place.

We now discuss the parameter estimates for the threshold models estimated for each G7 country. To repeat, these estimates allow for country-specific means, country- and regime-specific thresholds, and country- and regime-specific autoregressive dynamics. A number of interesting results

Table 5.2 Threshold models of de-meaned CA/NO (Q1:1979–Q3:2003)

	Thresholds (asymmetric band)		Slope coefficients (estimation by SUR)			Means	
Country	Upper threshold	Lower threshold	Above	Band	Below	Surplus	Deficit
Canada	1.41	–4.05	0.927	1.000	0.930		–1.792
			(0.048)		(0.060)		
France	2.13	–1.13	0.931	1.000	0.910	1.646	
			(0.048)		(0.045)		
Germany	2.84	0.00	0.880	1.000	0.827	6.185	Pre-1991
			(0.070)		(0.064)	1.496	Post-1991
Italy	0.00	–0.37	0.944	1.000	0.867		–0.269
			(0.058)		(0.059)		
Japan	0.84	–0.18	0.908	1.000	0.894	3.951	
			(0.058)		(0.037)		
United Kingdom	1.08	0.00	0.777	1.000	0.929		–1.764
			(0.073)		(0.064)		
United States	2.15	–2.18	0.907	1.000	0.973		–2.011
			(0.039)		(0.034)		

Note: Bootstrap: LR-test for band coefficient equal to 1 (SUR): marginal significance level = 0.520; LR-test for single threshold (SUR): marginal significance level = 0.004. Standard errors are in parentheses.

are obtained. First, as suggested by Greenspan's comment cited previously, we see there is wide cross-country variation in the estimated current account deficit adjustment thresholds. For example, the estimated deficit adjustment threshold for the United States is –2.18 percent of net output, while for Japan it is only –0.18 percent of net output. This means that empirically, there is no evidence from these estimates of systematic adjustment in the U.S. current account deficit until the deficit exceeds –4.19 percent of net output (equal to the mean of –2.01 plus the threshold of –2.18), while for Japan, adjustment begins to take place when the surplus falls below 3.77 percent of net output (equal to the mean of 3.95 plus the deficit threshold of –0.18). We estimate a similar pattern for the other structural surplus countries, France and Germany. For France, we estimate that adjustment begins to take place once the surplus falls below 0.51 percent of net output; for Germany adjustment begins to take place once the surplus falls below the mean of 6.19 before unification and 1.19 percent after unification. Second, we see that for most G7 countries, there are thresholds of adjustment to current account surpluses as well as for current account deficits. Third, we see from table 5.3 substantial cross-country variation in the estimated autoregressive dynamics once countries cross their current account deficit or surplus thresholds. For deficit adjustment episodes, the estimated autoregressive coefficients range from 0.827 for Germany to 0.973 for the United States. For surplus adjustment episodes, the estimated

Table 5.3 Empirical Distribution of Current Account Regimes

	Canada	France	Germany	Italy	Japan	United Kingdom	G6 average	United States
	Percent of sample spent in each regime							
Surplus	34	23	20	51	36	37	34	20
Inertia	48	35	20	3	30	17	25	63
Deficit	18	42	60	46	34	46	41	17
	Adjustment per quarter during adjustment regimes (measured from peak and as percent of net output)							
Surplus	0.687	0.507	1.081	0.467	0.336	0.644	0.620333	0.303
Deficit	0.604	0.246	0.693	0.575	0.361	0.612	0.515167	0.327

Table 5.4 Estimated Half-life of Displacement from Current Account Threshold

	1 percent	2 percent	3 percent
Half-life of displacement from deficit threshold (in quarters)			
Canada	1.14	2.49	3.30
France	2.64	4.08	4.79
Germany	3.65	3.64	3.64
Italy	3.18	3.84	4.13
Japan	4.79	5.48	5.69
United Kingdom	9.41	9.41	9.41
G6 average	4.17	4.82	5.16
United States	6.25	9.99	12.49
Half-life of displacement from surplus threshold (in quarters)			
Canada	3.07	4.58	5.48
France	2.43	3.88	4.84
Germany	1.09	1.81	2.32
Italy	12.03	12.03	12.03
Japan	3.29	4.50	5.13
United Kingdom	1.09	1.56	1.82
G6 average	3.83	4.72	5.27
United States	1.77	2.82	3.53

autoregressive coefficients range from 0.777 in the United Kingdom to 0.944 in Italy.

In the top panel of table 5.4, we compute the half life of 1, 2, and 3 percent of net output displacements of the current account imbalance from the deficit threshold. In our equilibrium threshold model, the speed of adjustment to a given displacement from the deficit (or surplus) threshold is a function of the distance between the imbalances and the unconditional mean, not just to the threshold itself (as for example would be the case for a so-called band threshold model). As is evident from the table, the United States stands out in terms of the slow speed of adjustment to current account deficits, even when it is adjusting. For example, in response to a 2 percent of GDP displacement of the U.S. current account from the estimated deficit threshold of –2.18 percent (to a deficit of –4.18 percent of net output), it takes the United States nearly ten quarters on average to close 1 percentage point of that displacement, whereas for the average G6 country (G7 minus United States), it takes fewer than five quarters to close such a displacement. In the bottom panel of table 5.4, we compute the half life of 1, 2, and 3 percent of net output displacements of the current account imbalance from the upper (surplus) threshold. As before, we estimate substantial cross-country variation in the speeds of adjustment to displacements of the current account away from the adjustment thresholds. Note that the United States actually adjusts faster than the G6 average to current account surpluses.

In table 5.3, we present some summary statistics for the three current account regimes estimated for each G7 country. We see that the average G6 (excluding the United States) country spent only roughly 25 percent of the 1979 to 2003 sample in the inertia regime and thus spent 75 percent of the sample adjusting to either current account surpluses (34 percent of the sample) or deficits (41 percent of the sample). Of course, there is cross-country variation, but the G6 country spending the maximum time in the inertia regime was Canada, which spent 48 percent of sample in the inertia regime. The United States, by contrast, spent a full 63 percent of the sample in the inertia regime, and only 17 percent of the sample adjusting to current account deficits, and 20 percent of the time adjusting to current account surpluses. The bottom panel of table 5.3 reports, for each country, the average adjustment per quarter that actually occurred during the sample (as a percentage of net output) when that country was estimated to be in a deficit adjustment regime or a surplus adjustment regime. These adjustments are measured from the peak current account imbalance reached during the adjustment episode to the level reached when the adjustment regime concludes. Thus, for the average G6 country, once current account deficits (relative to mean) peak and begin to contract, they adjust at an average rate of 0.51 percent of net output per quarter (2 percent of net output per year) until adjustment concludes with the current account imbalance crossing the deficit adjustment threshold. The table also shows that for the G6, on average, once current account surpluses peak and begin to contract, they adjust at an even faster average rate 0.62 percent of net output per quarter (2.4 percent of net output per year) until adjustment concludes with the current account imbalance crossing the surplus adjustment threshold. Evidently, adjustment of current account imbalances in the U.S. data is much more sluggish than the G6 average, with the U.S. current account imbalance falling by roughly 0.3 percent of net output during each quarter (1.2 percent per year) that the United States is in an adjustment regime.

To summarize the results of this section, having tested and found evidence of nonlinearity in G7 current account adjustment data, we estimated for each G7 country a threshold autoregressive model that allows for asymmetric, country-specific thresholds, country-specific means, and regime- and country-specific speeds of adjustment. We find evidence in favor of deficit as well as surplus thresholds for most countries, as well as evidence of substantial cross-country differences in the amount of time spent in the three different regimes, as well as in the pace at which adjustments occur. Compared with other G7 countries, the United States has large thresholds of current account adjustment, spends relatively little time in adjustment regimes, and adjusts slowly even when in those imbalance adjustment regimes. In the next section of the paper, we explore what happens to the probability distributions of exchange rates, stock prices, and interest rate differentials during current account adjustment regimes in each country.

5.4 Exchange Rates, Stock Prices, and Interest Rates during Current Account Adjustment Regimes

In this section, we investigate what happens to the probability distributions of nominal exchange rate changes, stock price index changes, and long-term interest rate differentials during the various current account adjustment regimes that we estimate for each country in section 5.3. The motivation is to determine whether crossing the current account adjustment threshold is itself associated with shifts in the probability distributions for exchange rates, stock prices, and interest differentials. We specifically account for—and allow for current account regime specific shifts in—autoregressive conditional heteroscedasticity as well as for shifts in the mean by estimating GARCH models for nominal exchange rate changes, stock prices changes, and interest differentials. We also in this section explore, for the United States, whether the expectation of a *future* adjustment in the current account imbalance is associated with a present shift in the probability distribution for exchange rates, stock prices, or interest differentials.

Switching models of exchange rates were introduced in Engel and Hamilton (1990). They hypothesized that the log difference in the nominal exchange rate is a stochastic process with a regime-specific mean and a regime-specific (but constant) variance. In their model, the regimes themselves are unobservable states; the probability that the exchange rate is in a particular regime is inferred from the exchange rate data itself. Our approach is different, but similarly motivated. Having found evidence of three regimes of current account adjustment for each G7 country, we estimate and test whether being in a current account adjustment regime is associated with shifts in the drift and variance of exchange rate changes for that country. We allow for autoregressive conditional heteroscedasticity in exchange rate changes. We estimate similar models for the log difference in stock price changes and for long-term interest rate differentials, allowing for regime specific drifts and variances.

The GARCH models we estimate in this section are of the form

$$\Delta_t = d + d1\text{DUMS}_t + d2\text{DUMD}_t + u_t \tag{2}$$
$$\sigma_t^2 = c + au_{t-1}^2 + b\sigma_{t-1}^2 + c1\text{DUMS}_t + c2\text{DUMD}_t,$$

where DUMD_t is a dummy variable that takes on a value of 1 when a country is in a deficit adjustment regime, DUMS_t is a dummy variable that takes on a value of 1 when a country is in a surplus adjustment regime, σ_t^2 is the conditional variance of u_t, and Δ_t is the log difference in the exchange rate, the log difference in the equity price index, or the interest rate differential (adjusted for first order autocorrelation) observed at a monthly frequency. Thus, in each quarter in which a country is in a particular regime, there will be three observations on the monthly change in the asset price during that quarter. Because Italy and France were part of the European Monetary System (EMS) during most of the sample, the behavior of their exchange rates and interest rates reflected their EMS commitments to stabilize their exchange rates vis-à-vis Germany. We exclude them from the analysis of this section. Estimation is by maximum likelihood. For each country, we report the results for the log (change) in the trade weighted exchange rate, the log (change) in a broad stock market index, and the differential between each country's long-term interest rate and G7 average (adjusted for first order autocorrelation). When significant, we also report the results for key bilateral exchange rates. In what follows "**" indicates significance at the 5 percent level, "*" significance at the 10 percent level, and "†" at the 15 percent level. Data sources are the IFS for long-term interest rates and Bloomberg for exchange rates and stock market indexes. The sample is monthly from 1979:2 to 2003:9 with some exceptions as noted in the following.

5.4.1 Results

U.S. Results

For the U.S. dollar index, we see that the estimated coefficient on the surplus regime dummy is positive, and the estimated coefficient on the deficit regime dummy is negative (table 5.5). This means that the dollar index tends to appreciate during U.S. surplus adjustment regimes and to depreciate during U.S. deficit adjustment regimes, although the coefficients are not measured precisely. For the pound, we estimate a statistically significant shift in the probability distribution of exchange rate changes that coincides with U.S. surplus adjustment regimes, in favor of an appreciation of the dollar relative to the pound. For the Canadian dollar, we estimate a statistically significant shift in the probability distribution of exchange rate

Table 5.5 **Asset prices during U.S. current account adjustment regimes**

U.S. dollar index

$$\Delta_t = -.0004 + \underset{(.0028)}{.0035}\text{DUMS}_t - \underset{(.0025)}{.0028}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0001 - .0325u_{t-1}^2 + .5976\sigma_{t-1}^2 + \underset{(.00003)}{.0002}\text{DUMS}_t - \underset{(.00003)}{.0002}\text{DUMD}_t$$

Pound per dollar

$$\Delta_t = -.0013 + \underset{(.0044)^{**}}{.0101}\text{DUMS}_t - \underset{(.0038)}{.0019}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0002 + .2151u_{t-1}^2 + .6013\sigma_{t-1}^2 + \underset{(.0001)}{.0001}\text{DUMS}_t - \underset{(.00007)}{.0002}\text{DUMD}_t$$

Canadian dollars per U.S. dollar

$$\Delta_t = .0009 + \underset{(.0019)}{.0006}\text{DUMS}_t - \underset{(.0025)^{*}}{.0044}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0002 - .0161u_{t-1}^2 - .5754\sigma_{t-1}^2 + \underset{(.0001)}{.00001}\text{DUMS}_t + \underset{(.00007)^{**}}{.0002}\text{DUMD}_t$$

Equity prices

$$\Delta_t = .0107 - \underset{(.0061)}{.0029}\text{DUMS}_t - \underset{(.0091)^{\dagger}}{.0139}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0014 + .0004u_{t-1}^2 + .0681\sigma_{t-1}^2 + \underset{(.0004)}{.00027}\text{DUMS}_t + \underset{(.0011)^{**}}{.00223}\text{DUMD}_t$$

Long-term interest differentials

$$\Delta_t = .0094 - \underset{(.0304)}{.0154}\text{DUMS}_t - \underset{(.0181)}{.0014}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0002 - .0177u_{t-1}^2 + .9788\sigma_{t-1}^2 + \underset{(.0009)^{**}}{.00305}\text{DUMS}_t + \underset{(.00014)}{.00007}\text{DUMD}_t$$

**Significant at the 5 percent level.
*Significant at the 10 percent level.
†Significant at the 15 percent level.

changes that coincides with U.S. deficit adjustment regimes, in favor of a depreciation of the dollar relative to the Canadian dollar. We also estimate a statistically significant rise in the volatility of the Canadian dollar exchange rate that coincides with U.S. deficit adjustment regimes. For U.S. equity prices, we estimate a significant (at the 12 percent level) fall in equity returns during U.S. current account deficit adjustment regimes. We also estimate a significant rise in equity volatility that occurs during U.S. current account adjustment regimes. For long-term interest rate differentials, we do estimate a significant increase in volatility during U.S. current account surplus adjustment regimes.

Japanese Results

For the yen index, we see that the estimated coefficient on the Japan current account surplus adjustment regime dummy is positive and significant, indicating that the yen index tends to appreciate during Japan's current ac-

Table 5.6 Asset prices during Japan current account adjustment regimes

Yen index

$$\Delta_t = -.0016 + \underset{(.0034)^{**}}{.0093}\text{DUMS}_t + \underset{(.0031)}{.0005}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0006 - .2115u_{t-1}^2 - .2848\sigma_{t-1}^2 + \underset{(.00013)}{.00012}\text{DUMS}_t - \underset{(.00012)}{.00005}\text{DUMD}_t$$

Dollar per yen

$$\Delta_t = .0008 + \underset{(.0050)}{.0066}\text{DUMS}_t - \underset{(.0048)}{.0044}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00001 - .0095u_{t-1}^2 + .9383\sigma_{t-1}^2 + \underset{(.00005)^{**}}{.00012}\text{DUMS}_t + \underset{(.00003)^{**}}{.00008}\text{DUMD}_t$$

Equity prices

$$\Delta_t = -.0031 + \underset{(.0084)}{.0105}\text{DUMS}_t + \underset{(.0076)}{.0093}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0006 + .1245u_{t-1}^2 + .7605\sigma_{t-1}^2 - \underset{(.0003)}{.00017}\text{DUMS}_t - \underset{(.00029)^{\dagger}}{.00044}\text{DUMD}_t$$

Long-term interest differentials

$$\Delta_t = -.1045 - \underset{(.0344)}{.0153}\text{DUMS}_t - \underset{(.0371)^{**}}{.0844}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0049 + .0082u_{t-1}^2 - .1245\sigma_{t-1}^2 + \underset{(.0142)^{**}}{.028796}\text{DUMS}_t + \underset{(.01493)^{**}}{.03240}\text{DUMB}_t$$

**Significant at the 5 percent level.

†Significant at the 15 percent level.

count surplus adjustment regimes (table 5.6). For the dollar-yen exchange rate, we estimate a statistically significant increase in exchange rate volatility during both Japan surplus adjustment regimes and Japan deficit adjustment regimes. We also obtain point estimates that suggest that the yen tends to appreciate relative to the dollar during Japanese current account surplus regimes and to depreciate during Japanese current account deficit adjustment regimes, although these coefficients are not measured precisely. For Japanese equity prices, we estimate a significant fall in equity volatility during Japan current account deficit adjustment regimes. For long-term interest rate differentials, we do estimate a significant increase in volatility during both Japan's current account surplus adjustment regimes and current account deficit adjustment regimes. We also estimate a significant widening in Japanese long-term interest differential (it becomes larger in absolute value) during Japan's current account surplus adjustment regimes as well as a widening during Japan's current account deficit adjustment regimes (although the latter is not significant).

German Results

For the volatility of the deutsche mark (DM) index through 1998:12, we see that the estimated coefficient on the German current account deficit adjustment regime dummy is positive and significant (table 5.7). For the

Table 5.7 **Asset prices during German current account adjustment regimes**

DM index

$$\Delta_t = .0021 - \underset{(.0014)}{.0013}\text{DUMS}_t - \underset{(.0012)}{.0012}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00002 + .0886u_{t-1}^2 + .1619\sigma_{t-1}^2 + \underset{(.00001)}{.00001}\text{DUMS}_t + \underset{(.00001)^{**}}{.00003}\text{DUMD}_t$$

Dollar per DM

$$\Delta_t = -.0058 - \underset{(.0066)}{.0013}\text{DUMS}_t - \underset{(.0053)^{\dagger}}{.0082}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00127 + .0921u_{t-1}^2 - .2801\sigma_{t-1}^2 - \underset{(.0004)}{.00004}\text{DUMS}_t + \underset{(.00031)}{.00008}\text{DUMB}_t$$

Equity prices

$$\Delta_t = .0037 - \underset{(.0144)}{.0025}\text{DUMS}_t + \underset{(.0102)}{.0053}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0015 + .0726u_{t-1}^2 + .7386\sigma_{t-1}^2 - \underset{(.0006)}{.00026}\text{DUMS}_t - \underset{(.00051)^{**}}{.00115}\text{DUMD}_t$$

Long-term interest differentials (1979:1–1990:12)

$$\Delta_t = -.0129 - \underset{(.0481)}{.0282}\text{DUMS}_t - \underset{(.0541)^{**}}{.2147}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0242 + .2351u_{t-1}^2 - .0644\sigma_{t-1}^2 + \underset{(.0122)}{.01303}\text{DUMS}_t + \underset{(.02499)^{\dagger}}{.03635}\text{DUMD}_t$$

Long-term interest differentials (1991:1–1998:12)

$$\Delta_t = .0074 - \underset{(.0927)}{.0619}\text{DUMS}_t - \underset{(.0247)^{\dagger}}{.0358}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = -.0001 + .0804u_{t-1}^2 + .7183\sigma_{t-1}^2 + \underset{(.0152)}{.01583}\text{DUMS}_t + \underset{(.00294)^{\dagger}}{.00455}\text{DUMD}_t$$

**Significant at the 5 percent level.
†Significant at the 15 percent level.

dollar-DM exchange rate estimated through 1998:12, we estimate a statistically significant depreciation of the DM during German current account deficit adjustment regimes. For German equity prices, we estimate a significant fall in equity volatility during German current account deficit adjustment regimes. For long-term interest rate differentials, we do estimate a significant increase in volatility during German current account deficit adjustment regimes. German interest rate differentials increase in absolute value during deficit adjustment regimes before unification and narrow after unification. We split the sample at unification because of an obvious shift in the mean of the interest differential series at that time.

U.K. and Canadian Results

For the Canadian dollar index, we see that the estimated coefficient on the Canadian current account deficit adjustment regime dummy is negative and significant, indicating that the Canadian dollar index tends to depreciate during Canada's current account deficit adjustment regimes (table

Table 5.8 Asset prices during U.K. current account adjustment regimes

Pound index

$$\Delta_t = -.0013 + \underset{(.0029)}{.0012}\text{DUMS}_t + \underset{(.0028)}{.0019}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00011 + .2775u_{t-1}^2 + .5646\sigma_{t-1}^2 - \underset{(.00005)^{\dagger}}{.00007}\text{DUMS}_t - \underset{(.00005)^{*}}{.00008}\text{DUMD}_t$$

Dollar per pound

$$\Delta_t = .0049 - \underset{(.0044)^{**}}{.0093}\text{DUMS}_t - \underset{(.0045)}{.0035}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00024 + .1959u_{t-1}^2 + .5747\sigma_{t-1}^2 - \underset{(.0001)}{.00004}\text{DUMS}_t + \underset{(.0001)}{.00001}\text{DUMD}_t$$

Equity prices

$$\Delta_t = -.0006 + \underset{(.0082)^{**}}{.0185}\text{DUMS}_t + \underset{(.0081)}{.0048}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0040 + .0224u_{t-1}^2 - .8964\sigma_{t-1}^2 - \underset{(.0003)^{**}}{.00084}\text{DUMS}_t + \underset{(.00070)}{.00091}\text{DUMD}_t$$

Long-term interest differentials

$$\Delta_t = .0312 + \underset{(.032)}{.0073}\text{DUMS}_t + \underset{(.028)}{.0177}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00037 + .0461u_{t-1}^2 + .9402\sigma_{t-1}^2 + \underset{(.0018)}{.00048}\text{DUMS}_t - \underset{(.0012)}{.00037}\text{DUMD}_t$$

**Significant at the 5 percent level

*Significant at the 10 percent level.

†Significant at the 15 percent level.

5.8). For the U.S. dollar-Canada exchange rate, we estimate a similar result, but it is not statistically significant. For the United Kingdom, the most noteworthy result is a significant increase in equity returns during current account surplus adjustment regimes, a fall in equity volatility during U.K. current account surplus adjustment regimes, and a rise in equity volatility during U.K. current account deficit adjustment regimes (table 5.9). Because of a break in the U.K. equity price data series at 1984:1, the U.K. equity sample is 1984:1 to 2003:9.

Summary of Results for Section 5.4.1

In this subsection, we have reported evidence of statistically significant shifts in the mean and variance of the probability distribution of several G7 exchange rates, equity prices, and interest rate differentials that occur in conjunction the current account adjustment regimes estimated in section 5.3. Our approach cannot answer the question of which triggers what, but we do find evidence that regimes of current account adjustment do coincide with shifts in the distribution of some important asset prices. The estimates that are significant tend to show exchange rate depreciation during current account deficit regimes and exchange rate appreciation during current account surplus regimes. We also find statistically significant increases

Table 5.9 **Asset prices during Canada current account adjustment regimes**

CAD index

$$\Delta_t = .0002 - \underset{(.0014)}{.0015\text{DUMS}_t} - \underset{(.0017)^{\dagger}}{.0025\text{DUMD}_t} + u_t$$

$$\sigma_t^2 = .00004 + .1961u_{t-1}^2 + .4708\sigma_{t-1}^2 - \underset{(.00001)}{.000002\text{DUMS}_t} + \underset{(.00002)}{.000002\text{DUMD}_t}$$

U.S. dollar per Canadian dollar

$$\Delta_t = .0003 - \underset{(.0014)}{.0018\text{DUMS}_t} - \underset{(.0018)}{.0021\text{DUMD}_t} + u_t$$

$$\sigma_t^2 = .00001 + .0608u_{t-1}^2 + .8727\sigma_{t-1}^2 + \underset{(.00006)}{.00004\text{DUMS}_t} + \underset{(.00005)}{.00002\text{DUMD}_t}$$

Equity prices

$$\Delta_t = .0051 + \underset{(.0067)}{.0030\text{DUMS}_t} - \underset{(.0065)}{.0030\text{DUMD}_t} + u_t$$

$$\sigma_t^2 = .0007 + .0534u_{t-1}^2 + .7576\sigma_{t-1}^2 - \underset{(.0002)^{\dagger}}{.00041\text{DUMS}_t} - \underset{(.00047)}{.00062\text{DUMD}_t}$$

Long-term interest differentials

$$\Delta_t = .1855 - \underset{(.0605)}{.0429\text{DUMS}_t} + \underset{(.0331)}{.0300\text{DUMD}_t} + u_t$$

$$\sigma_t^2 = .0124 + .1002u_{t-1}^2 + .6336\sigma_{t-1}^2 + \underset{(.0033)^{\dagger}}{.05082\text{DUMS}_t} + \underset{(.00396)}{.00013\text{DUMD}_t}$$

†Significant at the 15 percent level.

in exchange rate volatility during current account deficit adjustment regimes for the United States, Japan, and Germany. For equity markets, we estimate that current account deficit adjustment regimes are associated with significantly lower U.S. equity returns and higher U.S. equity volatility, while in the United Kingdom, equity returns are higher during current account surplus adjustment regimes, equity volatility is lower, while U.K. equity volatility is higher during current account deficit adjustment regimes.

5.4.2 Do Expectations of Future U.S. Current Account Adjustment Trigger Adjustment in Present Asset Prices?

We now explore, for the United States, whether the expectation of a *future* adjustment in the current account imbalance is associated with a *present* shift in the probability distribution for exchange rates, stock prices, or interest differentials. As discussed previously, compared with other G7 countries, the United States has wide thresholds of current account adjustment, spends relatively little time in adjustment regimes, and—as shown in table 5.3—adjusts slowly even when in deficit or surplus adjustment regimes. To capture the hypothesis that expectations of future current account adjustment may have an impact on present asset prices, we augment our basic GARCH specification to include two additional dummy variables. Let DUMBD equal one when $-2.18 < \text{ca} < -1$, and let

DUMBS equal one when $1 < \text{ca} < 2.15$. Thus DUMBD equals one when the current account deficit is more than 1 percentage point below its mean but still less (in absolute value) than the deficit threshold, while DUMBD equals one when the current account is more than 1 percentage point above its mean but still less (in absolute value) than the surplus threshold. Our specification becomes

$$(3)\quad \Delta_t = d + d1\text{DUMS}_t + d2\text{DUMD}_t + d3\text{DUMBS}_t + d4\text{DUMBD}_t + u_t$$

$$\sigma_t^2 = c + au_{t-1}^2 + b\sigma_{t-1}^2 + c1\text{DUMS}_t + c2\text{DUMD}_t + c3\text{DUMS}_t + c4\text{DUMBD}_t.$$

In order to focus on significant results, we proceed in two steps. In the first step, we estimate specification (3). In the second step, we drop any dummy variable that in the first-stage estimate is not significant at the 15 percent level or better. The results are reported in table 5.10.

From table 5.10, we see that when current account deficits are large but *before* the United States enters a current account deficit adjustment regime, the dollar index starts to depreciate, at a pace of roughly 7 percent per year. We also see that the volatility of the dollar index is lower when deficits are small but before the United States enters a current account surplus adjustment regime. As for equity prices, the results reported in table 5.5 are robust to the inclusion of the two additional dummy variables. We continue to find a significant negative effect of current account deficit adjustment regimes on equity returns and a significant positive effect on equity volatility. Interestingly, we also find that equity volatility is lower when

Table 5.10 **Asset prices before and during U.S. current account adjustment regimes**

U.S. dollar index

$$\Delta_t = .0006 - \underset{(.0033)^{*}}{.0064}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .00012 - .05u_{t-1}^2 + .7083\sigma_{t-1}^2 - \underset{(.00003)^{**}}{.00006}\text{DUMBS}_t$$

Equity prices

$$\Delta_t = .0115 - \underset{(.0087)^{\dagger}}{.0131}\text{DUMD}_t + u_t$$

$$\sigma_t^2 = .0015 + .0058\text{u}_{t-1}^2 + .1106\sigma_{t-1}^2 - \underset{(.0003)^{**}}{.0007}\text{DUMBS}_t + \underset{(.00097)^{**}}{.0019}\text{DUMD}_t$$

Long-term interest differentials

$$\Delta_t = -.0020 + \underset{(.0194)^{**}}{.0384}\text{DUMBS}_t$$

$$\sigma_t^2 = .0003 + .0241\text{u}_{t-1}^2 + .9418\sigma_{t-1}^2$$

**Significant at the 5 percent level.
*Significant at the 10 percent level.
†Significant at the 15 percent level.

deficits are small but before they have entered a current account surplus adjustment regime. Finally, we see that long-term interest differentials in favor of the United States are larger when current account deficits are small.

5.5 Assessing the Present U.S. Current Account Deficit

In this section we draw on our empirical results to take stock of the present U.S. current account deficit. Our empirical results indicate that compared to other G7 countries, the United States over our sample exhibited relatively wide thresholds within which current account adjustment is absent and relatively slow speeds of adjustment once these thresholds, especially the deficit threshold, are crossed. Moreover, the present U.S. current account deficit substantially exceeds—and has for some time—our estimated thresholds of current account deficit adjustment for the United States. We explore several possible explanations. The first is that the threshold model, while a useful description of current account adjustment for other G7 countries, does not apply to the United States and that the present deficit of nearly 6 percent of GDP is, in fact, sustainable. The second explanation is that there are thresholds of current account adjustment for the United States, but that adjustment has been delayed over the past several years due to unusual circumstances that were not in evidence during the sample over which the models were estimated, 1979 to 2003. These circumstances could include (a) the low level of global real interest rates (which support higher levels of investment and lower levels of saving in the United States than would be the case with historically average or above average real interest rates); (b) the more muted and less uniform decline in the dollar than occurred, for example, during the 1985 to 1987 Plaza-Louvre episode (reflecting the intervention activities of Asian central banks); (c) the fact that the United States continues to run a substantial surplus in dividends, interest, and profits on its stock of foreign assets compared with the dividends, interest, and profits that it pays out on its much larger stock of foreign liabilities; and (d) the adjustment in the net foreign liability position of the United States that occurs as a result of dollar depreciation (which in 2003 offset almost 80 percent of that years current account deficit). We review and evaluate these potential explanations for the absence of adjustment to date in the U.S. current account deficit even though it has passed well beyond the thresholds that would have triggered adjustments in other G7 countries. We begin by reviewing the data on the U.S. net foreign liability position.

Almost all claims held by foreigners against the United States are dollar denominated, while U.S. claims against the rest of the world are denominated in foreign currency. Thus, as has been emphasized by Pierre-Olivier Gourinchas and Hélène Rey (chap. 1 in this volume), a real depreciation of the dollar, by increasing the real value of U.S. holdings of foreign assets relative to foreign holdings of U.S. assets (which, of course, are dollar-denominated liabilities of the United States) is an important channel of international adjustment, over and above the impact of said real depreciation on the trade balance. This channel operates by narrowing the gap between the market value of foreign claims against the United States and the market value of U.S. claims against the rest of the world. In effect, because of the willingness on the part of the rest of the world to lend to the United States in the form of dollar-denominated debt and equity instruments, there is a transfer of wealth to the United States from the rest of the world as a result of a real depreciation of the dollar, all other things—including other asset prices—equal, a qualification to which we return below. It is important to note that while the United States benefits from this transfer effect that increases the real value of U.S. assets relative to U.S. liabilities, there is, of course, another implication of real dollar depreciation, which is the terms of trade deterioration that results from it. This terms of trade deterioration lowers the real purchasing power of any given flow of U.S. income, and it increases the relative price of imported inputs to U.S.-based production. In addition, as Obstfeld and Rogoff (chap. 9 in this volume) have emphasized, moving toward current account sustainability requires that resources be shifted from nontradable to tradable production. Empirically, this channel of international adjustment is potentially quite important in complementing the traditional channel in which the factors that contribute to a narrowing of the current account deficit also result in a real depreciation of the dollar.

Every year, the U.S. Commerce Department reports data on the net foreign liability position of the United States, and it provides detail on the revaluation of U.S. assets and liabilities that occurs as a result of exchange rate movements as well as asset price changes. The data on net foreign assets and liabilities is subject to substantial revisions. However, until quite recently—April 2005—the Commerce Department did not go back and revise the exchange rate and asset price revaluation attributions to make them consistent with the revised data on foreign assets and liabilities. However, at the request of one of the authors of this paper, the Commerce Department has now revised the exchange rate and asset price revaluation attributions to make them consistent with the revised data on foreign assets and liabilities. The newly released data are reported in table 5.11, and they tell an interesting story.

We begin with the most recent data available as of the time of writing, for year end 2003 (data for year end 2004 are preliminary). The United States began 2003 with gross foreign assets of \$6.6 trillion and gross foreign liabilities of \$9.2, for a stock of net foreign liabilities of \$2.6 trillion. During that year, the United States ran a current account deficit of \$530 billion that, after adjustment for errors and omissions, resulted in a net capital

Table 5.11 **Components of change in the net international investment position, with direct investment at market value, 1989–2004**

		Changes in position attributable to valuation adjustments					
Year	Position beginning	Financial flows (a)	Price changes (b)	Exchange rate changes[a] (c)	Other changes[b] (d)	Total [(a) + (b) + (c) + (d)]	Position ending
1988							10,466
1989	10,466	–49,545	7,129	–15,392	355	–57,453	–46,987
1990	–46,987	–60,337	–148,620	57,042	34,407	–117,508	–164,495
1991	–164,495	–46,421	–95,789	4,643	41,243	–96,324	–260,819
1992	–260,819	–96,253	–75,554	–74,991	55,312	–191,486	–452,305
1993	–452,305	–81,489	292,716	–21,969	118,779	308,037	–144,268
1994	–144,268	–127,052	23,172	73,069	39,828	9,017	–135,251
1995	–135,251	–86,298	–152,461	39,018	29,156	–170,585	–305,836
1996	–305,836	–137,687	84,188	–66,076	65,387	–54,188	–360,024
1997	–360,024	–221,334	–92,069	–207,625	58,320	–462,708	–822,732
1998(r)	–822,732	–69,740	–287,874	68,120	41,457	–248,037	–1,070,769
1999(r)	–1,070,769	–236,148	329,672	–125,970	65,778	33,332	–1,037,437
2000(r)	–1,037,437	–486,373	133,716	–270,594	79,681	–543,570	–1,581,007
2001(r)	–1,581,007	–400,243	–224,184	–151,685	17,671	–758,441	–2,339,448
2002(r)	–2,339,448	–500,316	–59,582	231,247	212,985	–115,666	–2,455,114
2003(r)	–2,455,114	–560,646	–1,716	415,507	229,599	82,744	–2,372,370
2004(p)	–2,372,370	–584,597	146,514	272,278	–4,070	–169,875	–2,542,245

Note: (p) = preliminary; (r) = revised.

[a]Represents gains or losses on foreign-currency-denominated assets and liabilities due to their revaluation at current exchange rates.

[b]Includes changes in coverage, capital gains and losses of direct investment affiliates, and other adjustments to the value of assets and liabilities.

inflow of $560 billion. In a simple textbook model that abstracts from asset price or exchange rate changes, this should have resulted in a dollar-for-dollar increase in net foreign liabilities, to approximately $3 trillion. During that year, asset price changes in local currency terms were substantial, but they roughly canceled out, having a minimal impact on the net foreign liabilities of the United States. By contrast, the exchange rate valuation effects were substantial. Dollar depreciation that year increased the value of U.S. assets abroad by $416 billion. By year end 2003, the net foreign liabilities of the United States were valued at $2.4 trillion dollars, an increase of only $83 billion compared with the previously discussed U.S. capital inflow of $560 billion.

Of course, a real dollar depreciation has a one-off impact on the value of U.S. net foreign assets, and a stabilization of net foreign liabilities as a ratio of U.S. GDP will require a reduction in the ratio of the current account to GDP. However, the current account deficit to GDP ratio need not return to zero for sustainability to be achieved. Indeed, a U.S. current account deficit-to-GDP ratio in the range of 2 to 3 percent is probably consistent with sustainability at something like the global level of interest rates and equity valuations. Consider this fact: in 2001, U.S. net foreign liabilities were 22.8 percent of U.S. nominal GDP. Two years later, U.S. net foreign liabilities to GDP had risen by a very modest 1.3 percentage points, to 24.1 percent of GDP, notwithstanding current account deficits of roughly 5 percent of GDP in each of 2002 and 2003. The data in table 5.11 show that exchange rate valuation effects have been important in previous years. For example, in 2002, the exchange rate revaluation of U.S. foreign assets offset 46 percent of the foreign capital inflow; in 1994 and 1995, the exchange rate valuation effect offset 52 percent of the net capital inflow. Of course, exchange rate appreciation has the opposite effect. Of the $1.3 trillion rise in U.S. net foreign liabilities that accumulated in the three years 1999 to 2001, $549 billion, or 43 percent, was due to the valuation impact of the appreciation of the dollar that occurred during those years.

Another factor that should be considered when thinking about sustainability and adjustment of international imbalances is the longstanding evidence for the United States of substantial differences in the rates of return that U.S. investors earn on their foreign investments compared with the rate of return that foreign investors earn and require on their investments in the United States. That is, even though the United States is, and has been for many years, the world's largest net debtor, with net foreign liabilities estimated to be some $2.4 trillion dollars at year end 2003, the United States still to this day earns more interest and dividends on its foreign assets than it pays out on its foreign liabilities, even though the latter exceed the former by more than 2 trillion dollars. Specifically, for 2004, income receipts on U.S. assets abroad totaled $366 billion, while income payments on foreign assets in the United States totaled $344 billion. How can the United States

Table 5.12 **Portfolio shares (%)**

	1989	1995	1997	1998	1999	2000	2001	2002	2003
				Private U.S. investment abroad					
FDI	39.7	36.8	36.4	38.4	39.6	37.5	34.6	32.0	35.9
Securities and currency	15.0	32.5	34.0	34.6	35.2	33.2	31.6	29.0	32.6
Other private assets	45.3	30.7	29.6	27.1	25.2	29.3	33.7	39.0	31.5
				Private foreign investment in the U.S.					
FDI	26.0	28.0	30.7	34.3	37.4	35.0	31.5	25.5	26.9
Securities and currency	34.9	40.9	42.5	42.1	40.6	41.0	42.6	44.6	47.0
Other private assets	39.1	31.1	26.8	23.6	22.0	24.0	25.9	30.0	26.0

continue to run a surplus on international investment income with its large stock of international liabilities? Differences in portfolio composition can probably account for some of this. For example, in recent years 60 percent of U.S. assets abroad were invested in foreign equities and foreign direct investment. By contrast, only 40 percent of foreign claims against the United States were invested in U.S. equities and direct investment. However, in order to account for the persistent surplus in the U.S. international investment income account, portfolio composition is probably not sufficient. In addition, it is likely the case that the United States earns consistent higher returns on its foreign direct investment (FDI) than the rest of the world earns on its U.S. FDI. (See table 5.12.)

We see that in both 2003 and 2004, the United States earned high returns on FDI, earning profits of 8.7 percent of FDI assets at market value in 2004 and 9.2 percent of FDI assets at market value in 2003. By contrast, foreign owned direct investment assets in the United States earned 4.3 percent of assets at market value in 2004 and 3.4 percent of assets at market value in 2003. This disparity is not a recent phenomenon. As the table shows, the United States has consistently since 1989—the year the U.S. net foreign asset position turned negative—earned higher returns on its FDI assets than foreigners have earned on their U.S. investments. Table 5.12 also reports the rate of return on non-FDI assets and liabilities. The absolute return differentials are much smaller, and are consistently negative, indicating that foreign non-FDI holdings pay slightly higher returns than U.S. non-FDI holdings. Once we take into account the differences in portfolio composition between U.S. assets abroad and foreign assets in the United States (reported in table 5.12), we obtain the time series on the total return differential reported in table 5.13.

Another factor that may have delayed adjustment in the U.S. current account is the more modest decline in the broad, real trade-weighted dollar as compared with the decline in the dollar that occurred during 1985 to 1988. The Federal Reserve's real, broad trade-weighted dollar index is plotted in figure 5.1.

Table 5.13

	1989	1995	1997	1998	1999	2000	2001	2002	2003	2004
					U.S. owned assets abroad					
Total assets	2,350,235	3,964,558	5,379,128	6,174,518	7,390,427	7,393,643	6,898,707	6,613,320	7,863,968	
U.S. private assets	2,094,878	3,703,433	5,158,094	5,941,744	7,169,782	7,180,075	6,683,092	6,369,409	7,595,619	
FDI assets	832,460	1,363,792	1,879,285	2,279,601	2,839,639	2,694,014	2,314,934	2,039,780	2,730,289	
Foreign securities	314,294	1,203,925	1,751,183	2,052,995	2,525,341	2,385,353	2,114,734	1,846,879	2,474,374	
Other U.S. private assets	948,124	1,135,716	1,527,626	1,609,148	1,804,802	2,100,708	2,253,424	2,482,750	2,390,956	
Income receipts										
Total receipts	160270	208065	254534	258871	290474	347614	283761	263861	291354	365886
FDI receipts	61981	95260	115323	103963	131626	151839	128665	147291	187522	237564
Returns on U.S.-owned assets abroad (%)										
Return on all assets	8.0	6.3	5.5	4.8	4.7	4.7	3.8	3.8	4.4	4.7
Return on FDI	9.0	8.5	7.2	5.5	5.8	5.3	4.8	6.4	9.2	8.7
Return on non-FDI assets	7.5	5.1	4.6	4.4	4.1	4.3	3.3	2.5	2.3	2.5
					Foreign-owned assets in the U.S.					
Total liabilities	2,397,222	4,270,394	6,201,860	7,249,895	8,437,115	8,982,199	9,206,868	9,166,727	10,514,958	
Liabilities to private foreigners	2,055,476	3,587,521	5,328,144	6,353,721	7,486,027	7,951,491	8,124,572	7,954,004	9,040,797	
FDI liabilities	534,734	1,005,726	1,637,408	2,179,035	2,798,193	2,783,235	2,560,294	2,025,345	2,435,539	
Securities and currency (Cash, US)	716,523	1,466,328	2,262,490	2,675,016	3,042,633	3,260,616	3,459,610	3,545,585	4,251,500	
Other liabilities to private foreigners	804,219	1,115,467	1,428,246	1,499,670	1,645,201	1,907,640	2,104,668	2,383,074	2,353,758	
Income receipts										
Total payments	–141463	–189353	–244195	–257554	–280037	–329864	–263120	–259626	–261106	–344925
FDI payments	–7045	–30318	–42950	–38418	–53437	–56910	–12783	–46460	–68657	–105262
Returns on U.S.-owned assets abroad (%)										
Return on all liabilities	7.1	5.5	4.9	4.2	3.9	2.9	2.8	2.8	3.3	
Return on FDI	1.8	4.0	3.5	2.3	2.5	2.0	0.5	1.8	3.4	4.3
Return on non-FDI liabilities	8.4	5.9	5.3	4.8	4.5	4.8	4.0	3.2	2.7	3.0
Return differentials (%)										
Total	0.9	0.8	0.6	0.7	0.8	0.8	0.9	1.0	1.6	1.4
FDI	7.2	4.5	3.7	3.2	3.3	3.3	4.3	4.5	5.8	4.4
Non-FDI	–0.9	–0.8	–0.7	–0.4	–0.4	–0.5	–0.7	–0.7	–0.4	–0.5

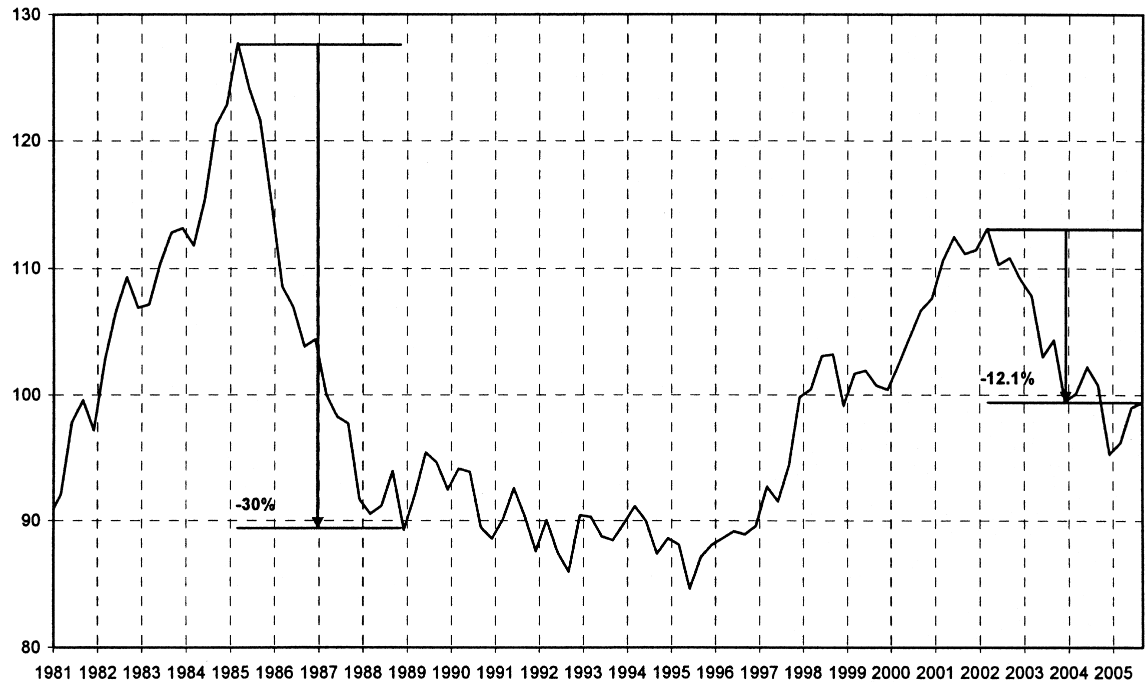

Fig. 5.1 U.S. real, broad trade-weighted dollar index (percentage decline from February 1985 to November 1988 versus February 2002 to November 2005)

In the three years after the dollar's peak in early 1985, the broad dollar index declined by 30 percent. By contrast, in the three years since the dollar's recent peak in early 2002, it has declined by less than 15 percent. Obviously, the intervention by Asian central banks has limited the depreciation of the dollar against a number of significant U.S. trading partners.

Our final point is that the U.S. current account deficit is in part an endogenous, general equilibrium outcome of global financial and macroeconomic integration. As such, we believe it reflects a global excess supply of saving relative profitable investment opportunities. In a world in which there is a global excess supply of saving relative to investment, we would expect to find and indeed find today that global real interest rates are low and that some country or group of countries must absorb the surplus of internationally mobile capital. Required real rates return—as measured by yields on Treasury inflation-protected securities (TIPS) in the United States and indexed gilts in the United Kingdom—are unusually low (below 2 percent as of this writing). In the late 1990s, the opposite was the case, and rapid (in retrospect unsustainable) world investment rates surged ahead of savings, pushing up real interest rates (TIPS yields were at 4 percent in March 2000 when the bubble peaked). Although no one can say for sure how long the present imbalance between global saving and investment will persist, it seems clear that this global imbalance between saving and investment is contributing to the size of the U.S. current account deficit and its failure to adjust as May 2005.

5.6 Conclusion

Are there thresholds of current account adjustment? This paper has reported evidence in favor of this proposition. We found statistically significant evidence of differing adjustment dynamics in the current account to net output ratio for all of the G7 countries examined. In particular, each country displayed three regimes—a surplus regime; a deficit regime in which the current account tended to revert toward its long-run mean, albeit at different speeds in each regime (showing that sign does indeed matter); and an inertia regime in which, for intermediate levels of the current account balance between the surplus and deficit regimes, current account adjustment was negligible (showing that size also matters). We also showed, however, that one size does not fit all in the sense that we found significant cross-country variation in the size of the estimated thresholds. We also found substantial cross-country variation in the estimated speed of adjustment once countries cross their current account deficit or surplus thresholds.

Our results support the findings of Caroline Freund and Frank Warnock (chap. 4 in this volume) by providing econometric evidence on the nonlinearities and differences in current account adjustment across industrial countries. In line with their results, countries with large deficits such as the United States exhibit relatively wide thresholds within which current account adjustment is absent and relatively slow speeds of adjustment once these thresholds, especially the deficit threshold, are crossed. While our analysis focuses on the relatively homogeneous post-Bretton Woods period, Muge Adalet and Barry Eichengreen (chap. 6 in this volume) present an historical analysis of current account reversals starting from the gold standard period and find evidence of substantial differences in current account adjustments episodes also across time.

We also found evidence of statistically significant shifts in the mean and variance of the probability distribution of several G7 exchange rates, equity prices, and interest rate differentials that occur in conjunction with our estimated current account adjustment regimes. In particular, we found a tendency toward exchange rate depreciation during current account deficit regimes and exchange rate appreciation during current account surplus regimes and statistically significant increases in exchange rate volatility during current account deficit adjustment regimes for the United States, Japan, and Germany. This suggests that a multivariate approach involving the joint modeling of exchange rates and the current account within a nonlinear framework would be a fruitful exercise, as well as being consistent with substantial evidence in favor of nonlinear adjustment in real exchange rates (see, e.g., Obstfeld and Taylor [1997]; Taylor and Taylor [2004]). This is an avenue we intend to pursue in future research.

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Comment Robert E. Cumby

This paper provides an ideal opening to this conference on current account imbalances and adjustment in the G7 countries. Like the good paper that it is, it both answers some interesting questions and raises several more. Because the paper deals with univariate current account dynamics, one is naturally led to ask questions about what might be generating these univariate dynamics. These questions involve both the nature of the underlying shocks and the way those shocks are propagated through the economies.

The paper presents persuasive evidence that, in the G7 countries, current account imbalances are more likely to decline when they are large relative to historical averages than when they are small. In addition, the evidence is consistent with country-specific thresholds. Unless current account imbalances exceed these thresholds, it is difficult to discern any adjustment of current account imbalances. The evidence is also persuasive that both average current account imbalances and the thresholds differ substantially across the G7 countries.

In this discussion, I would like to touch on some of the questions raised by these results. I will begin with a question involving the paper's treatment of the average imbalances and then proceed to ask questions about what might be behind the current account adjustment that the paper documents. In the course of doing so, I will raise three questions about fiscal policy and its potential role in helping to explain the behavior described in the paper.

The average current account imbalances (expressed as a fraction of net output—output less government purchases less investment) reported in the paper range from approximately –2 for Canada, the United Kingdom, and the United States to approximately 4 for Japan and 6 for preunification Germany. The paper treats these average imbalances as estimates of the long-run values to which current account ratios will tend to converge rather than evidence of average imbalances during the sample. The paper quite reasonably points out that there is no reason that a country's current needs to be balanced in steady state and presents an expression for the steady-state current account ratio from a benchmark two-country, overlapping generations model. One interesting question that arises is how closely the sample average current account ratios reported in the paper correspond to the steady-state current account ratios predicted by the benchmark model. Of course that comparison is not straightforward because the model's steady-state current account ratio depends on the unobservable rate-of-time preference. One possibility would be to compute the value of the rate-of-time preference that would be required to equate the model's

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predicted current account ratio to the sample averages from the G7 countries.

Why is it that large current account imbalances—that is, current account ratios that are large relative to their mean—tend to get reversed, but small imbalances exhibit no tendency to decline? One possibility is that large imbalances arise when realizations of the shocks that impinge on an economy are in the tails of their joint probability distribution. If this is the case, subsequent draws are unlikely to be as extreme, and current account ratios are likely to be smaller. This is not a particularly interesting explanation, and it is perhaps more consistent with smooth-transition dynamics and with threshold dynamics. The fact that the authors were unable to fit models with smooth-transition dynamics to the data suggests that something more is behind the current account adjustment dynamics in the G7 countries.

Two explanations of reversals of substantial current account imbalances—particularly current account deficits—that are commonly found in the literature are increases in private savings (perhaps driven by wealth effects) and a change in the willingness of foreign creditors to continue to finance large current account imbalances. While it is not obvious how the first of these is consistent with threshold effects in current account dynamics, the second is perhaps a more promising possibility. It would be interesting to see if it is possible to model creditor behavior in a way that is consistent with the threshold effects documented in this paper and with the dynamics of adjustment documented in Freund and Warnock (chap. 4 in this volume).

Might other forces behind current account adjustment exhibit threshold effects? Threshold effects can arise when agents face fixed costs, an idea that has been fruitfully applied to a number of problems, including market entry and exit decisions in foreign markets (Dixit 1989a,b). Another potentially interesting possibility that could conceivably contribute to threshold behavior in current account dynamics is fiscal policy. Casual empiricism suggests that significant political costs are incurred when a substantial fiscal tightening is enacted. This might lead to legislative behavior in which fiscal policy does not adjust until fiscal imbalances are sufficiently extreme. An interesting extension of this paper would be to investigate whether fiscal policy exhibits threshold effects.

Two countries stand out in the results reported in table 5.2, Canada and the United States. Unlike Italy, Japan, and the United Kingdom, the size of the inertia region is large. The difference between the estimated surplus and deficit thresholds is nearly 4.5 percent of net output for the United States and nearly 5.5 percent of net output for Canada. In contrast, it is less that 0.5 percent of net output for Italy and just above 1 percent of net output for Japan and the United Kingdom. In addition, unlike Japan, Germany, and France, where the deficit thresholds correspond to current account surpluses, the deficit thresholds for Canada and the United States correspond to substantial deficits.

Is there anything different about the adjustment to current account deficits in these countries that is different from adjustment in the other countries? The paper provides some interesting evidence in section 5.4 when they examine whether the probability distribution of exchange rate changes, stock price changes, and long-term interest differential is different when current accounts are adjusting. One concern that frequently arises in discussions of adjustment to large current account imbalances (particularly deficits) is that adjustment may result in stress in financial markets. The evidence in section 5.4 does not suggest that increased volatility in financial markets is associated with adjustment to large deficits. Although estimated U.S. equity volatility is significantly greater during periods of adjustment to current account deficits, Canadian equity volatility is estimated to be lower (although not statistically significantly lower) during periods of adjustment to current account deficits.

Are there other differences that characterize adjustment to large deficits that might help us understand the causes of the current account dynamics documented in the paper? A second interesting question involving fiscal policy might be to ask if fiscal policy in the United States and Canada behaves differently during periods of adjustment to large current account deficits.

The final section of the paper asks why the U.S. current account deficit has not declined despite being substantially above the estimated threshold for a sustained period. An additional possibility that might be interesting to explore is whether U.S. fiscal policy has behaved differently during this period than it did over the sample used to estimate current account dynamics.

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6

Current Account Reversals
Always a Problem?

Muge Adalet and Barry Eichengreen

6.1 Introduction

Sharp reductions in current account deficits can be disruptive. Milesi-Ferretti and Razin (1997) in their seminal study of the phenomenon, known as *current account reversals,* emphasize the dangers of large current account deficits that must be compressed when external financing dries up. Their study, written in the aftermath of the Asian crisis, presumably had countries like Thailand in mind. The authors cite other disruptive reversals, such as Uruguay's at the beginning of the Latin American debt crisis, when financing for the current account deficit collapsed and growth fell from +5 percent to –7 percent.[1] Looking forward, there is the question of what would happen to growth in the United States if financing for the country's +5 percent current account deficit evaporated abruptly. Will the dollar fall, fanning import price inflation and forcing the Fed to raise interest rates? How would the housing and stock markets react? Sharp reductions in consumption and investment might have to be brought about by this rise in interest rates and fall in asset valuations as the current account is the difference between investment and saving.

But not all current account reversals are disruptive. In Milesi-Ferretti and Razin's own sample, the median change in growth between the periods before and after such reversals is zero. The output response, in other words,

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1. Between 1979 to 1981 and 1982 to 1984.

is very heterogeneous. For every Uruguay there is a Nigeria, where growth went from –5.5 percent in 1981 to 1983 to +3 percent in 1984 to 1986, despite sharp compression of the current account.

From an analytical standpoint, this is not surprising. Deficits develop for different reasons. A deficit reflecting a temporary surge in investment owing to unusually rapid productivity growth and high profitability will have different implications than a deficit reflecting a temporary surge in consumption produced by the growth of public consumption or overvaluation of the currency. Equally, current account deficits can be eliminated for number of very different reasons, which are likely to have very different output effects.

Nor is it clear that current account reversals were always as disruptive as in recent years. The obvious contrast is the period before World War I, when very large deficits were allowed to develop and persist. Bayoumi (1989) considers average current account deficits over periods as long as 1870 to 1913 and finds that these reached high levels in countries like Australia and Canada. Taylor (1996) and Obstfeld and Taylor (2004) do the same over successive decades starting in the late nineteenth century and show that current account balances were larger in that period than anytime in the twentieth century. To be sure, some of these deficits were compressed abruptly with interruptions to the flow of external finance, reflecting a combination of rising interest rates in the capital-exporting countries and economic and political problems in the capital importers, and led to serious economic and financial difficulties. Instances springing to mind where current account deficits fell sharply and precipitated banking or currency crises include Denmark in 1885 to 1886, Argentina in 1889 to 1890, Canada in 1890 to 1891, Australia in 1891 to 1892, Brazil in 1896 to 1897, Japan in 1899 to 1900, and Finland in 1900 to 1901.[2] Although crises can occur for reasons other than those associated with current account reversals, the connections between the two phenomena are clear.

At the same time, crises—currency crises in particular—were lower in frequency under the gold standard than in recent years.[3] Indeed, another reading of gold standard experience is that the economic and political environment made current account reversals less of a problem. Greater wage and price flexibility in an era of unstructured labor markets facilitated the adjustment of relative prices when the current account balance had to be compressed abruptly (Bayoumi and Eichengreen 1996). With government budgets close to balance in peacetime, the twin deficits problem that gives rise to *bad current account deficits,* financing for which dries up suddenly when concerns arise about the sustainability of public debts, was less

2. These are all years of or adjoining banking and currency crises as independently dated by Bordo and Eichengreen (2003).

3. This is the finding of Bordo and Eichengreen (2003).

prevalent. Because large current account deficits reflected unusually high levels of investment in export-supporting infrastructure, those deficits could be smoothly reduced by increased savings out of progressively higher domestic incomes and increases in exports of goods and services (Feis 1930; Fishlow 1986).[4] Because the credibility of the commitment to exchange rate stability was beyond reproach, events that might have interrupted capital inflows and forced disruptive compression of the current account elicited capital inflows that allowed that deficit to be wound down smoothly rather than precipitating a crisis. Some of these tales are consistent with fewer or smaller current account reversals, while others are consistent with smaller output losses (smoother adjustment to equally frequent or large current account shocks).

These observations suggest a series of questions. Were current account reversals less frequent under the gold standard? Were their growth effects less disruptive? And if there are differences across epochs, what is their explanation?

Bracketed by the gold standard and the post-1970 float were the 1920s and 1930s, when capital flow volatility, economic instability, and financial crises were pervasive, and the Bretton Woods quarter century, when capital flows were limited, recessions were rare, and banking crises were essentially nonexistent. Given the contingent nature of the connection between economic volatility on the one hand and current account reversals on the other, it would be illuminating to know whether reversals were larger, more frequent, and more disruptive in the interwar period—and smaller, less common, and less disruptive under Bretton Woods.

In what follows we take a first cut at measuring the frequency, magnitude, and effects of current account reversals in the gold standard era (1880 to 1914), the interwar period (1919 to 1939), Bretton Woods (1945 to 1970), and the post-Bretton Woods float (1972 to 1997). We use regression analysis to see how far we can get in ascribing cross-period differences to observable characteristics of countries and the international economic environment.

The results confirm that the gold standard era and the period since 1970 differed strikingly from one another: reversals were smaller and less frequent in the gold standard years. Controlling for, inter alia, the size of the initial current account imbalance, the movement in the real exchange rate and the state of the global economy does not make this difference go away. Evidently, there was something else about the gold standard years that rendered current accounts more stable. But when reversals did take place, their effects were every bit as disruptive as after 1945. This prompts us to consider a set of case studies in an effort to shed more light on the issue.

4. We can think of this as a somewhat refined version of the Lawson Doctrine as applied to the gold standard.

The intervening period from the 1920s through the 1960s is more difficult to characterize. The two interwar decades emerge here, as elsewhere, as years of instability: reversals were frequent and large and had major output costs. Under Bretton Woods, in contrast, reversals were few and small; in both respects this period resembles the gold standard years. These facts are presumably explicable in part by the prevalence of capital controls and tight regulation of domestic financial markets.

Finally, the years since 1972 are grouped with the gold standard years in terms of ease of adjustment to reversals. The output losses from current account reversals appear to be significantly smaller not just compared to the interwar years (which is not surprising) but also compared to Bretton Woods. In the conclusion, we speculate about what changes in markets and institutions might help to account for this fact.

6.2 The Country Sample

Our empirical analysis utilizes data from Bordo and Eichengreen (2003) extended to incorporate additional variables and countries.[5] The principal sources are compendia and monographs containing national historical statistics for the period prior to 1913, publications of the League of Nations for the interwar period, and standard World Bank and International Monetary Fund sources after World War II. The resulting data set has been checked and adjusted for compatibility.[6]

A problem for any study that undertakes historical comparisons over long periods is the country sample. Reasonably complete macroeconomic statistics including not only gross domestic product (GDP) and trade but also financial variables are available back to the late nineteenth century

5. For a more extensive discussion of data sources, see that publication.

6. Several limitations of these data are worth noting. The current account estimates for the period before 1945 build on reported figures for imports and exports of goods and services, following inter alia Bayoumi (1990), Taylor (1996), and Obstfeld and Taylor (2004). This leaves open the possibility that some service items are under- or unreported (imports and exports of shipping, insurance and financial services, for example). In addition, there is the possibility of spurious volatility in earlier (specifically, pre-1914) output data (Romer 1986). To the extent that this bias exists, it will presumably exaggerate the difference between growth rates during expansions and contractions and therefore the magnitude of the output effects of current account reversals. Finally, some variables that have proven popular in recent analyses of the causes and consequences of current account reversals (measures of the composition of the public debt, for instance) are not readily available for this earlier period and are therefore excluded from the analysis. In particular, information on the capital account, as distinct from the current account, is not readily available for earlier periods. (For an idea of what kind of distinct data on international capital flows exist for the period prior to 1913, see Bloomfield 1963, 1968; Stone 1999.) Data on reserves and imports and exports of goods and services capture capital flows imperfectly to the extent that they do not measure trade in certain services—see the preceding—and to the extent that information on foreign exchange reserves is incomplete. The analysis here follows Milesi-Ferretti and Razin (1997), who similarly focus on the current account reversals but do not look separately at sudden stops in capital flows, unlike Edwards (2004a,b), who looks at both.

only for a subset of Western European countries, overseas regions of recent European settlement (the United States, Canada, Australia, and New Zealand), and a few of the larger Latin American countries (Argentina and Brazil). The question is whether to follow this same group of countries over time (as in, for example, Taylor [1996] and Obstfeld and Taylor [2004]) or to add additional countries as more data become available (as in inter alia Bayoumi 1989).

Both approaches have drawbacks. Following the same ten to fifteen European countries and offshoots over the entire 120 years maximizes the comparability of the country sample at the cost of representativeness. If we are interested in the determinants and consequences of current account reversals in modern-day emerging markets and how these compare with such reversals in their historical antecedents, then a sample that includes at most a couple of modern-day emerging markets is not likely to be representative of their experience. If, on the other hand, one freely adds more countries as data on these become available, then one ends up with better representation of modern emerging markets but also with problems of intertemporal comparability. At the beginning of the period, the sample will mainly comprise a small number of relatively advanced industrial economies, while at the end of the period it will be dominated by a large number of low-income countries, where the causes, consequences, and incidence of current account reversals may be significantly different. Assume, for example, that current account reversals are more frequent in low-income countries. Adding more low-income countries as data on them become available over time will then bias the analysis toward the conclusion that reversals have been growing more frequent purely as a result of sample composition.

We therefore take a third approach to sample selection. Our strategy is to define a consistent criterion in terms of relative per capita income—that is, a threshold value of per capita income relative to the highest income country in the first period, 1880 to 1913—and to add additional countries as data on them become available only if they satisfy this criterion.[7] We calculate for the period 1880 to 1914 the ratio of per capita income in the lowest income country in the sample for that period (Brazil) to the highest income country (the United States), which turns out to be 0.6. As data for more countries become available, we then add all countries whose per capita incomes are at least 60 percent of the per capita incomes of the lead country. In 1919 to 1939, for example, the lead country is again the United States, so we add all countries whose per capita incomes are at least 60 percent of U.S. levels for which we have comprehensive data. We do the same for the Bretton Woods period and again once more for the post-Bretton Woods years.

7. Observations for very low income economies are also limited toward the beginning of the sample period because many such economies were not then independent countries.

The resulting country sample is shown in appendix table 6A.1. One can see how sample size increases over time, while sample composition is not unduly dominated by low-income countries, which are necessarily omitted at the beginning of our long historical period. Thus, our analysis of current account reversals should be thought of as characterizing their incidence and consequences in middle- and high-income countries (also referred to in the literature as *emerging* and *advanced* markets) but not also in the poorest countries. Insofar as the economic volatility tends to be higher and dependence on capital flows is less in the poorest countries, separate analysis of such countries would seem appropriate. In some of the analysis that follows, we compare what we find using this limited sample for the post-1970 period with results obtained using the somewhat larger country sample employed by Milesi-Ferretti and Razin as a way of gauging the consequences of our sampling strategy.

6.3 A Brief History of Current Accounts

We set the stage for the analysis that follows by first summarizing the historical behavior of current accounts.

Two traditional ways of doing so are calculating the mean absolute value of the current account over some period of time (say, five years) and running Feldstein and Horioka (1980) regressions of the two components of the current account (investment and savings) on one another. Obstfeld and Taylor (2004) have done this for fifteen countries similar to our pre-1914 sample. They report that the average absolute value of the current account balance as a share of GDP was between 3 and 4 percent prior to 1914. The (absolute) current account remains at a relatively high 3.9 percent in the immediate post-World War I years (1919 to 1926), reflecting the exceptional investment demands associated with postwar reconstruction (the largest value is for France), but then falls to 2.7 in 1927–31 and 1.5 in 1932 to 1939 as capital controls are imposed and international financial markets shut down. The average absolute value of current accounts was small in the Bretton Woods years, when capital flows were still heavily controlled (1.8 percent of GDP in 1947 to 1959 and 1.3 percent in 1960 to 1973), before rising in 1974 to 1989 and 1989 to 2000 (to 2.2 percent and 2.3 percent, respectively), higher than under Bretton Woods but not the same levels witnessed before 1914.[8]

Obstfeld and Taylor (2004) also run a succession of cross section regressions using five-year averaged data of investment on savings and a constant term. The results are consistent with the hypothesis that capital mobility and hence the average magnitude of current account balances traces out a

8. Obstfeld and Taylor (2004) also look at wartime current account balances, which we do not consider here.

U-shaped pattern over time. The savings-retention coefficient (the estimated effect of savings on investment) is 0.5 until 1914, 0.6 to 0.7 in the 1920s, 0.8 to 0.9 in the 1930s, 0.9 in the Bretton Woods years, and 0.7 to 0.8 in the post-Bretton Woods sample. Like the summary statistics in the previous paragraph, this regression analysis suggests that while capital mobility is higher today than in the third quarter of the twentieth century, it has yet to rescale the peak reached before 1914.[9]

While these results provide a summary measure of ex post capital mobility in a constant sample of countries, it is not clear that they adequately summarize capital mobility in the world as a whole as the number of independent countries—and the number of middle- as well as high-income countries potentially connected to international capital markets in particular—is changing over our twelve decades. Bear in mind, as emphasized in the preceding, that we are concerned with middle- and high-income countries and systematically omit from our sample low-income countries that are plausibly less connected to international capital markets (and for which data are scarce). To the extent that our country sample corrects for this, we may paint a somewhat different picture. A further problem with these estimates is that for almost all of these cross section estimates of the savings-retention coefficient the confidence levels overlap.[10] While the tendency for this coefficient to be larger toward the middle of the sample period suggests a U-shaped time profile for capital mobility (high toward the beginning and end of the period), it is not clear whether the intertemporal differences are significant—and thus whether the null of a random fluctuation around the average can be rejected in favor of the alternative hypothesis of a U-shaped time profile of capital mobility.

We may be able to do better insofar as our criterion for selecting countries allows the sample to expand over time, while still applying consistent conditions for an observation's inclusion in the sample. The first column of table 6.1 shows the mean absolute value of current accounts for various subperiods for our sample; column (2) is the comparison with Obstfeld and Taylor (2004). We still observe a U-shaped pattern, with the magnitude of current account balances dipping down in 1927 to 1931 and 1932 to 1939. Our numbers are essentially the same as Obstfeld and Taylor's through 1939 but larger for the recent period. Taken literally, this suggests, contrary to Obstfeld and Taylor, that international capital markets are more integrated than before 1913, not less.[11] The difference reflects our sampling strategy and our addition of more relatively small countries with relatively large current account balances, especially in the last subperiod. Figure 6.1

9. It has not even matched the levels reached in the 1920s.

10. In part, this is presumably a function of the small samples of twelve countries for each point in time.

11. That capital markets are more integrated today than before 1914 is also the conclusion of Bordo, Eichengreen, and Irwin (1999), who use an entirely different approach.

Table 6.1 **Mean absolute value of current accounts, percent of GDP (unweighted averages)**

Time	Present sample	Obstfeld-Taylor
1880–1889	3.8	3.9[a]
1890–1913	3.6	3.7
1919–1926	3.9	3.9
1927–1931	2.7	2.7
1932–1939	1.5	1.5
1947–1959	2.4	1.8
1960–1973	1.9	1.3
1974–1989	4.8	2.2
1990–2000	4.7	2.3

Source: See text.

[a]This value is from Taylor (1996); Obstfeld and Taylor (1994) provide a statistic for the longer period 1870–1889.

Fig. 6.1 Mean absolute value of current account as a percent of GDP

Source: See text.

Note: War years are excluded from the sample.

provides visual confirmation of these patterns. It is also a reminder, however, that confidence intervals are wide so that not too much should be made of these differences.

Table 6.2 is another reminder of this fact. Using a different periodization, it reports estimates of the associated savings-retention coefficients.

Table 6.2 **Estimates of savings-retention coefficient for successive five-year periods, current sample**

Period	Coefficient	Standard error	95% confidence interval	
1880–1884	0.534	0.198	0.099	0.970
1885–1889	0.311	0.145	–0.003	0.625
1890–1894	0.536	0.141	0.231	0.840
1895–1899	0.668	0.114	0.421	0.915
1900–1904	0.548	0.132	0.262	0.833
1905–1909	0.567	0.207	0.119	1.014
1910–1914	0.581	0.206	0.135	1.027
1920–1924	0.590	0.219	0.107	1.073
1925–1929	0.613	0.196	0.185	1.041
1930–1934	0.783	0.074	0.622	0.944
1935–1939	0.927	0.068	0.780	1.075
1945–1949	0.667	0.128	0.395	0.939
1950–1954	0.721	0.069	0.576	0.866
1955–1959	0.778	0.057	0.659	0.897
1960–1964	0.744	0.084	0.570	0.919
1965–1969	0.887	0.073	0.737	1.037
1970–1974	0.863	0.069	0.719	1.007
1975–1979	0.708	0.111	0.478	0.938
1980–1984	0.623	0.124	0.368	0.878
1985–1989	0.699	0.122	0.448	0.951
1990–1994	0.598	0.113	0.365	0.832
1995–1999	0.452	0.112	0.222	0.683

Source: See text.

(Figure 6.2 is a graphic depiction of our estimates.) The savings-retention coefficients are 0.58 for the prewar period, 0.88 for interwar period, 0.86 for the Bretton Woods period, and 0.73 for the post-1971 sample. This methodology and periodization thus suggest that capital mobility was slightly higher before 1914 although the contrast here is more muted than in some previous results (see, e.g., Bayoumi 1989).

Thus, our new sample, intended to facilitate summary characterizations of differences in the extent of global capital mobility over time rather than simply following an unchanging country sample, broadly confirms the standard historical interpretation but also provides some new nuances.

6.4 From Current Accounts to Current Account Reversals

We now move from current account balances to current account reversals, defined as episodes in which the current account strengthens sharply, generally moving from deficit to surplus in three or fewer years. It is useful at this point to reiterate what was said in the introduction about why we focus on these episodes. Current account balances have a number of positive functions that appear in textbooks under the heading of "the intertempo-

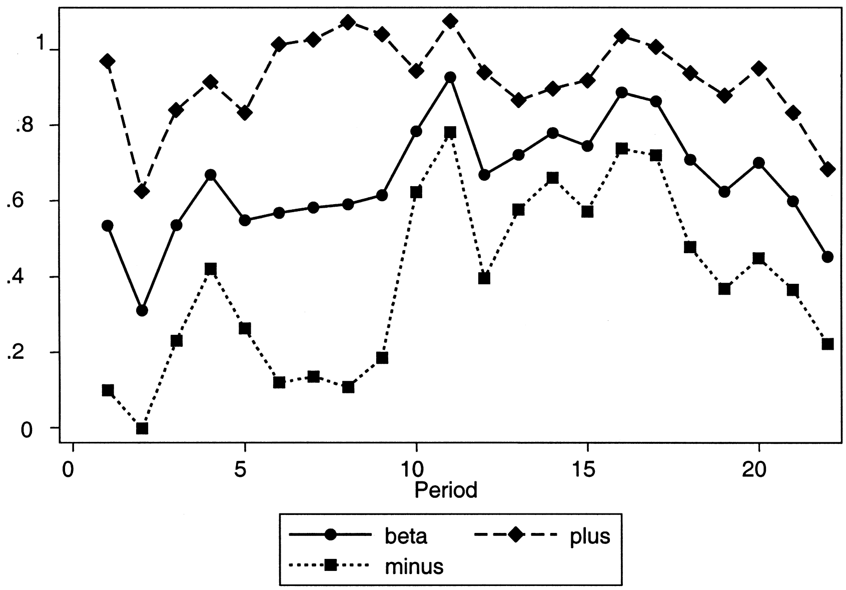


Fig. 6.2 Plot of savings-retention coefficients and confidence intervals, successive five-year periods (1 = 1880–1884, . . . 22 = 1995–1999)

Source: See text.

Note: War years are excluded from the sample.

ral approach to the current account" (see, for example, Obstfeld and Rogoff 1996). If the current account strengthens when output is high and weakens when it is low, its fluctuation is indicative of a country's ability to smooth its consumption. An ongoing current account deficit in a rapidly growing country may also be an indication that investment and growth are not unduly constrained by domestic savings capacity, facilitating the country's convergence to steady-state levels of output and capital intensity. In practice, however, these advantages may be neutralized or dominated if large or persistent current account deficits increase the likelihood of disruptive adjustments that produce large output losses.[12] Everyone can recall episodes when large current account deficits ended in the sudden curtailment of financing, sharp compression of the current account, and a drop in economic growth. Yet, as we have also noted, post-1970 experience suggests that not all current account reversals end this way. And it is not obvi-

12. This is the warning in the preceding quote from Fischer to the effect that large current account deficits are leading indicators of impending problems. His intuition that large current account deficits are leading indicators of currency and banking crises gains further support from the literature on early warning systems for emerging markets (Goldstein, Kaminsky, and Reinhart 2000).

ous a priori that large current account deficits bore the same association with instability in earlier periods, such as the pre-1914 gold standard years.

Thus, we wish to determine whether current account reversals were always a problem—whether they have always been frequent and disruptive. If current account reversals were not always a problem, then it will be important to establish why. Hopefully the answer will point to policy measures that can be taken at the national or international levels to tilt the costs and benefits of international capital mobility in socially desirable directions.

To identify current account reversals we use the same criteria as Milesi-Ferretti and Razin. We construct two variants of their measure, denoted Rev1 and Rev2. Rev1 (and Rev2) must satisfy three criteria: the average current account deficit must fall by 2 (3) percent of GDP between the first three and second three years; the maximum deficit in second three years must be no larger than minimum deficit in first three years; and the average deficit must fall by at least a third (as a percentage of GDP) between the first three and second three years. Obviously, the 2 percent cutoff generates more reversals than the 3 percent cutoff.

A list of the individual reversals for the pre-1970 period, excluding reversals occurring in consecutive years and reversals occurring in wartime, appears as appendix table 6A.2.

6.5 Statistical Findings

Table 6.3 summarizes the frequency of reversals under the gold standard, the interwar period, Bretton Woods, and the post-Bretton Woods years. Rev1 (based on two percent reductions in the current account deficit relative to the three preceding years) shows that a lower frequency of reversals under the gold standard than under any of the subsequent regimes. There are 59 reversal episodes (11 percent of the period sample of years) in 1880 to 1914, 102 episodes (27 percent of the sample) in 1918 to 1939, 62 episodes (12 percent of the sample) in 1945 to 1972, and 361 episodes (26 percent of the sample) in 1972 to 1997. So measured, reversals were relatively infrequent under the gold standard and Bretton Woods but much more frequent during the interwar period and since the collapse of Bretton Woods. If one excludes reversals occurring in consecutive years, their number falls to 30, 35, 28 and 101, but the ranking of frequencies (6, 10, 5, and 10 percent) remains basically unchanged, the main difference being that the Bretton Woods period looks slightly better than the gold standard years. From the perspective of the historical literature, these contrasts are not surprising; the interwar years and recent decades are both periods when there was much commentary about capital flow volatility, unusually severe recessions and financial crises, all of which may be correlates of current account reversals.

Table 6.3 **Time distribution of reversals**

	Pre-1885	1885–1889	1890–1894	1895–1899	1900–1904	1905–1909	1910–1914	Total
REV1								
No reversal	26	77	67	76	79	93	66	484
Reversal	2	5	18	9	13	2	10	59
REV2								
No reversal	28	81	76	83	86	94	73	521
Reversal		1	9	2	6	1	3	22
	1918–1922	1923–1927	1928–1932	1933–1937	1938			Total
REV1								
No reversal	40	66	67	83	18			274
Reversal	28	27	32	14	1			102
REV2								
No reversal	45	74	76	88	19			302
Reversal	23	19	23	9				74
	1945–1949	1950–1954	1955–1959	1960–1964	1965–1969	1970–1972		Total
REV1								
No reversal	52	79	94	97	94	57		473
Reversal	20	21	6	3	6	6		62
REV2								
No reversal	54	89	98	100	100	63		504
Reversal	18	11	2					31
	1970–1974	1975–1979	1980–1984	1985–1989	1990–1994	1995–1998		Total
REV1								
No reversal	96	179	179	198	213	104		969
Reversal	24	58	97	88	74	20		361
REV2								
No reversal	17	193	209	221	242	114		996
Reversal	13	44	67	65	45	10		244

Source: See text.

Note: REV1 and REV2 refer to a fall in the current account deficit of at least 2 or 3 percent over three years with respect to the preceding three years.

To be sure, simple tabulations do not tell us *why* reversals were more frequent in some periods than others. Candidate explanations include, inter alia, volatile policies, volatile financial markets, and a volatile global economic environment. We will consider these possibilities more directly in the following.

Figure 6.3 shows the number of reversals by year. In the first panel of figure 6.3 for the gold standard, the largest cluster is in the first half of the 1890s following the Baring-Argentina crisis and the collapse of international lending. In the interwar period, reversals are spread fairly evenly over the immediate postwar years, the 1920s, and the early 1930s, reflecting macroeconomic turbulence, shocks to international financial markets

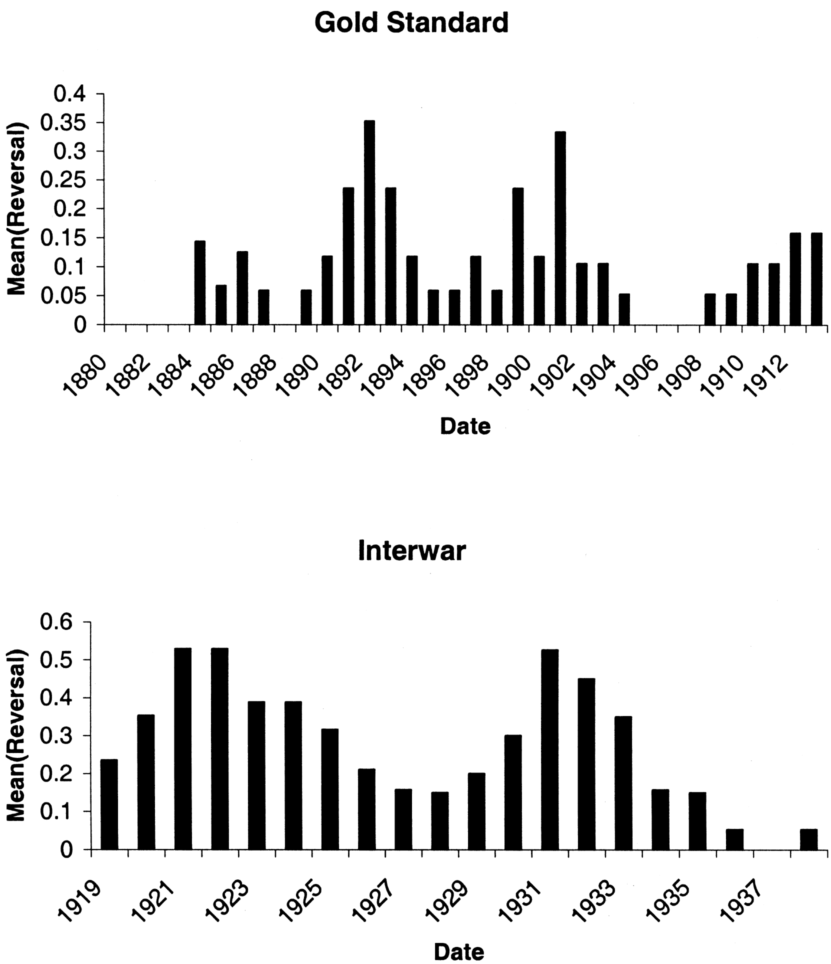
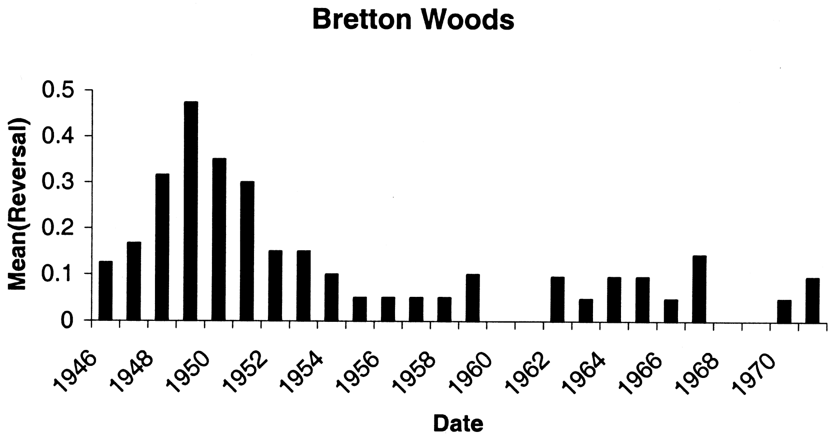


Fig. 6.3 Number of reversals by year (Gold standard, interwar, Bretton Woods, post-1970)

(associated with failed stabilization efforts, reparations disputes and so forth), the rise in U.S. interest rates in 1928 (which led to the sharp curtailment of foreign lending) and then onset of the Great Depression and widespread debt default starting in 1931. Reversals are relatively few in the mid-to-late 1930s, reflecting the widespread adoption of trade and capital controls through which countries balanced their current accounts and limited their dependence on capital flows. Under Bretton Woods, reversals are concentrated in the first postwar quinquennium and centered in Europe. This was the period when postwar foreign aid that had financed current ac-



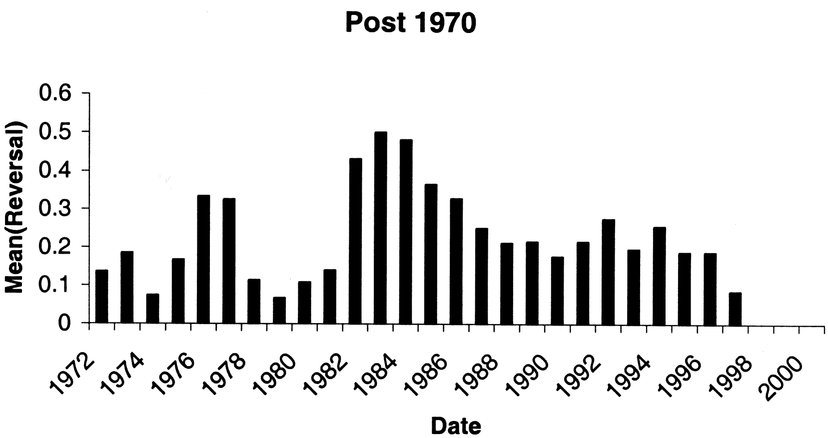


Fig. 6.3 (cont.)

count deficits was drawing to a close and foreign reserves had been run down, forcing countries to balance their trade accounts.

Next we calculated the magnitude of reversals in each period, measured as the change in the current account to GDP ratio between the three prereversal and three postreversal years. The magnitude of reversals so measured was 3.13 percent of GDP under the gold standard, 6.43 in the interwar years, 3.51 under Bretton Woods, and 5.46 since the breakdown of that system. Evidently, reversals were largest in the interwar years but only slightly smaller after 1970. They were smallest under the gold standard, but only slightly smaller than under Bretton Woods when international capital flows and the magnitude of feasible current account balances were tightly constrained. The special nature of gold standard experience compared to the two other periods of high capital mobility comes through clearly from this comparison.[13]

Table 6.4 shows summary statistics for GDP growth and the change in growth in the year of the reversal and windows ranging from one to four years following its occurrence. Growth is slower in reversal than nonreversal years, and it generally remains depressed for one or two additional years before bouncing back. Subsequently, growth in the reversal cases generally exceeds growth in the nonreversal cases, as output lost in the reversal episodes is made up. The v-shaped output response to reversals has been noted previously; see, for example, Calvo (2005).

Gauged in terms of the difference in growth rates between reversal and nonreversal years, reversals were less costly—as well as smaller and less frequent—prior to 1914. Growth was not significantly slower in reversal than nonreversal years before 1914 (the difference in growth rates, of –0.02 percent, is not significantly different from zero at standard confidence levels), 2.68 percentage points slower in the interwar years, and 3.75 percentage points slower in the Bretton Woods years (Rev1 definition). It is tempting to interpret the growing output costs of reversals as reflecting a secular decline in wage, price, and general economic flexibility over time (see, e.g., Bayoumi and Eichengreen 1996).

However, the difference in growth rates between reversal and nonreversal years falls to 1.32 percentage points after 1972, though that difference is still statistically significant at the 99 percent confidence level. Note that this is a different intertemporal pattern than we found for the frequency of reversals and their magnitude, both of which were greater after 1972 than in the Bretton Woods years. It also becomes hard to identify differences across regimes when we look at the longer term impact of reversals (the

13. As an alternative, we also scaled the change in the current account to GDP ratio by the initial current account balance (as a share of GDP, where initial is defined as the average over the three years preceding the event). Because the magnitude of the scaling factor varied across periods, this can be thought of as a period-specific measure of the magnitude of reversals (one that controls for differences across periods in, inter alia, the extent of international capital mobility and therefore the size of current account deficits in the typical prereversal period). The change in the current account to GDP ratio in (the three) subsequent years as a percentage of the initial (three-year) current account ratio is 79 percent, 210 percent, 190 percent, and 112 percent in our four chronologically successive periods. The main difference here is that Bretton Woods appears as a period of relatively large reversals, so scaled. Of course, the reason reversals appear so large under Bretton Woods when expressed as a percentage of the initial current account ratio is that those initial current account deficits were so small, reflecting the prevalence of controls on capital inflows and the demoralized state of international financial markets. Indeed, there are no very large current account deficits in the Bretton Woods years comparable to those evident in other periods, and the largest current account deficits in the Bretton Woods years tend to be concentrated in 1945 to 1950, when there were still reserves and foreign aid to finance them (see the preceding). The unweighted average of the current account deficit in the three years preceding the reversal episodes is 3.8 percent of GDP under Bretton Woods, compared to 5.2 in the interwar period and 5.7 in the post-Bretton Woods years (and 4.9 under the gold standard).

Table 6.4 **Summary statistics for GDP growth (reversal and no-reversal episodes)**

		Mean	Standard deviation	*t*-statistics
		Gold standard		
Year of	Reversal	2.79	5.08	–0.03
	No reversal	2.81	0.95	
1	Reversal	1.15	4.70	–0.80
	No reversal	1.95	1.31	
2	Reversal	3.59	6.28	0.95
	No reversal	2.38	1.59	
3	Reversal	6.22	4.14	**4.51**
	No reversal	2.45	1.36	
4	Reversal	3.47	5.35	0.26
	No reversal	3.10	1.43	
		Interwar		
Year of	Reversal	0.60	6.83	**–2.57**
	No reversal	3.28	4.77	
1	Reversal	3.28	14.28	–0.33
	No reversal	4.03	4.81	
2	Reversal	3.96	11.18	–0.41
	No reversal	4.66	4.19	
3	Reversal	3.32	6.60	–1.44
	No reversal	4.63	4.41	
4	Reversal	5.61	5.16	1.43
	No reversal	4.31	3.87	
		Bretton Woods		
Year of	Reversal	5.39	3.91	**–2.50**
	No reversal	9.14	5.69	
1	Reversal	6.94	6.03	**–1.89**
	No reversal	9.94	6.34	
2	Reversal	6.15	5.19	–1.30
	No reversal	8.05	5.39	
3	Reversal	4.74	4.72	–1.28
	No reversal	6.19	3.14	
4	Reversal	5.21	5.03	–0.95
	No reversal	6.37	2.77	
		Post-1970		
Year of	Reversal	1.85	5.53	**–3.30**
	No reversal	3.57	1.42	
1	Reversal	2.73	5.82	–1.44
	No reversal	3.45	1.13	
2	Reversal	3.85	4.64	1.09
	No reversal	3.40	1.11	
3	Reversal	4.12	6.01	1.42
	No reversal	3.36	1.34	
4	Reversal	4.00	5.78	**1.86**
	No reversal	2.88	1.15	

Source: See text.

Notes: *T*-statistics reported for two-sided null hypothesis of no difference between reversals and non-reversals. *T*-statistics in bold represent rejection of the null hypothesis.

Table 6.5 **Indicators of reversals**

	(1)	(2)	(3)	(4)	(5)	(6)
GDP per capita	–0.205**	–0.205	–0.177	–0.300***	–0.300	–0.272
	(0.099)	(0.154)	(0.152)	(0.108)	(0.184)	(0.183)
Fiscal balance/GDP	–0.014**	–0.014	–0.013	–0.016**	–0.016*	–0.014
	(0.007)	(0.009)	(0.009)	(0.007)	(0.009)	(0.009)
Trade balance/GDP	–0.033***	–0.033***	-0.035***	–0.032***	–0.032***	–0.034***
	(0.005)	(0.011)	(0.012)	(0.005)	(0.011)	(0.012)
U.K./U.S. interest rate	0.011	0.011	0.016	0.009	0.009	0.017
	(0.009)	(0.011)	(0.012)	(0.010)	(0.012)	(0.012)
Lagged U.K./U.S. growth	–0.024***	–0.024***	–0.019***	–0.024***	–0.024***	–0.020***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)
U.K./U.S. growth	0.004	0.004	0.006	0.007	0.007	0.007
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)
Peg	–0.063	–0.063	–0.044	–0.091	–0.091	–0.073
	(0.075)	(0.100)	(0.101)	(0.078)	(0.100)	(0.101)
Gold Standard Dummy	–0.389***	–0.389**	–0.372**	–0.434***	–0.434**	–0.439**
	(0.115)	(0.178)	(0.177)	(0.132)	(0.192)	(0.193)
Interwar Dummy	0.142	0.142	0.137	0.092	0.092	0.067
	(0.102)	(0.135)	(0.139)	(0.121)	(0.148)	(0.154)
Bretton Woods Dummy	–0.338***	–0.338**	–0.349**	–0.330***	–0.330**	–0.329*
	(0.107)	(0.153)	(0.156)	(0.112)	(0.165)	(0.169)
Deficit	0.164**	0.164**	0.165**	0.134*	0.134*	0.135*
	(0.069)	(0.069)	(0.071)	(0.072)	(0.071)	(0.073)
Openness	0.004***	0.004**	0.004**	0.004***	0.004**	0.003**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Capital controls				–0.102	–0.102	–0.127
				(0.091)	(0.134)	(0.135)
Constant	–1.030***	–1.030***	–1.062***	–0.879***	–0.879***	–0.891***
	(0.110)	(0.147)	(0.148)	(0.135)	(0.177)	(0.180)
No. of observations	1,978	1,978	1,895	1,869	1,869	1,793
Log-likelihood	–894.13	–894.13	–864.97	–836.52	–836.52	–810.56
Pseudo-R^2	0.08	0.08	0.08	0.08	0.08	0.08

Source: See text.

Notes: Dependent variable takes the value 1 if a reversal of at least 2 percent takes place and 0 otherwise. Standard errors are in parentheses. All the explanatory variables are lagged once. The variable trade balance to GDP ratio is averaged over the three years before the event to maintain consistency with the definition of reversals. Government surplus to GDP, world interest rate, and growth rates are levels.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

change in output between the reversal year and the subsequent three years, or between the year following the reversal and the subsequent four years).[14]

Table 6.5 reports probit regressions designed to shed light on the incidence of reversals. All independent variables are lagged. Following Milesi-Ferretti

14. We return to this in the following.

and Razin, most of the explanatory variables are averaged over the first three years of the six-year window in question to maintain consistency with the definition of reversals themselves.[15] Given our limited degrees of freedom and interest in intertemporal comparisons, we pool the data for the four periods and include period-fixed effects. Because certain countries are especially prone to reversals in certain periods, we use the cluster option in Stata to adjust for the fact that the error terms for a particular country in a particular period may not be independent of one another.[16] The regressions come in trios. Within each trio, the first column reports robust standard errors. The second clusters the observations by countries. The third then drops the observations for the United Kingdom, which we classify as the center country for part of the period, on the grounds that reversals in a country that either is or recently was the financial center are a qualitatively different phenomenon.[17]

Milesi-Ferretti and Razin found that reversals are more likely in countries with large current account deficits, real exchange rates suggesting growing overvaluation, large government deficits, low per capita incomes, low reserves, high interest rates at the center, high growth at the center, and high ratios of concessional to total debt. They consider U.S. interest rates and Organization for Economic Cooperation and Development (OECD) growth; for the period before 1914, we consider British interest rates and British growth, while for the interwar period we consider U.S. interest rates and U.S. growth. Like them, we find some evidence that reversals are more likely in countries with large current account deficits and large budget deficits, in countries with low per capita GDPs relative to the lead country (proxying, presumably, for relatively weak institutions and markets), and in periods when growth rates in the center country are high. We also find that reversals are more likely in more open economies, where here openness may be proxying for economic size. Edwards (2005), in another analysis of middle- and high-income countries, similarly finds that reversals are more likely in relatively small, relatively open economies.[18]

It is important to mention some of the variables that do not show up as consistently significant. For example, some studies of recent decades have found that reversals are more likely when the exchange rate is pegged, presumably making it more difficult to adjust relative prices prior to the event (Edwards 2004a). Here the coefficient estimates for whether the exchange

15. See the footnote to the relevant table for details.

16. To be clear, we do not allow for clustering of the error terms for all reversals for, say, Argentina, but for all reversals for Argentina in a particular period, say, 1880 to 1913 or 1972 to 1998.

17. In contrast, we have no reversals for the United States except in the first period, when we take Britain and not the United States as the center country.

18. Freund and Warnock (chap. 4 in this volume) do not find evidence that openness affects the exchange rate adjustment that accompanies a reversal, but they suggest that the price elasticity of imports and exports and their components used by Mann and Plück (chap. 7 in this volume) may be a more relevant measure.

rate is pegged display never approach statistical significance at standard confidence levels.[19] Similarly, the last three columns of the table add a dummy variable for capital controls. There is some evidence that the maintenance of controls limits the incidence of reversals, although this variable again is not statistically significant at conventional confidence levels.[20]

Another noteworthy feature of table 6.5 is that the dummy variables for the gold standard and Bretton Woods periods are negative and significant (the post-1972 years are the omitted alternative). Recall that we found in the preceding that reversals were less frequent under the gold standard and Bretton Woods than in the interwar and post-1972 periods. These coefficients are telling us that this difference is not fully explained by differences in observable country characteristics (the size of the initial imbalances, the fiscal stance, the global growth environment, etc.) but that it is at least partially explicable in terms of other factors that we are not capturing here.

Table 6.6 turns to the consequences of current account reversals. The dependent variable is growth over three years, starting with the year of the reversal, as a deviation from the world average for that same three-year period following the reversal onset.[21] The explanatory variables include the size of the reversal and a vector of controls (except where indicated otherwise, averaged over the three years preceding the event). Again, the data are pooled and estimated with period-fixed effects. The first two columns show ordinary least squares regressions with robust standard errors. Columns (3) through (6) then cluster the observations by country within each period.

19. We replicated Milesi-Ferretti and Razin's result when we used our sample of countries but limited the observations to the post-1972 period, but not otherwise.

20. We found essentially the same thing for the four subperiods estimated separately (in results not reported here), although significance levels vary. For the gold standard period, large prior current account deficits, large prior budget deficits, and low GDP per capita are the most robust and statistically significant determinants of reversal incidence. For the interwar period, reversals are more likely in countries with lower GDP per capita, large prior current account deficits and budget deficits, and no capital controls. For the Bretton Woods period, countries with terms of trade improvement and large current account deficits are more likely to experience reversals. For the post-1970 sample, a large prior current account deficit and having a peg are the main determinants of reversals. We also ran our specification using the Milesi-Ferretti and Razin sample of countries in the post-1970 period. The main difference is that the GDP per capita changes sign such that countries with relatively high per capita incomes are more likely to experience reversals. (Note that the Milesi-Ferretti and Razin sample does not include the advanced industrial countries, so this result is telling us—consistent with intuition—that within the sample of emerging markets the higher income emerging markets more integrated into international capital markets are more subject to reversals.) The main difference between these two pooled regressions is that the one using the Milesi-Ferretti and Razin countries for the post-1970 period shows a positive sign on the interwar dummy (although one that varies in significance across specifications).

21. It makes little difference if we instead define the dependent variable as the growth rate in the subject country over the three-year period and include the global growth rate over the same period as another independent variable on the right-hand side. In this case, the main difference is that the dummy variable for Bretton Woods becomes positive (although it remains insignificant).

Table 6.6 **Consequences of reversals**

	(1)	(2)	(3)	(4)	(5)	(6)
Trade balance/GDP	0.077***	0.115***	0.077	0.115	0.085***	0.129*
	(0.026)	(0.034)	(0.069)	(0.082)	(0.028)	(0.075)
RER overvaluation	–0.166***	–0.180***	–0.166***	–0.180***	–0.156***	–0.169***
	(0.021)	(0.023)	(0.044)	(0.031)	(0.021)	(0.032)
U.K./U.S. interest rate	0.055	0.092	0.055	0.092	0.046	0.075
	(0.069)	(0.065)	(0.064)	(0.061)	(0.071)	(0.073)
U.K./U.S. interest rate (+1)	0.051	0.031	0.051	0.031	0.082	0.073
	(0.077)	(0.073)	(0.072)	(0.066)	(0.079)	(0.070)
Gold Standard Dummy	0.913**	0.445	0.913	0.445	0.668	0.013
	(0.445)	(0.556)	(0.918)	(1.056)	(0.503)	(1.426)
Interwar Dummy	–2.788***	–3.257***	–2.788***	–3.257***	–3.959***	–4.702***
	(0.477)	(0.568)	(0.863)	(0.967)	(0.533)	(1.379)
Bretton Woods Dummy	–2.708**	–3.394**	–2.708	–3.394	–2.707*	–2.806
	(1.359)	(1.398)	(3.100)	(3.045)	(1.482)	(3.279)
Size of reversal		–0.097**		–0.097*		–0.679
		(0.042)		(0.051)		(0.414)
Capital controls					–0.391	–0.068
					(0.405)	(0.048)
External Def. Dummy					–0.749*	–0.828
					(0.395)	(1.251)
Constant	0.267	1.060**	0.267	1.060	0.889*	1.749
	(0.297)	(0.513)	(0.685)	(0.955)	(0.462)	(1.383)
No. of observations	318	222	318	222	288	199
R^2	0.21	0.28	0.21	0.28	0.26	0.33

Source: See text.

Notes: Estimated using OLS with White's correction for heteroscedasticity. Standard errors are in parentheses. Reversal defined according to rev1. The dependent variable is output growth defined as three-year averages, expressed as deviations from world averages. The explanatory variables trade balance, the real exchange rate, and the U.K./U.S. interest rates are averaged over the three years before the event.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

The results suggest that reversals were relatively costly when a large current account deficit had been allowed to emerge and the real exchange rate was allowed to become significantly overvalued in the preceding period.[22] In addition, we consider a dummy variable for whether the current account was in deficit or surplus in the prereversal period, as in some of our cases the event in question is one in which a small current account surplus becomes much larger, and it can be argued that in this case the output effects may be easier to accommodate. The results are consistent with this hypothesis. Finally, we added a dummy variable for the presence of controls

22. Freund and Warnock (chap. 4 in this volume) also find that large deficits are associated with slower growth for industrial countries.

on capital account transactions on the grounds that such controls may limit capital flight in the wake of the reversal, again moderating the output effects. The results are consistent with this intuition: output losses are smaller when the current account is already in surplus in the prereversal period and capital controls are present. But again, the addition of these variables does not alter our earlier findings.

An additional result is that a number of period dummies show up as statistically significant. A negative (positive) sign means that growth was slower and output losses were larger (growth was faster and output losses were smaller) in the period in question: thus we find smaller output losses under the gold standard but larger output losses in the interwar and Bretton Woods periods than in the omitted post-1972 alternative after controlling for other observed characteristics of countries and the global environment (that is, after controlling for the values of the independent variables). Recall that the simple tabulation of output losses in different periods showed the same thing. That we see the same pattern here suggests that the other explanatory variables such as the size of the initial current account imbalance, the overvaluation of the real exchange rate, or the presence or absence of capital controls do not explain why the typical output loss from reversals was smaller in some periods than in others.

This result sits uneasily with the cases in section 6.6, which show that the output effects of current account reversals under the gold standard could be substantial. Eyeballing the data suggests that prior to 1914 the drop in output only commenced after a year or more, whereas after 1971 it more commonly set in immediately. An explanation for this different pattern is the greater incidence of currency crises after 1971, as noted previously, and the tendency for output to fall with the onset of a crisis. Consistent with this conjecture, Bordo and Eichengreen (2003) identify currency crises coincident with only 7 percent of the current account reversals occurring before 1914 but coincident with 12 percent of the reversals occurring after 1971.

To determine whether the results were sensitive to this timing, we redefined the output response as the change in GDP not between year t (the year of the reversal) and $t + 3$ but between year $t + 1$ and $t + 4$. When we do this, the negative coefficient on the gold standard dummy is no longer significantly different from zero. (The other results are unchanged.) This suggests that not too much weight should be attached to the results in table 6.6, suggesting that the output losses from reversals were smaller under the gold standard. Reversals may have been less frequent and smaller, but when they occurred their output effects could still be severe, especially when they were accompanied by a currency crisis. (See the next section.)

In comparison, a variety of further sensitivity analyses had little impact on the results. For example, when we added a vector of country-fixed effects, the basic results continue to hold. We also experimented with a number of additional explanatory variables. For instance, a potential explanation for why the output effects of reversals were smaller in some periods than others is that the reversals themselves were smaller. We therefore added the size of the reversal (measured here as the change in the current account ratio between time $t - 3$ and time t) as an additional explanatory variable. This has plausible effects; for example, it lowers the significance level on the gold standard dummy in table 6.6, suggesting that one reason that the output losses associated with current account reversals were smaller under the gold standard is that the magnitude of the reversals themselves were smaller. However, the new coefficient is not statistically different from zero, and the other results are little affected by its addition. Finally, we followed Edwards (2004b) in estimating treatment regressions, first an equation for current account reversals and then a second-stage regression that treats the reversal variable as endogenous.[23] The results, in table 6.7, are consistent with their predecessors. Reversals are more likely in countries that had been running large external deficits in the immediately preceding period and where growth was slow. They continue to cause significant output losses, although output begins bouncing back relatively quickly.

In sum, the results here suggest that the gold standard period was different: current account reversals were less frequent and smaller than they have become subsequently, although when they did occur their output effects could be substantial. The years since 1972 do not compare unfavorably in these respects with the 1920s and 1930s; if anything, the opposite is true. But reversals today are more frequent and larger than they were before 1914. Obvious measures of country characteristics and global economic conditions do not seem to account for this difference. This motivates us to look more closely at a number of episodes of sharp current account reversals before 1913 to see whether this can help us to understand better what is going on.

6.6 Case Studies

In this section we consider three prominent pre-1914 current account reversals: Argentina in 1889 to 1890, Australia in 1891 to 1892, and Brazil in 1896 to 1897.

6.6.1 Argentina 1889 to 1890

The 1880s was a golden decade for Argentina. The wool and wheat producers of the pampas were integrated into world markets by the construc-

23. In the first stage, probit estimates of the treatment equation are obtained. From these estimates a hazard is then computed. In the second stage, the hazard is included in the estimation of the outcome equation. This augmented outcome equation lets us get consistent estimates of the regression disturbance term.

Table 6.7 **Causes and effects of current account reversals: Two-step estimates**

	(1)	(2)	(3)
	Growth regression		
Initial Log GDP per capita	–0.459***	–0.483***	–0.535***
	(0.136)	(0.136)	(0.135)
Population growth	0.564***	0.539***	0.450***
	(0.100)	(0.101)	(0.100)
Fiscal surplus/GDP	0.114***	0.112***	0.113***
	(0.024)	(0.024)	(0.024)
Peg	0.313	0.329	0.305
	(0.243)	(0.244)	(0.242)
Capital controls	0.702***	0.653***	0.654***
	(0.237)	(0.237)	(0.235)
Reversal	–4.825***	–5.700***	–6.022***
	(1.095)	(1.139)	(1.137)
Lagged Reversal		1.147***	0.562
		(0.335)	(0.391)
Lagged (2) Reversal			0.878***
			(0.335)
	Determinants of reversal		
Trade balance/GDP	–0.033***	–0.032***	–0.031***
	(0.005)	(0.005)	(0.005)
Growth	–0.022***	–0.024***	–0.023***
	(0.009)	(0.009)	(0.009)
Money/Reserves	–0.009*	–0.009*	–0.009*
	(0.005)	(0.005)	(0.005)
Prewar Dummy	–0.591***	–0.572***	–0.566***
	(0.118)	(0.119)	(0.120)
Interwar Dummy	–0.053	–0.046	–0.052
	(0.115)	(0.115)	(0.115)
Bretton Woods Dummy	–0.726***	–0.717***	–0.741***
	(0.107)	(0.108)	(0.109)
Lambda	2.164***	2.282***	2.490***
	(0.649)	(0.666)	(0.665)
No. of observations	1,919	1,890	1,855

Source: See text.

tion of ports and railways.[24] Argentina already had 2,500 kilometers of railroad track in 1880, and its ample endowment of productive land promised the traffic to support many more. Labor arrived in abundance; slow growth in Europe, depressed conditions in that continent's agrarian economies, and cheap international passenger rates combined to encourage more than 1 million immigrant arrivals between 1880 and 1890. (Argentine government propaganda and subsidies for travel costs did not hurt.) While only some two-thirds of these immigrants settled permanently, this was a

24. Wheat was first exported in 1878.

very large increase in labor supply for a country with an 1880 population of only 2 million.

Britons in particular were galvanized by the attractions of investment in this economy: new capital calls in London on behalf of the country rose from little more than £.5 million a year between 1875 and 1880 to nearly £5 million a year between 1881 and 1885 and then £17.5 million annually between 1886 and 1890.[25] The British lent for railway construction, for the improvement of port facilities, for the development of urban infrastructure (most of the immigrants of the 1880s settling in the cities), and for the system of ranches and meatpacking plants that allowed the exportation of canned and, eventually, chilled beef. They were active participants in the real estate, securities market, and banking booms of the period, and they lent extensively to politically connected provisional mortgage banks.

While domestic and foreign economic events go some way toward explaining these developments, their timing cannot be understood without reference to the political consolidation that occurred in Argentina in the 1880s. This was the period when the central state, bolstered by recent military victories, asserted its authority over the provinces and the economy. The rebellion of the province of Buenos Aires was defeated in 1880, and the city was transformed into the federal capital. The state then established dominion over the regions inhabited by indigenous peoples. The territorial limits of the nation were, for the first time, clearly defined. Starting in 1880 a new institutional framework was created based on strong presidential power, checks and balances exercised by the congress, and prohibition of presidential reelection. A uniform national money was finally established. Basic fiscal, administrative, and judicial powers were defined (Botana 1997). Although Romero (2002) remarks that some of these powers were more notional than real, it is clear that this picture did much to enhance investor confidence in the administrative capacity of the state. And this, in turn, facilitated foreign finance for Argentina's twin deficits.

Thus, the growth of the current account deficit in the 1880s resulted from a combination of domestic economic and political factors. Investment was encouraged by the exceptional commercial opportunities afforded by a period of geographical expansion, integration into world markets, large-scale immigration, and political consolidation; meanwhile, the working-age population was increasingly dominated by recent immigrants as yet in no position to support high savings rates. The central government reinforced the disparity by undertaking public investment projects while running deficits. For better or worse, the consolidation of the state in the 1880s and the extensive guarantees provided for private investment (investments in railways in particular) encouraged foreigners to help finance the differ-

25. This is from Stone (1999), table 3. British investment accounted for the majority but certainly not the entirety of European investment in Argentina in this period; see Ford (1962).

ence.[26] Not least among the beneficiaries was the government itself, which could borrow abroad in order to finance public spending on projects that benefited its clients. Cronyism similarly prevailed in the provinces, whose governments used provincial banks to contract foreign loans and use the proceeds to extend credit to the provincial government.

Maintenance of this fragile equilibrium depended on two conditions. First, there was a considerable gestation period between the initial investment in export-oriented infrastructure and the coming on line of exports. Keeping current in the interim on short-run–debt-service obligations hinged on the willingness of foreign investors to provide a steady stream of bridge finance. Between 1885 and 1890, as Ford (1962, 87) observes, "to some considerable extent foreign borrowings were employed in paying service charges on previous foreign loans . . ." One potential explanation for why current account reversals were smaller and less frequent than in subsequent periods is that current account deficits reflected high levels of export-oriented infrastructure investment—that is, foreign capital was devoted to uses that generated additional export revenues that could be used to make debt service payments in the normal course of events (see Feis 1930; Fishlow 1986; and the preceding discussion). Analysis of the Argentine case suggests that this factor may be subject to exaggeration. Natural complementarities there may have been, but gestation periods were long.

Second, this happy equilibrium hinged on the credibility of the government's commitments. Paying out on its guarantees required a healthy rise in public-sector revenues; here the gestation period between the initial investment projects and the induced rise in economic activity again posed a problem. Insofar as some of the projects that the government guaranteed were of low quality—they were likely to neither pay for themselves nor to induce an increase in revenues through other channels—the authorities might find themselves unable to uphold their part of the bargain. At that point, capital inflows might dry up, forcing the current account deficit to be compressed.

Thus, the Argentine episode displays many of the characteristics identified in the preceding analyses as raising the likelihood of current account reversals and heightening their output effects, prominent among them large budget and current account deficits in the run-up to the event. In addition, explanations for the Argentine crisis in this period invoke two factors also emphasized in modern studies that do not show up in other gold standard era reversals: tight credit conditions and slowing growth in the center. The importing country on which Argentina depended most heavily, Great Britain, experienced a cyclical peak in 1885, and its economy remained officially in recession through 1889 (the latter being the conven-

26. Money finance contributed also, Argentina having gone off the gold standard in 1884.

tionally dated business cycle trough). This made growing Argentine exports more difficult. At the same time, the stability of British savings rates and, hence, the inverse fluctuation of home and foreign investment (Cairncross 1953) meant that ample British capital was available to Argentina and other contemporary emerging markets from the middle of the decade.

But these same relationships rendered Argentina vulnerable to a decline in the availability of finance when British growth began to accelerate and investment picked up starting in 1889 and when the Bank of England began raising rates. Overall, the 1880s was a decade of low interest rates, reflecting relatively weak investment demand in Europe. Goshen's 1888 debt conversion took advantage of this fact and put further downward pressure on yields. Low interest rates encouraged investors to look abroad for higher yields. As Bailey (1959, 272) put it, London and Edinburgh were soon "honeycombed with agencies" for collecting money for overseas investments. But in 1889, the cyclical trough had passed, and British activity began to accelerate. The Bank of England ratcheted up its discount rate sharply, from 2.5 to 6 percent over the second half of the year. It is not surprising that this led to a decline in new issues in London on behalf of Argentina and made it difficult for Barings to place the Buenos Aires Water Supply and Drainage Loan. Foreign financial factors clearly played a role in this current account reversal, although it can perhaps be argued that it would have occurred with or without sharp changes in the Bank of England's discount rate.[27]

With the failure of the Buenos Aires waterworks loan and the distress experienced by Barings, lending to Argentina ground to a halt. Reversing the current account balance was painful when the prior deficit was so large and the government budget was in deficit. Successive governments struggled, with little success, to balance the budget through a combination of tax increases and expenditure reductions and thereby limit the need for monetization and inflation. The need to compress imports in order to facilitate current account adjustment further complicated this task as import duties were the single most import source of revenues for the federal government. Moreover, compressing imports by 50 percent in 1891 and then boosting exports required sharp depreciation of the real exchange rate, which further eroded domestic living standards and depressed consumption. Real GDP contracted by 4 percent in 1890 and by a further 11 percent in 1891 before bouncing back to +9 percent in 1892 and +5 percent in 1893. Thus, by the end of 1893, output was roughly back up to where it had been in 1889.[28] Still, this was a large output drop by the standards of contemporary current account reversals, reflecting the unfavorable initial conditions.

27. Given its prominence in this case, just why the British discount rate does not show up more generally in our regressions explaining the incidence of current account reversals remains something of a mystery.

28. Living standards and imports in particular remained below earlier levels, however (Argentine imports not again reaching 1889 levels until 1904).

On the other hand, this was not an exceptionally long recession; that growth was again positive little more than two years after the reversal was not atypical.[29] Historians point to a number of factors helping to avert a more extended recession. Argentina avoided having to compress demand still more sharply and to move the current account into surplus even further by restructuring its debt, first suspending payments, then obtaining a bridge loan through the Rothschild Committee sufficient to finance the federal government's debt service for three years, securing a reduction of debt service and holiday on amortization payments, and finally assuming the provincial debt at less than 60 percent of its face value.[30] As a region of overseas European settlement dominated by recent immigrant arrivals, labor exhibited an unusual degree of intersectoral mobility, moving smoothly from the production of nontraded to traded goods in response to the depreciation of the real exchange rate.[31] World demand conditions were favorable; export prices rose over much of the 1890s, and there was a positive technology shock with the coming on line of large scale exports of chilled beef.[32] Some of these factors are policies that governments might attempt to pursue in order to cope with current account reversals. But others reflect factors having to do with the structure of markets and the development of technology over which they have little control.

6.6.2 Brazil 1896 to 1897

Brazil's reversal took place later than Argentina's, although it was affected by the same global economic and financial developments. Between 1886 and 1890, Brazil imported only about 40 percent as much British capital as Argentina, despite enjoying the same low global interest rates. In part, this reflected the prevailing commitment to fiscal orthodoxy and the desire to restore the milreis to its official 1846 par; this more conservative fiscal stance limited the magnitude of the subsequent twin deficits. In part the difference reflected the fact that Brazilian publicity and propaganda were less effective. It took the abolition of slavery in 1888 and the end of the monarchy in 1889 to really put the country on the radar screen of international investors.[33]

As in Argentina, the government then used fiscal largess to buy and main-

29. Fishlow (1989a, 90) observes that "the data on railway receipts are suggestive of a less severe and prolonged downturn than other peripheral economies experienced during the 1890s."

30. Perhaps not too much should be claimed of this factor, for these negotiations took many years to complete and were a pervasive source of demoralizing financial uncertainty while still underway.

31. Fishlow (1989a,b) emphasizes labor market flexibility as a factor in adjustment.

32. While Cardoso (1989) emphasizes this factor in explaining Argentina's recovery from the 1890 to 1892 crisis, in reality it comes a bit late to explain the questions at hand here (Argentina exports of chilled beef rise to significant levels only in the second half of the 1890s).

33. To be sure, British investors had preferred Brazil earlier in the nineteenth century, but not in the 1880s.

tain the political support of the military and the provinces. In the Brazilian case there was also the fact that the abolition of slavery imposed financial losses on powerful agricultural interests. The latter sought preferential access to cheap credit to compensate for the capital losses suffered as a result of emancipation.[34] Thus, following the proclamation of the republic in 1889, domestic interest rates were kept low and the exchange rate was allowed to depreciate. Sauce for the goose being sauce for the gander, financial preferences were extended to industry as well. The speculative boom that resulted from the ample provision of credit, financed partly by domestic money creation and partly by foreign borrowing, is known in the Brazilian literature as the *Encilhamento.* So soon after the abolition of slavery, and with continuing political uncertainty, domestic conditions were not conducive to high domestic savings rates. The investment encouraged by the ample availability of credit thus bequeathed chronic current account deficits.

It is striking, given the recent literature on contagion, that Brazil did not experience a current account reversal, as we measure the phenomenon, at this time. As Cardoso and Dornbusch (1989) note, negative financial spillovers from Argentina to Brazil were limited. Part of the explanation, for this as for many things Brazilian, is coffee prices, which strengthened from 1890. But another part may lie in the fact that Brazil satisfies less well the leading indicators of vulnerability to a current account reversal. While current account deficits were chronic, they were not allowed to widen to the same extent as in Argentina; Brazil was never the darling of foreign investors to the same extent. Although the commitment to fiscal orthodoxy weakened after the 1880s, the legacy lived on; budget deficits were never allowed to explode as they did in Argentina. Less pressure of demand meant less tendency toward overvaluation, which further slowed the development of a patently unsustainable external position. As a result, the country retained limited capital market access: Brazil was able to contract new loans in London, most prominently in 1893 and 1895 but also a short-term advance in 1896.

In this manner Brazil staggered into the second half of the 1890s. Limited capital market access to finance ongoing deficits allowed the debt to continue rising, which inevitably contributed to growing unease on the part of foreign investors. After 1893, coffee prices weakened, bringing the situation to a head. By 1896 funding for the current account deficit had dried up. The trade balance swung from a deficit of a bit less than 1 percent of GDP to a surplus of more than 5 percent, reflecting the magnitude of ongoing debt service obligations. Like Argentina before it, Brazil now secured a funding loan from its London bankers, in this case sufficient to cover the central government's interest payments for three years. In addition, amortization obligations were suspended for thirteen years. Fishlow (1989b) notes that because the effective debt write-down was less than in

34. See Fishlow (1989b, 22–23).

Argentina (where the issue had been forced by the government's unilateral suspension of payments), reliance on internal adjustment measures was necessarily greater. The budgetary problem was addressed by raising tax rates and extending them to new products, imposing surcharges on customs duties, and renting the federal railways to private enterprises. The exchange rate was stabilized by withdrawing Treasury notes from circulation, as required by the conditions attached to the funding loan.

This sharp deflation, presided over by Finance Minister Joaquim Murtinho, sharply compressed domestic demand. Imports fell, partly owing to depressed demand but also due to the import surcharges, while more domestic production was freed up for export. Trade deficits gave way to ongoing surpluses, which grew larger after 1900. But the greater reliance in Brazil on deflationary adjustment measures also meant that the output effects of the reversal were as severe as in Argentina, notwithstanding the fact that prior conditions would have indicated a less severe recession. Adjustment took place mainly through the collapse of investment; the trade statistics show a sharp decline in imports of industrial equipment. National income estimates suggest that GDP declined by 10 percent in 1897 and 5 percent in 1898, mirroring the 1890 to 1891 contraction in Argentina, before stabilizing in 1899, and then beginning to grow again quite sharply starting in 1900, aided by strengthening coffee prices and the coming on line of rubber exports (although not soon enough to prevent a crisis in a banking system severely weakened by preceding events).

Thus, the Brazilian case is a reminder that the output effects of a current account reversal depend not just on inherited macroeconomic and financial conditions but also on how the reversal is managed.

6.6.3 Australia 1891 to 1892

In Australia, whose reversal was bracketed temporally by those of Argentina and Brazil, the government resorted to neither currency depreciation nor default. While many of the other circumstances surrounding this episode were similar to those in Argentina and Brazil, imperial identity meant that default and depreciation were essentially inconceivable. Even more than in Brazil, then, the burden of adjustment fell on the domestic economy. In Australia, GDP fell for four years running, from 1890 through 1893, not "just" two. The cumulative fall was on the order of 25 percent, not "just" 15. Unemployment rose sharply. Immigration slowed and tentatively reversed direction. Social disorder spread, led by protesting sheep shearers, dock workers, and miners. Post-1893 recovery, if it may be called that, was slow and uneven. A summary measure of the severity of the consequent recession is the comparison with Argentina: whereas Argentine real GDP doubled between 1890 and 1905 according to the conventional national income statistics, Australian GDP in 1905 was a mere 20 percent above what it had been a decade and a half before. This is especially impressive given that the absolute swing in the trade balance ratio, from –2.0 percent of GDP in the three prereversal years to +0.4 percent of GDP in the year of the event, was small by the standards of the other countries we are considering.

Australia had been experiencing an investment boom, based in substantial part on investment by nonresidents, off and on since the gold rushes of 1851. Much of this overseas finance was devoted to speculative assets, including pastoral and urban land. Like the government of Argentina, the governments of Queensland and New South Wales subsidized the fares of immigrants. Self-reinforcing capital and labor inflows fanned a speculative building boom. The urban land boom came to a head in the 1880s, fueled by rapid increases in mortgage lending by savings banks. As a share of GDP, bank credit (much of which was backed by foreign liabilities) doubled between 1880 and 1890. The majority of the increase went into residential construction as the rate of return on pastoral activities was declining and the 1880s was a decade of urbanization. Land and housing prices shot up in Melbourne in particular.

As in Argentina and Brazil, these developments were not unrelated to the activities of government, the individual colonial governments in particular. The Australian colonies competed with one another to attract both labor and capital, borrowing to build railways into the interior and providing urban amenities to appeal to recent settlers. As McLean (1996) puts it, many of these investment projects were based on overly optimistic assessments of the agricultural potential of the semiarid regions of the interior (reflecting temporarily favorable climatic conditions).[35] In the second half of the 1880s, they reflected the tendency for low interest rates in Britain to encourage relatively indiscriminate borrowing and lending. So long as growth prospects were rosy, government guarantees for the bonds underwriting the investments were credible. And, of course, these projects were associated with large current account deficits reflecting the propensity to import locomotives, steel rail, and a wide range of other investment goods.

The stop to lending that followed the Baring Crisis was more pronounced in Australia than in Brazil. Capital inflows fell from £20 million in 1888 to £l million in 1893. It is tempting to speculate that British investors were impressed by the similar resource endowments of the two pastoral economies and revised their expectations accordingly—although the fact that the curtailment of lending and current account reversal took place fully a year after the Baring Crisis is difficult to reconcile with this hypothesis. Given that "the imperial and Commonwealth tie" (in the language of Lindert and Morton [1989, 54]) closed off other options, harsh deflationary policies became the order of the day. There was no depreciation of the currency. Rather, relative prices had to adjust through a grinding downward move-

35. Very much the same syndrome, reflecting the same climatic conditions, was evident in the United States at this time.

ment of wages and costs. Demand was compressed by tight credit, which discouraged consumption and, in particular, investment. Capital formation fell from £34 million in 1888 to £16 million in 1892 and £9 million in 1893. State budgets were brought into rapid balance, further compressing demand. Despite the stop to borrowing, government debt as a share of GDP rose sharply with declining nominal income through the middle of the 1890s. Meanwhile, there was no relief from the interest burden like that obtained by Argentina (and no delay of amortization like that enjoyed by Brazil): debt service continued to account for nearly 10 percent of GDP. This meant that imports had to be compressed sharply. In contrast, exports were maintained at previous levels (unlike Argentina and Brazil, they did not rise significantly in the wake of the reversal, presumably reflecting the stagnation of the economy). Reflecting the impact of deflation, the export share rose from 20 to 28 percent of GDP in the first half of the 1890s.

The story would not be complete without reference to the drought that started in 1895, which nipped the economy's recovery in the bud. What coffee was to Brazil, wool was to Australia, and the drought of the mid-1890s had a devastating impact on the pastoral economy. Thus, climate and not simply policy may explain why recovery in Australia was so difficult and long in coming. However, drought was not an exclusively Australian phenomenon in the 1890s, so the decline in pastoral production was offset to an extent by strong prices. In addition, drought in 1895 cannot explain why the economy contracted so persistently and severely between 1890 and 1893. Here the fact that the domestic economy was forced to shoulder the entire burden of adjustment to the current account reversal cannot be denied.

6.7 Conclusion

In this paper we have presented some new facts and a mystery. The new facts concern the pre-1970 history of international capital flows and current account reversals. Analyzing a sample of countries with per capita GDPs at least 60 percent those of the lead country and measuring reversals in a consistent way, we find that the incidence of reversals has been unusually great in recent years. The only prior period that matched the last three decades in terms of the frequency and magnitude of reversals was the 1920s and 1930s, decades notorious for the instability of capital flows. In contrast, reversals were both less common and smaller in the Bretton Woods and pre-World War I gold standard eras.

That the Bretton Woods years were different is no surprise: capital controls were widespread and financial flows across borders were suppressed. Current account reversals were fewer because current account deficits were smaller, reflecting this limited finance. At the same time, when reversals did occur, their effects could be severe.

That reversals were relatively few and small before 1914 is striking, given the absence of impediments to capital flows and the large size of current account balances. This finding is clearly related to the much commented upon smooth operation of the prewar gold standard. Cross-country regressions and case studies alike suggest that the same observable characteristics of countries (large current account and budget deficits in the run-up, followed by negative shocks to growth at home and abroad) help to explain the incidence of reversals both before 1914 and after 1971. But controlling for these characteristics of countries and reversal periods does not make the contrast between the gold standard and recent years go away. Ultimately, why reversals were not more frequent and larger in the period of open capital markets a century ago is still a mystery. To put it another way that will be familiar to economic historians, the smooth operation of the classical gold standard remains to be explained.

It would be nice to be able to draw implications from this historical experience for prospects for the United States today—whether the United States is at risk of a disruptive reversal if foreign financing dries up abruptly. For a number of reasons, however, attempting to do so is problematic. First, there is the fact that the century of international economic history reviewed here does not provide another example of a country that is so large and important relative to the world economy running such a massive current account deficit.[36] All of the cases reviewed in section 6.6 are necessarily of small countries. Second, there is the fact that much of the difference in the incidence of reversals between the gold standard period and recent years cannot be explained by observable policy variables, as just emphasized. We do find in the larger historical sample a negative correlation between government budget deficits and the incidence of reversals, for example, suggesting that the smaller size of government, which implied a smaller response of deficit spending to capital inflows, made for less vulnerability to reversals—something that does not bode well for the United States. But the experience of East Asia in the first half of the 1990s reminds us that this is only one factor influencing susceptibility to sharp shifts in the direction of capital flows. And the more fundamental issue is that a significant portion of the difference in susceptibility to such shifts before 1913 is not explicable in terms of this and other observable policy variables. Third and finally, it is empirically difficult and analytically problematic to attempt to construct for the period before 1913 measures of institutional quality, which many observers think might shape the incidence of reversals. Political and social systems were different, standing in the way of simple comparisons of the effects of, inter alia, governmental turnover, the extent of encompassing coalitions, or the approach of elections. As the re-

36. This point is made in Eichengreen (2005) in a critique of previous attempts to draw implications for the United States of the experience of other countries.

maining chapters of this volume reveal, other investigators taking entirely different analytical approaches similarly find it difficult to agree whether an abrupt current account reversal is in the cards or whether there is still hope that the United States will be able to bring its current account deficit down to sustainable levels gradually and smoothly over time. It would be nice if it did, but history provides no simple answer to this question.

Appendix

Table 6A.1 **Countries in the sample**

1880–1914	1918–1939	1945–1971	1972–1998	
Argentina	Argentina	Argentina	Algeria	Romania
Australia	Australia	Australia	Argentina	Russia
Austria	Belgium	Austria	Australia	Seychelles
Brazil	Brazil	Belgium	Austria	Singapore
Canada	Canada	Brazil	Barbados	South Africa
Denmark	Denmark	Canada	Belgium	Spain
Finland	Finland	Denmark	Belize	Sweden
France	France	Egypt	Brazil	Switzerland
Germany	Germany	Finland	Canada	Thailand
Italy	Greece	France	Chile	Trinidad and Tobago
Japan	Italy	Germany	Colombia	Turkey
The Netherlands	Japan	Greece	Costa Rica	United Kingdom
Norway	The Netherlands	India	Denmark	United States
Portugal	Norway	Italy	Egypt	Uruguay
Spain	Portugal	Japan	Finland	Venezuela
Sweden	Spain	Mexico	Fiji	
Switzerland	Sweden	New Zealand	France	
United Kingdom	Switzerland	The Netherlands	Gabon	
United States	United Kingdom	Norway	Germany	
	United States	Portugal	Grenada	
		South Africa	Greece	
		Spain	Hungary	
		Sweden	Iceland	
		Switzerland	Ireland	
		Turkey	Iran	
		Uruguay	Israel	
		USSR	Italy	
		United Kingdom	Jamaica	
		United States	Japan	
			Jordan	
			Korea	
			Malaysia	
			Mexico	
			Malta	

Source: See text.

Table 6A.2 **Incidence of reversals: Gold standard and Interwar periods**

Country	Year	Country	Year
Argentina	1885	Argentina	1924
	1889		1926
	1898		1931
Australia	1891	Australia	1931
	1903	Belgium	1927
Brazil	1884	Brazil	1923
	1886		1929
	1897	Canada	1923
	1899		1932
Canada	1891	Denmark	1921
	1913		1925
Denmark	1886	Finland	1918
	1890		1929
	1901	France	1919
	1908	Germany	1928
Finland	1884	Greece	1930
	1892	Italy	1919
	1901		1931
	1913	Japan	1927
Germany	1913	The Netherlands	1921
Japan	1899		1932
	1901	Norway	1931
The Netherlands	1911		1931
Norway	1901	Portugal	1924
Sweden	1887	Spain	1925
	1891	Sweden	1922
	1910	Switzerland	1921
Switzerland	1892		1933
	1899	United Kingdom	1919
United States	1896		1932

Source: See text.

Note: These episodes list only the first year of successive-year reversals and exclude wartime reversals, using the REV1 definition.

Table 6A.3 Incidence of reversals: Bretton Woods and Post-Bretton Woods periods

Country	Year	Country	Year
Australia	1946	Algeria	1978
	1962		1989
	1970	Argentina	1976
Belgium	1950		1982
Denmark	1948	Austria	1981
	1954	Barbados	1973
Finland	1949		1982
	1951		1991
France	1948	Belgium	1983
	1959		1992
Germany	1952	Belize	1984
	1967		1995
Italy	1950	Brazil	1977
	1964		1981
Japan	1954	Canada	1982
The Netherlands	1949		1994
	1958	Chile	1974
	1967		1982
Norway	1950	Colombia	1973
	1964		1984
Sweden	1949	Costa Rica	1982
Switzerland	1949		1990
	1953		1994
	1965	Denmark	1991
United Kingdom	1948	Egypt	1982
Egypt	1987	New Zealand	1976
	1989		1986
Fiji	1973	Norway	1972
	1982		1977
Finland	1976		1989
	1983		1996
	1991	Oman	1978
Gabon	1973		1987
	1978	Panama	1976
	1988		1981
	1993	Portugal	1983
Germany	1985		1993
Greece	1986	Romania	1993
Grenada	1983	Singapore	1973
	1990		1975
	1994		1982
Hungary	1988		1992
Iceland	1983		1994
	1992	South Africa	1977
Ireland	1975		1983
	1982	Spain	1977
	1991		1984
Israel	1976	Sweden	1982

(*continued*)

Table 6A.3 (continued)

Country	Year	Country	Year
	1984		1992
Italy	1976	Switzerland	1973
	1992		1991
Jamaica	1977	Seychelles	1973
	1984		1983
	1992		1988
Japan	1976		1994
	1982	Thailand	1978
Jordan	1984		1986
	1992	Trinidad & Tobago	1973
Korea	1982		1985
Malaysia	1975		1987
	1984		1994
Malta	1973	United Kingdom	1976
	1986		1980
Mauritius	1981		1991
	1995	Uruguay	1982
Mexico	1981		1988
	1994	Venezuela	1973
	1982		1979
	1995		1988
The Netherlands	1980		1994
	1989		

Source: See text.

Note: These episodes list only the first year of successive-year reversals and exclude wartime reversals, using the REV1 definition.

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Comment Frederic S. Mishkin

This conference is focusing on one of the hot topics facing economic policymakers today: when you see a large current account deficit like the one we are currently facing in the United States, should you get nervous about a reversal? Specifically, how costly in terms of output losses might a current account reversal be? The excellent paper by Adalet and Eichengreen takes a first cut at the historical data to find some answers to these questions.

What do Adalet and Eichengreen find? First, they find that current account reversals are smaller, less frequent, and are followed by smaller output losses in the gold standard period. This result remains true controlling for the size of the initial current account deficit, overvaluation of the exchange rate, or the state of the global economy. Second, the interwar period has frequent reversals with high output costs. Third, the Bretton Woods period has few current account reversals that tend to be small but

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that have high output costs. Fourth, in the most recent period, current account reversals have been frequent, but they tend to have low output costs.

The documentation of these facts in the historical data are worthwhile, and Adalet and Eichengreen are to be commended for producing them. However, we have to ask what we have learned from these results? Do they help us answer the questions posed in this paper and in this conference? I am not sure. The basic problem is that without more theory to motivate the empirical findings, I find it very difficult to assess what these results mean. This is not meant to be a criticism of Adalet and Eichengreen's paper because they acknowledge this problem and do not overstate their conclusions. Let me outline what concerns I have about interpreting their results and why they do not provide answers to the basic questions the paper focuses on.

The first problem that I have with the results is that they focus on output losses. When I think about the cost of current account reversals, I suspect that information about consumption declines would be more informative than output declines. To see this, let me propose the following thought experiment. Suppose that a country has a large current account deficit because the country has excellent investment opportunities, but then these investment opportunities recede. As a result of more limited investment opportunities, investment spending would fall, and this would lead to a decline in output. However, it is not at all clear that consumption would fall in this situation. Indeed, the scenario I have been describing is one in which there is no welfare loss from the current account reversal so that the reversal should not be considered as costly despite the fact that output falls thereafter.

On the other hand, if the current account reversal is followed not only by a decline in output, but also by a fall in consumption, it would be far more likely that a welfare loss has occurred. It is not that I think that examining what happens to output after a reversal is uninteresting, but I think what happens to consumption would tell us more about whether we should worry about current account reversals. Adalet and Eichengreen may have looked only at output losses because consumption data is harder to come by, but nevertheless we should be cautious in interpreting their results as telling us when current account reversals are costly.

The second problem I have with interpreting the results in this paper is that the empirical analysis does not look at or give us a clue as to what the source of the initial current account deficits is. If a current account deficit occurs because of productive investments, a reversal may be less likely to happen, and if it does occur, it would be less likely to be harmful. In this case, the current account deficit reflects welfare enhancing behavior because the capital inflow has enabled productive investment to take place that would have not occurred otherwise. Because periods of productive investment are probably quite persistent, a sharp reversal would be unlikely.

Furthermore, when the reversal occurs because investment is no longer as productive, the economy may turn down, but this is not due to the reversal but rather to the decline in investment opportunities, which is certainly not caused by the reversal. If the empirical analysis told us more about the source of the initial current account deficits and why the reversal occurs, we might be able to get a better handle on when reversals are more likely to occur and whether the reversal actually tells us that the initial deficit and later reversal has been bad for the economy.

The third problem with the empirical work is that it does not take into account the state of the financial system before the reversal occurs. I actually found this surprising because of the excellent and prolific historical work that Barry Eichengreen has done on financial crises. When you look at the historical record, the nastiest current account reversals occur when the financial system is initially weak. Recent examples are the current account reversals in Chile in 1982 to 1983, Mexico in 1994 to 1995, and East Asia in 1997 to 1998. Weak financial sectors often lead to high current account deficits as I document in a recent book I am working on (Mishkin 2006). With inadequate prudential regulation and supervision and a government safety net for the banking sector, banks have incentives to borrow funds from abroad and use them to make very risky loans. If the loans pay off, the banks do well, and if they do not, the taxpayer foots the bill because he or she pays for the bailout of the banking system. The resulting increased risk taking on the part of banks eventually leads to many bad loans and a deterioration of bank balance sheets. If the deterioration is bad enough it can lead to a financial crisis in which lending collapses, not only by domestic financial institutions but also by foreign institutions. The result is that investment collapses, the economy goes into a recession or a depression, and the current account deficit reverses when foreigners (and domestic residents) pull their money out of the economy. In this situation, it is the weak financial sector that leads to the financial crisis that devastates the economy and also produces the sharp current account reversal. Knowing the state of the financial sector when there is an initial current account deficit should thus tell us a lot about whether a reversal is likely and, if it occurs, whether it will be associated with a sharp decline in output.

The theoretical and empirical work on what causes financial crises in emerging market countries also tells us that an important initial condition that we should be looking at when there is a current account deficit is whether there is substantial liability dollarization: that is, a debt structure in which borrowing is predominantly denominated in foreign currencies. Liability dollarization makes an emerging market economy financially very fragile because a current account reversal that is likely to be accompanied by a decline in the value of the currency blows up balance sheets. When the currency depreciates, the value of the foreign-denominated debt goes up in domestic currency terms. Because many of the firms that are borrowing are in nontradable sectors and so have the value of the goods they produce and therefore their assets priced in domestic currency, the depreciation does not raise asset values while it does cause liabilities to rise. The outcome of a current account reversal when there is liability dollarization is then more likely to be a financial crisis and a sharp contraction in economic activity. The empirical analysis in the paper does not control for the degree of liability dollarization, which could provide a lot of information about whether a current account reversal will be costly and even whether it might be more likely to occur.

My bottom line on the paper is that it does provide useful facts. It does demonstrate the important result that not all current account reversals are harmful. A current account deficit by itself should not scare us, but if it is occurring for the wrong reasons, then we indeed should be very nervous about it.

The paper also points out a mystery. The gold standard period is pretty benign: there are fewer current account reversals, and when they occur they are associated with low output costs. Why? With more theoretical grounding to the empirical analysis, maybe we can solve this mystery. Furthermore, with more theory and better control variables, we might be better able to assess how bad current account reversals are likely to be and whether they are a big problem.

It also is worth pointing out that this paper cannot not tell us much about what is on everyone's mind in a conference like this one. How much should we worry about the huge current account deficits in the United States that we are seeing lately? The empirical analysis in the paper lumps emerging market countries and industrialized countries together. Comparing advanced countries like the United States or those in western Europe with emerging market countries like Brazil, Argentina, Korea, or Indonesia is like comparing apples and oranges. The institutional framework and debt structure in emerging market countries is completely different from advanced countries, something that I have emphasized in much of my work on emerging market countries. Thus, we would expect that their experiences with current account reversals would be likely to be very different. If we want to understand whether we in the United States are in danger from our current account deficits, looking at samples that include emerging market countries but do not control for the type of country may not be very helpful.

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7

Understanding the U.S. Trade Deficit
A Disaggregated Perspective

Catherine L. Mann and Katharina Plück

7.1 Introduction

By late 2005, U.S. net trade had been in deficit for more than twenty-five years and was on a trajectory for more than $700 billion for the year. In dollar terms, this was the largest deficit of any country ever; as a share of gross domestic product (GDP), it was much larger than ever experienced by a large industrial country. Pundits, policymakers, financiers, and researchers wanted to know how the trade deficit got so large. They were even more interested in its future path.

Empirical modeling of the determinants of trade flows using the elasticities approach has a very long history in international economics and is used both to explain the past and to project the future. Key ingredients of this model are the elasticity of demand for exports and imports with respect to economic activity, the elasticity of exports and imports with respect to relative prices, and the influence of other factors, for example, global supply and increased product variety.

Given that so much work has already been done, has U.S. trade changed so as to warrant more analysis in this vein? An examination of U.S. trade patterns over the last twenty-five years finds that the commodity and country composition of trade have changed, particularly for imports. A changing country and commodity composition of trade may be particularly important to understand both the widening of the trade deficit and its future trajectory. Country composition may affect comparative advantage as new global supply comes on line and new trading partners appear and because

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differences in exchange rate regimes across countries may affect movements of relative prices. Commodity composition may matter because of different products may have differences in relative price elasticities. In addition, for both country and commodity composition, differences in growth rates of different categories of expenditure (particularly as reflected in persistent and systematic deviation between production and absorption) in the United States compared with that of U.S. trading partners could be particularly important in explaining the dynamics of U.S. trade and the deficit.

This paper considers whether measures of economic activity other than GDP better model observed trade flows. It investigates whether income and relative price elasticities of U.S. trade differ by trading partner or commodity category. It asks whether new estimates of key parameters improve the forecast performance of the trade equations. Our strategy creates a database of bilateral trade data for thirty-one countries, aggregates these detailed flows into four categories of goods based on the Bureau of Economic Analysis's (BEA) end-use classification system—autos; industrial supplies and materials, excluding energy (ISM-ex); consumer goods; and capital goods. We employ trade prices and measures of expenditure that match these four commodity categories and include a country-by-commodity proxy for global supply-cum-variety.

We find that using expenditure matched by commodity category is a superior measure of economic activity compared with using GDP and yields far more plausible values for the demand elasticities. We find that the demand and relative price elasticities differ between industrial and developing countries and across the four commodity categories. Because the commodity composition of trade and of trading partners has changed, particularly for imports, we find that the demand elasticity for imports is not constant. We find that industrial and developing countries have different demand and relative price elasticities for these four commodity categories. We find that variety is an important variable for the behavior of capital goods trade.

Comparing the in-sample performance of our specification—which disaggregates by product group, uses matched expenditure and trade prices, adds a variable for variety, and differentiates by trading partners' level of income into industrial and developing country groups—with that of the standard formulation of the model—which uses aggregated trade data and GDP as the expenditure variable—our disaggregated model predicts exports better in-sample but does not predict imports as well as the standard formulation. Auto trade and consumer goods imports are least well explained in-sample by the disaggregated model; in-sample predictions of exports in each commodity category (consumer goods, autos, ISM-ex, capital goods) are superior than the predictions from the standard model.

The new elasticities yield insights into the sources of the widening of the

U.S. trade deficit and have implications going forward for policymakers' approach to demand management and exchange rate regimes to rectify global trade imbalances. With respect to demand management, these newly estimated demand elasticities across commodity categories and trading partners imply that if U.S. consumers *saved more,* this would be a more important factor to change the trajectory of the trade deficit than if our trading partners *grew more.* With respect to exchange rate regimes, the estimated relative price elasticities for industrial countries imply that the dollar depreciation since 2002 should affect trade with those countries, but that significantly greater exchange rate variation on the part of developing countries as well is needed to appreciably narrow the U.S. trade deficit.

Section 7.2 of the paper briefly reviews the vast literature on modeling U.S. international trade, focusing on the workhorse model of income and relative prices, including its more recent variations that include proxies for global supply and variety. Section 7.3 presents and discusses data on the U.S. trade deficit that show changes in country and commodity composition of trade, which initiated this investigation. Section 7.4 discusses our newly constructed data. Section 7.5 presents the econometric approach. Section 7.6 discusses results and summarizes findings. Section 7.7 presents some implications and notes areas for further work.

7.2 Literature Review

The classic workhorse model for estimating trade elasticities has been used since at least the 1940s (Adler 1945, 1946; Chang 1945–1946). It relates the volume of exports or imports to real foreign and domestic income and relative prices (in log form):

$$\ln \text{trade} = \alpha + \beta_1 \ln \text{income} + \beta_2 \ln \text{rel.price}.$$

The model assumes that domestic and foreign tradable goods are imperfect substitutes, that price homogeneity holds (e.g., that an estimated coefficient on the trade price and domestic price are equal, thus allowing for a single relative price term), and that the elasticities with respect to economic activity (e.g., income) and relative prices are constant over time (see Hooper, Johnson, and Marquez [2000] for a concise summary of the model).

All studies find—as expected—that an increase in domestic economic activity (income) will raise the domestic demand for imports and that an increase in foreign economic activity (income) will raise the foreign demand for domestic exports. A rise in the relative price of imports to the domestic substitute will reduce demand for imports, and a rise in the relative price of a country's export good to the foreign competing good will dampen the demand for exports.

The sizes of the coefficients on income and relative price vary greatly by study, time period, countries analyzed, coverage of commodity groups, and as to whether different or additional explanatory variables are in the model. Most studies estimate that the income elasticity for U.S. exports is smaller than the income elasticity for U.S. imports and in this regard replicate the earliest and most well-known finding by H. S. Houthakker and Stephen Magee (1969). Subsequent studies often estimate higher export and import elasticities than the original findings but surprisingly find that the *ratio* of the import to export elasticity varies relatively little from the 1.7 found by Houthakker and Magee.[1]

Despite the empirical persistence of this asymmetry and its concomitant value for intermediate-term projections of U.S. trade flows, it is not consistent with global long-run equilibrium. The estimates imply that if the United States and the rest of the world grow at the same pace (long-run convergence), the U.S. trade deficit would worsen, absent a trend change in relative price[2]—which is also inconsistent with long-run equilibrium. Researchers continue to investigate U.S. trade flows and the Houthakker-Magee asymmetry by examining different data samples, considering more precise measures for certain variables, employing different estimation techniques, and adding new independent variables to the basic Houthakker and Magee specification.

One approach to the Houthakker-Magee asymmetry is to evaluate whether changes in the commodity composition of U.S. trade over the past twenty-five years changes the elasticities. For example, researchers have found different income and price elasticities for different product categories (see Stone [1979] and Marquez [2002] for different goods categories; see Sawyer and Sprinkle [1996] for a survey; see Deardorff, Humans, Stern, and Xiang [2001] and Mann [2004] for services). Hooper, Johnson, and Marquez (2000) cannot reject the hypothesis that the U.S. trade elasticities are constant over time, but they hold the country composition of trade fixed at the 1995 shares and, because of data availability and the objective of the study, focus on industrial-country trade. On the other hand, using a

1. Houthakker and Magee (1969) estimated the U.S. income elasticity for total imports of 1.7 (autocorrelation corrected estimate in the appendix) and the foreign income elasticity for U.S. exports at around 1. In their survey of import and export demand elasticities for the United States, Sawyer and Sprinkle (1996) find income elasticities for total merchandise imports ranging from 0.1322 (Welsch 1987) to 4.028 (Wilson and Takacs 1979). Estimates for foreign income elasticities for U.S. exports do not vary quite as much; still they range from 0.374 (Stern, Baum, and Greene 1979) to 2.151 (Wilson and Takacs 1979). The median (mean) estimate of the twenty-four studies on total U.S. imports referenced in Sawyer and Sprinkle is 2.02 (2.14). The median (mean) estimate of the seventeen studies on total U.S. merchandise exports referenced in Sawyer and Sprinkle is 1.12 (1.02). In one of the more recent studies, Hooper, Johnson, and Marquez (2000) find that the long-run income elasticities for U.S. exports and imports are 0.8 and 1.8, respectively, and are stable over time. See also discussion in Mann (1999, 123–26).

2. Krugman and Baldwin (1987), among others, make this observation and discuss implications.

century of data, Marquez (1999) finds that the elasticity with respect to income for U.S. imports varies over time as trade openness affects the share of imports in expenditure.

Researchers have also focused on "the notorious inadequacies of import and export price indexes" (Houthakker and Magee 1969, 112). Relative price measures used most often to proxy for domestic substitutes for the traded product—the GDP deflator and the wholesale price index—introduce bias because both include a considerable share of nontraded goods (Goldstein and Khan 1985). Moreover, conventional price indexes for traded goods are too aggregated to reflect new product introductions and may not take account of the effect of changes in global supply on prices and therefore on demand, which apparently have been important features of current data.[3] Incorporating different price indexes changes the estimated income elasticities in the workhorse model. In a narrow investigation, Feenstra's (1994) detailed work on prices of six narrowly defined manufacturing goods substantially reduced the estimated income elasticity of U.S. import demand for these six products.[4] Marquez (2002) constructs a relative price variable using Feenstra's price-index methodology and also includes a type of relative capital stock term originally used in Helkie and Hooper (1988); his estimation reduced income elasticities for U.S. imports of producer goods, but not of services or consumer goods.

Constructing new price indexes is outside the scope of most empirical work, so researchers have focused on putting auxiliary variables in the standard regression to account for changes to supply and demand that may not be incorporated into price indexes. The sign and size of any such supply-cum-variety variables is not clear. If new trading countries simply increase global supply, global prices would tend to fall and thus increase demand for their exports. But according to Paul Krugman's (1989) "45-degree rule,"[5] such fast-growing countries produce more varieties with in-

3. Broda and Weinstein (2004) show that between 1972 and 2002 the number of varieties imported by the United States increased by 252 percent (15), with an important source of the new varieties being the entry into global trade of dynamic emerging-market economies including China, Taiwan, Korea, India, and Mexico. Hummels and Klenow (2004) find that as countries industrialize and grow, not only do their exports increase in nominal value but also the breadth of variety these countries offer to the world widens. Schott (2004) shows that varieties within a product set differ systematically across countries, with higher unit-value varieties coming from countries with higher productivity. See also Funke and Ruhwedel (2001).

4. Feenstra considers imports of men's leather athletic shoes, men's and boys' cotton knit shirts, stainless steel bars, carbon steel sheets, color television receivers, and portable typewriters, and, for comparison purposes, gold and silver bullion between 1967 and 1987. He treats as variety a good from a particular country (often termed the *Armington assumption*) and calculates each variety's share in actual U.S. expenditure and the U.S. elasticity of substitution between those different varieties. This method takes account of the new varieties produced (in this case, equivalently new trading partners) and exported in ever greater quantities by developing countries, for example.

5. It is called the "45-degree rule" because the growth rates and the ratio of export to import income elasticities for countries can be plotted as a 45-degree line between two axes.

creasing returns to scale and should not experience a deterioration of their trade balance (and therefore face steady depreciation of their currency) because consumers love varieties. Given income, the apparent demand curve for the varieties shifts out, and there is no deterioration in the terms of trade. Peter Schott (2004) finds that fast-growing countries with high productivity growth produce varieties that are high unit value, so for them the demand curve is not only shifting out but also tilting in their favor.

The classic workhorse model (of equation [1]) using the standard complement of income and relative prices may not take account of the effect that trading partners' supply or variety of exports have had on U.S. import prices or import demand. The U.S. import elasticity would tend to be overestimated to the extent that some of the explanation for the rising share of imports in U.S. GDP lies with increased foreign supply (and thus lower prices and thus more demand for imports); and some of the explanation comes from increased domestic taste for variety, holding income constant. Researchers have implemented the global supply-cum-variety measure using several variables.

- Helkie and Hooper (1988) use the ratio of home to foreign productive capital stocks to represent exporters' increased capacity to supply more new products to the U.S. market. Their new variable significantly reduced the inequality between income elasticities for U.S. imports and exports for the time period of their estimation. But in later work using more recent data, the variable is no longer econometrically significant.
- Bayoumi (1999) includes exporters' GDP in a panel estimation for trade flows between 21 industrial countries. He finds that this supply effect is significant and increases in the longer run;[6] the importer's estimated income elasticity decreases over time.
- Marquez (2002) considers immigration as a proxy for American consumers' tastes for varieties from abroad. With a growing share of immigrants in the population, he posits that U.S. demand for imports from immigrants' home countries must be higher, all other things held equal. Including the immigration variable does reduce the estimated U.S. income elasticities for services and consumer goods imports.
- Gagnon, in three recent papers (2003a,b, 2004), finds a significant supply effect (defined as potential output growth or relative GDP of the exporting country). Including this supply variable reduces the coefficient on income in a U.S. import regression. His results for U.S. exports are less robust.

6. The fact that the coefficient on exporters' output increases with increasing lags shows that it is the exporting countries' potential growth that determines its capacity to supply variety, not short-run fluctuations in growth rates.

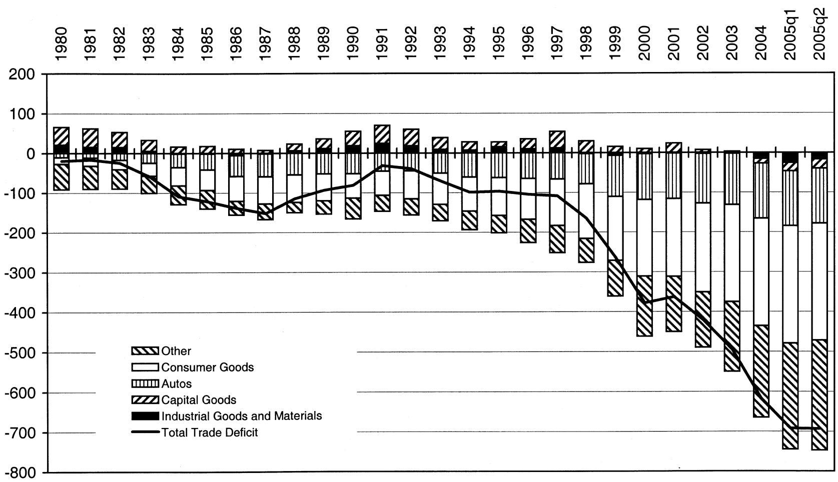

Fig. 7.1 U.S. trade balance by principal end-use categories, billions of U.S. dollars
Source: Bureau of Economic Analysis, International Transactions Accounts Data.

- Similarly, Cline (forthcoming) puts the trading-partner GDP into the workhorse model and finds that it reduces the income elasticities in U.S. trade equations for both exports and imports.

To summarize, considering changes in trading partners and commodity composition of trade, using more disaggregated trade prices, and taking better account of global supply or demand for variety are the predominant directions of the research to date. We will continue in these directions and also investigate the income variable itself, collecting data that better matches this variable to the disaggregated commodity and country composition of trade. So there are five dimensions for our analysis: trading partner, composition of trade, variety-cum-global supply, measures of economic activity, and trade prices.

7.3 Graphical Evidence to Support a Disaggregated Approach

Figure 7.1 and table 7.1 display the *commodity decomposition* of U.S. merchandise trade and are key spurs to this investigation.[7] Figure 7.1 shows the U.S. trade deficit disaggregated into the BEA's end-use categories of capital goods, ISM-ex, consumer goods, and autos and auto parts. (For completeness, the figure also shows net trade in "other"—petroleum and agricultural products.) The bulk of the deterioration in the trade deficit can be accounted for by a widening deficit in autos, consumer

7. Detailed presentation of all the data is available in the appendix figures in Mann and Plück (2005).

Table 7.1 **Trade share by principal end-use category (%)**

	Imports		Exports	
	1980	2004	1980	2004
ISM-ex	31	26	29	14
Capital goods	34	40	13	23
Consumer goods	8	13	14	25
Autos	8	11	11	15
Other	20	12	43	23
Memo: Trade as a share of GDP	10.7	15	9.4	9.8

Source: Bureau of Economic Analysis, International Transactions Account data, table 2.
Notes: ISM-ex = industrial supplies and materials, excluding oil. "Other" defined as petroleum products and feeds, foods, and beverages.

goods, and oil. Capital goods and ISM-ex appear to be more global procyclical.

Table 7.1 decomposes export and imports into these same commodity groups. The largest categories of both imports and exports are capital goods and ISM-ex; from 1980 to 2004, the share of capital goods rose and that of ISM-ex fell. Capital goods is a particularly interesting category because of the potential importance of changing global supply and variety. Moreover, from a macroeconomic perspective, global investment cycles may differ from global GDP cycles, with consequences for U.S. capital goods exports and imports. Consumer goods is a large category with a dramatic increase in the share of U.S. merchandise imports, rising from 14 to 25 percent in twenty-five years. The share of consumer goods in total merchandise exports rose only modestly and accounts for only 13 percent of exports. Consumer goods constitute a particularly interesting category because of the potential role of changes in country source of supply. Moreover, from a macroeconomic perspective, differential growth in personal consumption expenditures in the United States versus that in trading partners may be an important factor in the widening of the U.S. trade deficit.

Table 7.2 shows that the *country composition* of trade, particularly of imports, has changed dramatically.[8] Trade with the industrial countries in general has stayed relatively stable, with the share of imports remaining at about 50 percent and that of exports falling from 60 to 55 percent (1980 to 2004). Within the industrial-country group, exports to Europe and Japan have fallen. The share of imports from certain developing countries and regions has changed dramatically, with the share of imports from China increasing from basically 0 to 13 percent over the period, the share of exports

8. Additional detail on these data can be found in appendix figures A2.1 and A2.2 in Mann and Plück (2005).

Table 7.2 **Trade shares by country/region (%)**

	Exports		Imports	
	1980	2004	1980	2004
Europe	32	23	19	22
Canada	19	24	17	18
Mexico	7	14	5	11
Japan	9	6	13	9
China	2	4	0	13
Asia without China and Japan	15	18	20	17
Latin America without Mexico	11	8	10	7
Australia	1	2	1	1
Other	5	2	15	3

Source: Bureau of Economic Analysis, International Transactions Accounts Data.
Note: "Other" includes Africa and international organizations.

to Mexico doubling to 11 percent, and the share of trade with Latin America (less Mexico) contracting.

Putting the evidence on commodities and countries together with the evolution of trade flows and the trade deficit suggests that closer inspection of trade flows by country *and* commodity is warranted. However, the BEA does not publish bilateral trade data by merchandise categories. The Census Bureau's published trade data by category and trade partner does not extend back further than 1995, and the United States International Trade Commission (USITC) database covers bilateral trade by product only from 1989. Hence, we turn to another comprehensive source of a long time series of data to analyze the changing commodity-and-country composition of U.S. trade.

7.4 Our Database on U.S. Trade Commodity—By Country

Our empirical investigation of trade by commodity and country requires a new database of disaggregated bilateral trade; it also requires additional country and commodity-specific data. Our database includes (a) a thirty-one-country sample of bilateral trade with the United States aggregated into four commodity groups so as to replicate the BEA's main end-use categories; (b) expenditure data matched by country and matched to the commodity groups; (c) trade prices matched to the commodity groups, and relative prices matched by country and commodity group; and (d) a supply-cum-variety proxy for each commodity group.

7.4.1 Constructing Bilateral Trade Data

To approximate our initial evidence derived using BEA data and because we use the Bureau of Labor Statistics's (BLS) trade price indexes that are matched to the BEA categories, we recreate the BEA's end-use categories using the Standard International Trade Classification (SITC, Revision two-, four-, and five-digit), which in the United Nations Comtrade database spans the longest time period. To match BEA's end-use commodity groups, we use Comtrade's raw materials and intermediate goods for our "ISM-ex" category; "capital goods" encompasses most of SITC chapter 7 and some categories in chapter 8; "autos" includes passenger vehicles and their parts from chapter 7; and "consumer goods" is made up almost entirely of the categories comprising chapter 8. We excluded all of chapter 3 (energy) and all of chapter 1 (food) as these are also excluded from the BEA's end-use categories that are the focus of our graphical evidence. Table 7A.1 in the appendix shows the complete list.

For our econometric technique, we need a uniform panel with the same set of countries for each of the commodity groups for both imports and exports. To select countries to include in the database, we start with bilateral trade between the United States and partner countries by each four-digit or five-digit SITC category. For each country reporting trade data to the United Nations, we calculated its share in U.S. total merchandise imports and total merchandise exports and its share in trade in each of our four commodity groups. Of all countries in the database, we selected those that represented the first 90 percent of trade in each category. We excluded most of the Middle East because of the suspicion that trade with these countries might not be well estimated with the income and relative price formulation of the standard workhorse model. We excluded the countries of the former Soviet Union because there are insufficient data on expenditure and prices. We also excluded South Africa. Hence, our sample of bilateral trade pairs includes thirty-one countries from Asia and the Pacific, North America, Latin America, and Western Europe.[9]

Because of our intended econometric approach, some variation in country composition across the commodity groups is ignored. For example, Bangladesh, Honduras, and Sri Lanka are excluded; even though they are in the first 90 percent of U.S. imports of consumer goods, they were not important trading partners in the other end-use categories. At the other extreme, we included thirty-one countries in U.S. auto imports and exports even though the United States trades autos and parts overwhelmingly with Canada, Mexico, Japan, and Germany.[10]

9. Trade data on thirty countries are from the United Nations's (UN) Comtrade database. Data on a comparable basis for Taiwan come from that country's statistical office.

10. Our econometric estimates in this paper confirm that the coefficients differ across the commodity-and-country composition of trade. In a subsequent analysis, we will drop the requirement to have a uniform panel and allow the country composition of the commodity groups to vary. As noted later, this may improve the in-sample predication of imports of autos and consumer goods.

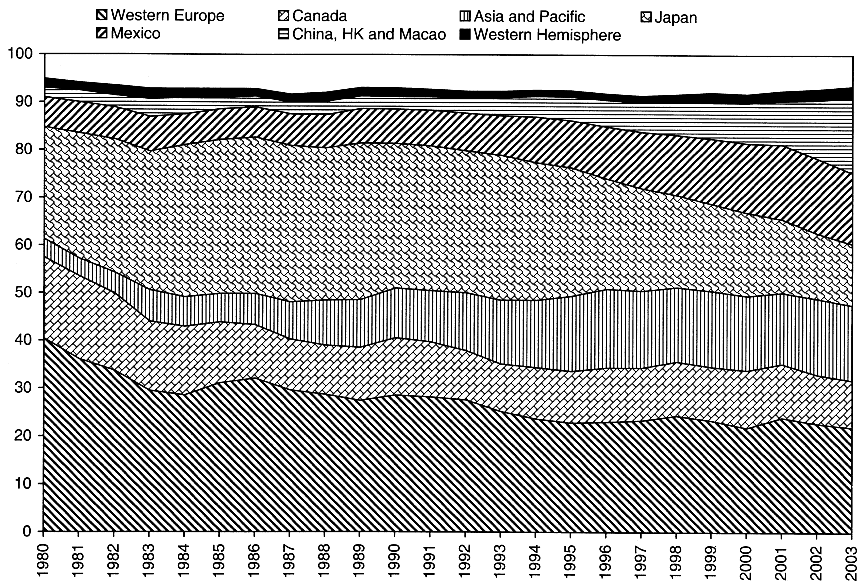

Fig. 7.2 Regional or country shares of U.S. capital goods imports (percent)
Source: United Nations Comtrade database.

Figure 7.2 shows one example—imports of capital goods—of how significant is the change over time in the country-by-commodity shares.[11]

To employ the workhorse model of trade, we need real exports and real imports. We deflate all nominal values by the corresponding end-use export and import price indexes from the BLS's International Price Program.[12]

7.4.2 Constructing Matched Expenditure Variables and Relative Prices

A key part of the analysis is whether the elasticities estimated in the workhorse model differ by the measure of economic activity employed. The standard measure of economic activity used in trade equations is real GDP. Although this makes sense in aggregated trade equations, given the commodity focus of this paper, superior elasticity estimates may be generated by better matching the activity variable to the type of traded commodity.

We construct country-specific measures of real consumption expendi-

11. See appendix figures A4.1 to A4.8 in Mann and Plück (2005) for detailed presentation of the country-by-commodity data over 1980 to 2003.

12. The end-use import and export prices do not differentiate by trading partner. Inspection of some country-specific time series data from the BLS rejects the assumption that prices do not vary by trading partner. However, country-specific trade-price data are unavailable at sufficient time series length and are not disaggregated on an end-use basis.

ture, investment, and GDP from the Penn World Tables.[13] On the import side, U.S. real GDP, real consumption expenditure, and real investment are all from the National Income and Product Accounts (NIPA) tables. In the estimation, we use real consumption expenditures in the trade equations for consumer goods and autos and real investment expenditures in the trade equations for ISM-ex and capital goods.[14] Notably, real investment growth is much more volatile than GDP, and real consumption growth and real GDP growth diverge for extended numbers of years in the 1980s and 1990s.

There is another rationale for using a different measure of economic activity than GDP. The systematic deterioration of the U.S. current account deficit and the comparable rise in current account surpluses around the world (as documented in Truman [2005] and Mann [2005]) suggest a systematic bias in GDP as a measure of economic activity. For chronic surplus countries, GDP growth as a measure of activity generating demand for U.S. exports may be too high as domestic demand growth is less than GDP growth by the share of net exports in those countries' GDPs. For the chronic U.S. deficit, GDP growth as a measure of activity generating demand for U.S. imports may be too low as domestic demand growth is greater than GDP growth by the share of net imports in U.S. GDP. A key econometric exercise is to compare the estimated demand elasticities across these alternative measures of economic activity, controlling for country and commodity-specific effects.

In our analysis, we take the relative price variable of the workhorse model (trade price relative to domestic competing substitute) as given rather than estimate a system of trade and price equations.[15] We construct relative prices for U.S. imports as the ratio of the end-use specific import price index from the BLS and the corresponding U.S. domestic price index from the BLS: The producer price index (PPI) is used for ISM-ex and capital goods. The consumer price index (CPI), excluding energy and food prices, is used for consumer goods and autos. To construct relative export prices, we converted the dollar-based end-use–specific export price index

13. We generate real measures of expenditure by multiplying the real per capita values by population. Because the Penn data only extend through 2000, we use the growth of these expenditure categories from the IMF's *International Financial Statistics* (IFS) deflated by domestic producer price or consumer price indexes to complete the time series to 2003. For a discussion of purchasing power parity (PPP)–adjusted data versus market exchange rate–adjusted data when undertaking comparative country analysis, see Castles and Henderson (2005).

14. Appendix figure A3.1 in Mann and Plück (2005) shows the various export-weighted foreign activity variables and various U.S. activity variables.

15. Most recent studies estimate prices as part of a set of simultaneous equations (Hooper, Johnson, and Marquez 2000). While researchers have always warned of the bias that may be introduced by treating relative prices as exogenous, several recent studies could not confirm that the coefficient on economic activity changed when including different formulations of this price variable or when allowing for simultaneity.

from the BLS into foreign currency using current market exchange rates and divided by the respective trading partner's price index (using CPI or PPI depending on the commodity group, as for the U.S. data).[16] Notably, over the twenty-three-year period, the relative price of capital goods exports and imports exhibit more variation than the relative price of all imports and exports; the relative price of consumer goods imports shows relatively less variation.

7.4.3 Constructing Variety

Recent literature has focused on adding variables to the workhorse model, in part to address the issues, as previously discussed, that have not been embodied in official price indexes. A global supply variable could account for entry of dynamic emerging-market economies into global trade and proxy for an outward shift of the global supply curve, which enables the United States to buy more imports at lower prices. A variety variable could account for differences in quality of goods within a commodity category and how variety in imports (exports) available to U.S. consumers (foreign buyers) has grown. Such quality or variety shifts and changes in taste may not be incorporated into the price indexes we use, hence biasing the overall regression.

Following Broda and Weinstein (2004) as well as Gagnon (2003b), we construct a variety proxy by counting the number of SITC four-digit categories that are included in each commodity group for a given country in each year. To compare the growth in variety across countries and categories, we set the number of categories equal to 100 in the first year of our panel. Similar to Broda and Weinstein, we find that the growth in variety was modest for the industrial countries; emerging-market economies on the other hand substantially increased their supply of variety to the United States.

The growth in variety was especially great for capital goods imports—with the number of SITC categories provided by China having grown by more than 250 percent.[17] In 1980, China provided only forty-six categories under the capital goods heading, with "metalworking machine tools" being the biggest in nominal dollar terms ($18 million); in 2003, China supplied 125 goods out of a possible 136 four-digit categories in capital goods, with $9 billion worth of "peripheral automatic data processing units" as the largest and $6 billion of "office-machine accessories" as the second-largest category. Varieties from other developing countries have also risen: capital goods variety from non-Japan Asia increased by 76 percent; varieties in consumer goods from the Western Hemisphere and Asia increased

16. See Mann and Plück (2005), appendix figures A3.2 and A3.3 for the movement of selected relative price variables.

17. Broda and Weinstein's (2004) findings are similar.

by 39 and 30 percent, respectively. The United States's supply to its different trading partners behaved similarly to that of other industrial countries: Between 1980 and 2003, U.S. variety of exports in capital and consumer goods grew, on average, by 10 percent.

7.5 Econometric Implementation

Our panel thus comprises import and export data, activity variables, and relative prices for thirty-one U.S. partner countries, twenty-four years, and four commodity groups (2,976 observations in all). Each commodity group panel contains thirty-one time series of country data. The whole panel consists of the four commodity panels stacked on top of each other.

We use a dynamic panel specification to model bilateral trade flows. Our model allows us to estimate both short-term and long-term effects of changes in the explanatory variables—similar to an error correction model (ECM) common in time-series estimations:

$$\begin{aligned}\ln \Delta\text{trade}_{ij,t} = \beta_0 &+ \beta_1\Delta \ln \text{trade}_{ij,t-1} + \beta_2\Delta \ln \text{activity}_{ij,t} \\ &+ \beta_3\Delta \ln \text{activity}_{ij,t-1} + \beta_4\Delta \ln \text{rel.price}_{ij,t} \\ &+ \beta_5\Delta \ln \text{rel.price}_{ij,t-1} + \beta_6 \ln \text{trade}_{ij,t-1} + \beta_7 \ln \text{activity}_{ij,t-1} \\ &+ \beta_8 \ln \text{rel.price}_{ij,t-1} + \alpha_{ij} + u_{ij,t},\end{aligned}$$

where i denotes the ith trading partner, j denotes the jth commodity group, and $t = 1980–2003$ are the years in our sample; the α_{ij}s are the unobserved fixed effects and the $u_{ij,t}$ denotes the idiosyncratic error.

For the short-run effects, the coefficient on the differenced natural logarithms of economic activity shows the short-run effect of a 1 percent point change in GDP, investment, or personal consumption expenditure on real exports or imports.

For the long-run relationships, the coefficients on the level logs divided by the coefficient on the lagged dependent variable represent long-run effects; as in the long run, we can set the differenced terms equal to zero:

$$\begin{aligned}\ln \text{trade}_{ij,t-1} = -\frac{\beta_0}{\beta_6} - \frac{\beta_7}{\beta_6} \ln \text{activity}_{ij,t-1} - \frac{\beta_8}{\beta_6} \ln \text{rel.price}_{ij,t-1} \\ - \frac{1}{\beta_6}(\alpha_{ij} + u_{ij,t}).\end{aligned}$$

The calculated coefficient on economic activity in this equation shows the effect of a 1 percent increase in GDP, investment, or personal consumption expenditure on real trade flows.

Using a dynamic formulation in a fixed-effects or first-difference context presents econometric problems. The random error terms are correlated both with the differences and the level of the lagged dependent variable, thus biasing the results for the coefficients. Arellano and Bond (1991) and Blundell and Bond (1998) propose an estimation method that instruments the lagged levels of the dependent variable with the lagged differences of this variable and the differences of the dependent variable with its lagged levels. Our results using these instruments and technique were poor. Wooldridge (2002, chapter 11) and Kennedy (2003, 313) discuss the challenge of choosing an econometric technique in the context of dynamic panel data estimation, and note the bias, yet greater precision, of fixed-effects estimators, as opposed to general least squares or instrumental variable regressions. Studies indicate that the bias induced by fixed effects is offset when the time variable exceeds thirty observations. Our time series is twenty-four years, and we proceed.[18]

7.6 Results and Discussion

This section discusses the findings of the econometric exercise. We wish to compare estimated coefficients constrained over the whole panel versus unconstrained over several different dimensions: commodity decomposition; GDP versus alternative activity variables; and industrial versus developing countries.

7.6.1 Benchmark Regression and Matched Expenditure versus GDP

For the first comparison to previous research, we use the thirty-one-country and four-commodity whole panel with country- and commodity-fixed effects to run a benchmark regression for U.S. imports and U.S. exports. An *F*-test of the constrained whole panel against the unconstrained country- and commodity-fixed effects panel rejects the null hypothesis that the constrained and unconstrained regressions are the same. Table 7.3 presents short-run and long-run estimates for the elasticity estimates for income and for relative prices from representative previous work. Wald tests (see note to table 7.3) test the null hypothesis that the short-run and the long-run coefficients are the same. Generally, the null is rejected for the activity variable. For relative prices, the null is rejected for exports but not for imports.

The first question is how our elasticities estimated using our thirty-one-country and four-commodity panel and using *GDP as the measure of economic activity* compare with previous research. Our income elasticities for

18. Ideally, one might try to estimate this panel using a vector error correction model (VECM) suited for dynamic panel data estimation—these techniques go beyond the scope of this paper (see, for example, Beck [2001]; Schich and Pelgrin [2002]; and Smith [2000] for estimation of long and wide panels). In future work, it makes sense to try to generate the cointegrating vector explicitly using panel dynamic ordinary least squares (Mark and Sul 2002; Mark, Ogaki, and Sul 2003) and implement the result in a panel ECM.

Table 7.3 Estimates for activity and relative price elasticities for U.S. exports and imports

				Exports		Imports	
Previous research	Data period	Method	Level of disaggregation	Relative price	Activity	Relative price	Activity
Previous research							
Houthakker and	Annual 1951–66	OLS	Goods and services	–1.51	0.99	–1.03	1.68
Magee (1969)					1.8** (SR)	–0.1 (SR)	1.0** (SR)
				–0.5*** (SR)	0.8*** (LR)	–0.3*** (LR)	1.8*** (LR)
Hooper, Johnson, and Marquez (2000)	Quarterly 1956–96	ECM (SR); Johansen (LR)	Goods and services	–1.5*** (LR)			
Wren-Lewis and Driver (1998)	Quarterly 1980–95	ECM (SR); Johansen (LR)	Goods	–0.96 (SR)	1.12 (SR)	–0.38	2.43 (SR)
				–0.65 (SR)	1.21 (LR)	–0.18	2.36 (LR)
Our study							
GDP as income[a]	Annual 1980–2003	Country- and commodity-fixed effects, dynamic panel	Panel of 4 categories of goods	–0.07** (SR)	2.79** (SR)	–0.17 (SR)	4.11** (SR)
				–0.2** (LR)	1.44** (LR)	–0.28 (LR)	2.22** (LR)
				–0.03* (SR)	0.58** (SR)	–0.09 (SR)	1.00** (SR)
Matched expenditure and matched prices[b]				–0.09 (LR)	1.19** (LR)	0.10 (LR)	1.63** (LR)

Notes: SR = short run; LR = long run; ECM = error correction model; OLS = ordinary least squares.

[a]Imports: Null rejected for GDP as income; not rejected for relative prices. Exports: Null rejected for GDP as income; null rejected for relative prices.

[b]Imports: Null rejected for "activity"; not rejected for relative prices. Exports: Null rejected at 1 percent level for "activity"; null rejected at 10 percent level of significance for relative prices.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

both exports and imports are higher in the short run but are similar to the long-run estimates that come from regressions run over sample periods starting from the 1980s, such as Wren-Lewis and Driver (1998). Our price elasticities are generally lower than comparable studies, particularly on the export side and often are not significant. This may be a result of the construction of our relative price index using the GDP deflator for all the categories of trade. (Note that this is not the deflator we construct for subsequent regressions, where we instead use matched trade price and deflators.)

Changing from the workhorse model specification to *matched expenditure as the measure of economic activity and matched prices* makes a large difference to the estimated income elasticities. Both the short-run and long-run elasticities are much lower (with the short-run coefficients almost too low) and the long-run coefficients close to the theoretical priors based on constant share of trade in expenditure of about 1.0. This suggests that the GDP variable may not be the correct measure of economic activity that drives trade flows.

With respect to relative prices, although the regressions with matched expenditure also incorporate greater richness with regard to the relative prices (as discussed in the data section), the significance level of relative prices does not improve in this panel specification of the four-commodity model.

Finally, and to be further discussed in the following, we find that the variety variable is statistically significant in the regressions for imports and exports implemented with matched expenditure and matched prices but not for the export regression using GDP as the measure of activity and the GDP deflators in the measure of relative prices.

In sum, a key finding is that although the Houthakker-Magee asymmetry (in estimated elasticity of trade with respect to measures of economic activity) persists both in the short and long run, the magnitude of the asymmetry is dramatically smaller than with the benchmark specification of the workhorse model. Matched expenditure, matched prices, and variety appear to play a key role in reducing the asymmetry of estimated elasticities of trade with respect to economic activity.

7.6.2 Disaggregating by Product Categories

Given that the commodity-by-country composition of trade has changed, in some cases dramatically, do the coefficients on economic activity, relative prices, and variety vary across product categories? Table 7.4 presents regressions by commodity group with country-fixed effects. An F-test of the constrained whole panel with country-fixed effects versus the unconstrained panel with country-fixed effects rejects the null hypothesis that the constrained and unconstrained regressions are the same. Wald tests in general reject the null hypothesis that the short-run and long-run coefficients are the same on the matched expenditure variable but do not reject

Table 7.4 **Regressions by commodity group with country fixed effects**

Level of disaggregation (R^2M, R^2X)	Exports: Relative price	Exports: Matched expenditure	Exports: Variety categories	Imports: Relative price	Imports: Matched expenditure	Imports: Variety categories
Expenditure and matched prices						
Capital goods (0.16, 0.38)	–0.021 (SR)	0.79** (SR)	4.66**	–0.25 (SR)	0.48** (SR)	1.74**
	0.012 (LR)	0.88** (LR)		1.56* (LR)	1.54** (LR)	
Consumer goods (0.18, 0.32)	–0.02 (SR)	0.713** (SR)	0.16	–0.40* (SR)	3.73** (SR)	–0.21
	0.07 (LR)	1.37** (LR)		3.64 (LR)	1.69** (LR)	
Autos and parts (0.20, 0.26)	–0.07 (SR)	1.03** (SR)	0.92*	0.48 (SR)	9.01** (SR)	0.54
	–0.3* (LR)	1.13** (LR)		1.35 (LR)	2.21** (LR)	
Annual 1980–2003						
ISM-ex (0.26, 0.31)	0.01 (SR)	0.35** (SR)	0.99	–0.13 (SR)	1.03** (SR)	0.52*
	0.02 (LR)	0.94** (LR)		1.36 (LR)	0.64** (LR)	
Panel of 4 categories of goods (0.25, 0.14)	–0.03*** (SR)	0.58** (SR)	0.91**	–0.17 (SR)	1.00** (SR)	0.70**
	–0.09 (LR)	1.09** (LR)		0.16 (LR)	1.40** (LR)	

Notes: SR = short run; LR = long run. Wald Test: Null hypothesis that SR and LR are the same. Autos—Imports: income coefficients reject; prices not reject. Exports: income coefficients reject; prices reject at 5 percent level. Capital goods—Imports: income coefficients reject, prices not reject. Exports: income coefficients reject, prices not reject. Consumer goods—Imports: income coefficients reject, prices not reject. Exports: income coefficients reject, prices not reject. Industrial supplies and materials, excluding oil (ISM-ex)—Imports: income coefficients reject, prices not reject. Exports: income coefficients reject, prices not reject.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

the null hypothesis that the short-run and long-run relative price coefficients are the same (excepting that the null is rejected at the 5 percent level for auto exports).

Comparing the elasticities on matched expenditure and variety across the commodity panels: for exports, the long-run elasticities of autos, capital goods, and consumer goods are greater than the short-run elasticities, as expected. For imports, differences in estimated expenditure elasticities are substantial across the disaggregated commodities groups. Comparing the short-run and the long-run estimates, the short-run cyclical responsiveness of trade with respect to matched economic activity exceeds the long-run responsiveness for U.S. imports of consumer goods and autos and auto parts, but this is not in evidence for capital goods. The situation of short-run exceeding long-run elasticities is consistent with the oft-discussed unsustainability of the trajectory of the U.S. trade deficit (Mann 2005). Whereas most of the estimates make sense and are of plausible magnitudes, those for autos seem unreasonable, particularly the short-run estimate. Based on this analysis that disaggregation of product categories is statistically relevant for understanding the drivers of trade flows, our future program of work will allow the countries included in each product category to vary as we will no longer require the uniform panel.

7.6.3 Disaggregating Industrial and Developing Countries by Product Group

Not only has the commodity composition of trade changed but there has also been a significant change, particularly evident for imports, in the composition of U.S. trade with the industrial versus developing countries. Moreover, apropos our implementation using matched expenditure and trade prices, exchange rate regimes and sources of economic growth may differ between industrial and developing countries. Are differences observed in the estimated activity and relative price coefficients between industrial and developing countries and across product groups? (tables 7.5 and 7.6). *F*-tests of regressions including country-fixed effects reject the null hypotheses that the industrial and developing countries regressions are the same for each of the four product groups. Wald tests of the null hypothesis that short-run and long-run coefficients are the same are as noted.

The following summarizes key aspects of the tables:

- **With respect to relative prices:** The relative price coefficient is of the correct sign and significant for imports of consumer goods and capital goods from industrial countries; it is significant and of the correct sign for all product categories of exports. This is in contrast to the estimates that constrained the relative price coefficient to be the same for industrial and developing countries and that resulted in poorly estimated coefficients.

Table 7.5 **Import regressions using a dummy variable for industrial trading partner with country-fixed effects**

Level of disaggregation	Matched expenditure: Industrial country	Matched expenditure: Developing country	Relative price: Industrial country	Relative price: Developing country	Variety categories, 1980–2003
Capital goods	1.29** (SR)	–0.24* (SR)	–0.31 (SR)	–0.20 (SR)	
	0.78** (LR)	3.12** (LR)	–0.71** (LR)	5.01** (LR)	1.42**
	3.52[a] (SR)	4.156** (SR)	–1.35** (SR)	0.86*** (SR)	
Consumer goods	1.32[a] (LR)	1.96** (SR)	–4.34** (LR)	14.34** (SR)	–0.19
	8.16** (SR)	9.72*** (SR)	0.72 (SR)	2.26* (SR)	
Autos and parts	1.59** (LR)	3.53** (LR)	–1.71 (LR)	6.88 (LR)	0.32
	1.52** (SR)	0.97** (SR)	–0.29 (SR)	0.16 (SR)	
ISM-ex	0.26 (LR)	1.47** (LR)	1.97 (LR)	0.86 (LR)	0.17

Notes: SR = short run; LR = long run. Wald Test: Null hypothesis that LR and SR are the same. Capital goods—Expenditure for both groups rejects the null. Consumer goods—Relative price for both groups rejects the null. Autos—Expenditure for developing countries rejects the null. Industrial supplies and materials, excluding oil (ISM-ex)—Expenditure for developing countries rejects the null and for industrial country at the 10 percent level.

[a]Dummy for industrial countries is not significant.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 7.6 **Export regressions using a dummy variable for industrial trading partner with country-fixed effects**

Level of disaggregation	Matched expenditure: Industrial country	Matched expenditure: Developing country	Relative price: Industrial country	Relative price: Developing country	Variety categories, 1980–2003
Capital goods	0.67* (SR)	0.79** (SR)	–0.38** (SR)	–0.014 (SR)	
	0.70*** (LR)	0.94** (LR)	0.12 (LR)	0.013 (LR)	5.2**
	0.45** (SR)	0.69** (SR)	–0.45** (SR)	0.014 (SR)	
Consumer goods	1.09** (LR)	1.64** (SR)	–0.58* (LR)	0.022 (LR)	–0.12
	1.19*** (SR)	1.41** (SR)	–0.922** (SR)	0.043 (SR)	
Autos and parts	0.66*** (LR)	1.22** (LR)	–1.55** (LR)	–0.19 (LR)	0.79
	0.32[a] (SR)	0.37** (SR)	–0.02 (SR)	0.01 (SR)	
ISM-ex	0.81** (LR)	1.46** (LR)	–1.18** (LR)	–0.26 (LR)	–0.46

Notes: SR = short run; LR = long run. Wald Test: Null hypothesis that SR and LR are the same. Capital goods—Expenditure for developing countries rejects the null. Consumer goods—Expenditure for developing countries reject (1 percent level); expenditure industrial countries reject (5 percent level); relative prices industrial countries reject (1 percent level). Autos—Expenditure for developing countries and relative prices for industrial countries reject the null. Industrial supplies and materials, excluding oil (ISM-ex)—Expenditure for both groups reject; relative prices for industrial countries reject (5 percent level).

[a]Dummy for industrial countries is not significant.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

- **With respect to activity:** The elasticity for U.S. capital goods exports to industrial countries does not differ significantly from that to developing countries, but U.S. capital goods imports from industrial countries is more responsive in the short run and less responsive in the long run to U.S. activity than imports from developing countries. The U.S. consumer goods exports to industrial countries respond differently to foreign activity in those high-income countries as compared with the response to activity in the developing countries. On the other hand, there is no difference in elasticity of U.S. consumer goods imports with respect to source country.

What does all this add up to in the context of the recent evolution of the U.S. trade deficit? First, with respect to ***capital goods*** imports and exports, changing *relative prices* in industrial countries, and net trade, these coefficients are consistent with a story that dollar appreciation has, ceteris paribus, dampened capital goods exports and encouraged capital goods imports from the industrial countries. The depreciation of the dollar against these same currencies since 2002, and the somewhat higher pass-through of that exchange rate change vis-à-vis at least the euro[19] may, ceteris paribus, change the trajectory of the trade deficit in capital goods (presented in figure 7.1). But, to the extent that an increasing share of these goods come from developing economies, any dollar depreciation may have less of an effect to reduce capital goods imports or expand capital goods exports to developing countries, given the lack of significance in the estimated coefficient for relative prices of capital goods for developing countries.[20]

Second, with respect to changing *investment activity,* these coefficients are consistent with a story that robust U.S. investment demand has encouraged imports of capital goods with a relatively higher elasticity, whereas slower investment growth abroad (both in the industrial and the developing world) has tended to yield slower growth in capital goods exports.

Third, the fact that the *variety* effect is smaller for imports than for exports suggests that variety importantly underpins U.S. capital goods export growth, which is consistent with Schott (2004). Put together, the deterioration of net trade in capital goods comes from relatively more robust

19. The U.S. import prices from the European Union have risen about 14 percent since the peak of the dollar in February 2002. This represents more than a 25 percent pass-through of the euro appreciation into U.S. import prices. Import prices from Japan, on the other hand, have stayed stable since early 2002, in spite of a more than 25 percent appreciation of the yen against the dollar (Bureau of Labor Statistics)—while this limited pass-through is no doubt due in part to deflation in Japan that cannot be the only story.

20. The large positive and significant long-run coefficient for relative price of capital goods imports from developing countries suggests another missing variable or that the variety variable needs additional work.

U.S. investment with a relatively higher elasticity, a dollar appreciation particularly against the industrial countries where relative prices are estimated significantly, and significant increases in global supply-cum-variety.

For ***consumer goods,*** the story is somewhat different not only because the estimated U.S. consumer demand elasticity is so high in the short-run but also because relative prices are significant and rather high for products from the industrial countries. First, with respect to changing *relative prices* in industrial countries and net trade in consumer goods, these coefficients are consistent with a story that dollar appreciation has, ceteris paribus, hurt consumer goods exports to industrial countries and, particularly given the higher relative price elasticity, encouraged consumer goods imports from industrial countries. The depreciation of the dollar against these same currencies since 2002, and the somewhat higher pass-through of that exchange rate change vis-à-vis at least the euro may, ceteris paribus, reduce the net trade deficit in consumer goods (presented in figure 7.1). But, to the extent that an increasing share of consumer goods come from developing economies, any dollar depreciation may have less of an effect to reduce consumer goods imports, given the poorly estimated coefficient for relative prices of consumer goods from developing countries.[21]

Second, with respect to *consumer demand growth, variety,* and net trade, the coefficients are consistent with a story that relatively more robust U.S. consumer demand along with a very high short-run cyclical demand elasticity has encouraged imports of consumer goods and autos from all trading partners well in excess of the foreign demand for U.S. exports of consumer goods. Surprisingly, global supply-cum-variety does not appear to be a relevant determinant of trade in consumer goods. Put together, the deterioration of net trade in consumer goods comes from relatively strong U.S. consumer demand growth with a relatively higher short-run elasticity, as well as dollar appreciation (with greater imports of luxury, price-sensitive goods from industrial countries, and reduced exports of similarly price-sensitive goods to industrial countries).

7.6.4 Summary of Findings

The paper prepared new estimates of the elasticity of U.S. trade flows using bilateral trade data for thirty-one countries, using different measures of expenditure and including alternative measures of global supply and variety. We examine four categories of goods based on the BEA's end-use classification system—autos, ISM-ex, consumer goods, and capital goods. We consider whether industrial and developing countries differ in their elasticities.

21. The large positive and significant long-run coefficient for relative price of consumer goods imports from developing countries suggests another missing variable or that the variety variable needs additional work.

1. Using expenditure matched to commodity group rather than GDP as the measure of income significantly reduces the Houthakker-Magee asymmetry in the long-run estimates and yields far more plausible values for these income elasticities.

2. Short-run estimates of U.S. consumer goods imports with respect to matched economic activity exhibit very high cyclical elasticity, which is consistent with the unsustainability of the trajectory of the trade deficit.

3. The four product categories behave significantly differently from an aggregated panel.

4. Global supply-cum-variety is a significant variable, particularly for capital goods.

5. Industrial and developing countries have different income and relative price elasticities for these four product groups. In particular, when industrial countries are distinguished from developing countries, the estimated coefficients for relative prices for industrial countries are the correct sign, significant, and of plausible values.

6. We also investigated whether U.S.-China trade is significantly different than industrial country or developing country trade. The results are not conclusive.[22]

7.7 Implications and Direction for Further Work

7.7.1 Do Changing Trade Shares Change Trade Elasticities?

The results indicate that industrial and developing countries differ in their elasticities of economic activity and relative price. The shares of these two groups in trade have changed over time, in particular within product categories for imports. When elasticities for economic activity from the regression that splits the panel into four product categories and allows the elasticities to vary across the industrial and developing countries (tables 7.5 and 7.6) are reaggregated using the annual trade weights of these two groups and for the four product categories in U.S. trade, we conclude that the long-run expenditure elasticity of U.S. imports rises from 1980 to 2003. These results imply that the assumption of a constant elasticity of U.S. imports with respect to U.S. economic activity may have to be rejected and that projections of U.S. imports based on the constant elasticity assumption may be flawed. No similar trend is apparent for the expenditure elas-

22. For a number of reasons, we might expect China to be different from other countries in this specification of U.S. dynamic trade. China's trade shares changed the most. Its net trade deficit is on the steepest trajectory. Its variety increased the most. Its exchange rates have changed the least. Table 6 in Mann and Plück (2005) reports regression results investigating whether China is appreciably different from the rest of the world in the consumer goods and capital goods categories. The bottom line is that the picture is mixed in terms of short-run versus long-run effects. The very large long-run estimates on U.S. economic activity are consistent with the graphical evidence but arguably could not persist.

Table 7.7 Summary of in-sample predictive performance (billions of U.S. dollars)

	Matched expenditure, variety, and industrial country dummies		GDP as income and aggregate trade flows (from table 7.3)	
Total error, 1998–2003	Imports	Exports	Imports	Exports
Using whole-panel estimates	386	134	198	234
Using good-specific elasticities				
Consumer goods	172.99	0.89	20.43	23.27
Capital goods	–73.16	110.50	–0.15	124.83
Autos	273.2	28.99	97.91	42.04
Industrial supplies and materials, excluding oil	12.94	–6.69	106.52	20.41

ticity for exports, which is consistent with the observation that country shares have changed less.[23]

7.7.2 Do These New Elasticities Predict Better?

Research using the workhorse model often addresses the tension between the theoretical plausibility of the estimated elasticities, specifically the Houthakker-Magee asymmetry, and the affirmed excellence of these simple equations to predict U.S. exports and imports in the short and medium terms. By using matched expenditure and trade prices and by disaggregating product groups and industrial versus developing countries, we reduce the Houthakker-Magee asymmetry, but do we "do better" at prediction?

We examine this question by comparing in-sample predictive performance of two alternative models, estimating the models from 1980 to 1997, and then running the model forward from 1998 to 2003 using the short-run and long-run estimated coefficients for matched expenditure and relative prices and the actual values from the right-hand-side variables. We compare the actual with the predicted values in each year and sum the difference as the total error (table 7.7). The horse race is between the benchmark model that uses GDP and aggregated trade (from table 7.3)—a formulation that many forecasters would use because they are interested in aggregate exports and imports; and the matched expenditure model, with variety, with four separate product groups, and with industrial country dummies (from tables 7.5 and 7.6).

The bottom line in terms of predicted performance is the sum of the in-sample predictive errors. For total exports, our country-commodity disaggregated estimates better predict exports compared with the simple model. For total imports, even though we obtain more plausible values for the long-run elasticities, our predictions are poor compared with the benchmark model that uses U.S. GDP as the measure of expenditure because the short-

23. See discussion and presentation of the data, particularly figure 3 in Mann and Plück (2005).

run elasticities are so high, particularly for consumer goods and autos. Our results address the finding that surprised Houthakker and Magee (1969) in their original study: the very low income elasticities for U.S. exports. Our estimations suggest that these elasticities might in fact be closer to those of other industrial countries. But we have more work to do on the import side to estimate elasticities that meet theoretical norms and also predict well.

Does our matched expenditure model do equally well (or poorly) in the four commodity groups? We examined each of the four product groups comparing the model results for the matched expenditure, variety, and industrial-country dummies with the simple model that uses GDP as the driver of trade. (See table 7.7.) Within product groups, auto trade and consumer goods imports are particularly poorly explained in-sample by the new disaggregated model. But all the export categories are better predicted in-sample by the matched expenditure and variety model than when GDP is used as the measure of economic activity. Hence, future work should focus on narrowing the country group for autos and reestimating the equation for consumer goods, including augmenting the drivers of economic activity (beyond personal consumption expenditures to add a wealth variable for example) and recalculating the variety variable with more detailed data.

7.7.3 "What If" U.S. Spending Slows and Foreign Spending Booms?

In recent policymaker confabs such as the G8, it has been common to call for increased U.S. savings and greater foreign growth as well as more flexibility in exchange rate regimes.[24] Suppose the United States saves more and growth abroad increases over the next several years to 2007 [2006?]? How much would the U.S. trade deficit be different from a scenario where growth is as projected by *Consensus Economics Forecasts,* a well-known economic forecasting group?

The assumptions for real consumption and investment growth for our sample of countries from *Consensus Economics Forecasts* and our estimated elasticities are the starting points for illustrative scenarios for how U.S. trade deficit adjustment might take place for 2007 [2006?] (figure 7.3 and table 7.8). Given the estimated short-run and long-run elasticities, the *Consensus Economics Forecasts,* and no change in the exchange value of the dollar (from mid-2005), the real nonoil trade deficit in 2006 would be about $725 billion.

A rest-of-world investment boom and a rest-of-world consumption boom (as quantified in table 7.8, where *boom* is defined as the average high value for consumption or investment growth over the 1980 to 2003 period) yield some narrowing of the U.S. trade deficit. But because most of our capital goods exports go to mature industrial markets, whose average booms are modest, and because the short-run and long-run elasticities for exports are relatively low, our capital goods exports do not increase that much. And because the share of consumption goods in U.S. exports is rel-

24. This section draws on Mann (2006).

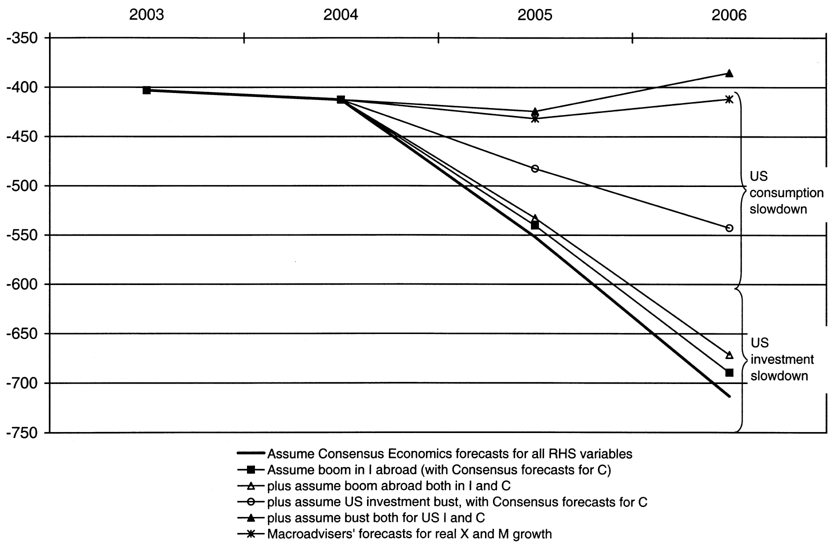

Fig. 7.3 Projected real trade deficit (ex. Oil), using commodity-specific elasticity estimates, billions of U.S. dollars

Source: Authors' calculations using regression estimates and forecasts for country investment and personal consumption expenditure from Consensus Economics Forecasts, August 2005 (http://www.consensusforecasts.com); Macroadvisers' Economic Outlook; United Nations Comtrade database; Macroadvisers forecast for real *X* and *M* growth are generated from macroadviser's forecast from June 22, 2005 (volume 23, number 5).

atively small, booming consumption abroad does little to improve the trade account. Overall, global consumption and investment booms do not play a very large role in narrowing the trade deficit in the short term because the geographical and commodity patterns of trade on the export side have been remarkably stable for twenty-five years. Over the longer term, however, as the long-term elasticities for exports are larger than the short-run elasticities, *sustained* foreign growth could have a larger impact on the trajectory of the U.S. trade deficit.

In contrast, investment and consumption slowdowns in the United States (compared to historical cycles from the 1980 to 2003 period) would yield a quick stabilizing of the real trade deficit. This is because consumption goods and autos are a large share of imports, and both have high estimated short-run elasticity of demand. The consumption slow-down assumed for the United States is modest by historical standards of the last twenty-five years but, nevertheless, is outside recent experience and therefore likely to be painful.[25]

What about a role for the exchange value of the dollar? Based on our estimates, the exchange rate plays an important role in expenditure switching for trade with industrial countries, but has little empirical significance for

25. See also Truman (2005) for a similar conclusion.

Table 7.8 **Assumptions for growth scenarios in figure 7.3**

Consensus forecasts (real growth, percentage points)	2005	2006	Add percentage points to achieve:	Average for "boom" in ROW/ "realistic slowdown" for the U.S. (based on 1980–2003 data)
		Gross fixed capital formation		
Europe and Japan	3.5	3.7	5.0	8.4
Other industrial countries	7.4	7.2	7.0	14.8
Developing countries	9.2	7.5	1.0	9.9
United States	8.8	7.5	–13.0	–6.0
		Personal consumption expenditures		
Europe and Japan	1.3	1.7	7.0	8.3
Other industrial countries	3.1	3.1	5.0	8.3
Developing countries	4.9	4.4	11.0	15.2
United States	3.5	3.1	–3.0	0

Source: Authors' calculations using regression estimates and forecasts for country investment and personal consumption expenditure from Consensus Economics Forecasts, August 2005 (http://www.consensusforecasts.com).

Note: ROW = Rest of the world.

exports to or imports from developing countries, for which real exchange rates have moved relatively little.

Our results are consistent with the findings of Freund and Warnock (chap. 4 in this volume), and Faruqee, Laxton, Muir, and Pesenti (chap. 10 in this volume). Freund and Warnock conclude that adjustments to consumption-driven current account deficits require significantly steeper exchange rate depreciation and thus more pain than adjustments to trade deficits that have financed private investment. Faruqee et al. determine that a loss of foreign appetite for U.S. assets (reflected in a dollar depreciation) and a consolidation of the U.S. fiscal position have a much larger impact on the current account deficit than do structural reforms in Japan and Europe. To the extent that a consolidation in the U.S. fiscal position took place via a sun-setting of the income tax cuts, then fiscal consolidation and demand for consumer goods imports would be more clearly linked.

On the other hand, our findings that the relative price elasticities are significant, but not large, and are limited to industrial countries, implies a challenge to the mechanism for adjustment emphasized in Obstfeld and Rogoff (chap. 9 in this volume). Their mechanism for adjustment depends on the relative price signal shifting resources between traded and non-traded sectors. Our relative price signal appears to play a more modest role in directing trade flows.

7.7.4 Conclusions and Further Work

These new elasticities yield insights into the sources of the widening of the U.S. trade deficit and help to understand the nature of global competition and how it is impacting broad sectors of the U.S. economy.

The differences in demand elasticities for consumer goods versus for other product categories—with consumer goods more responsive to consumption patterns in the United States—yields insights into how robust U.S. consumer demand through trending lower household saving rates, as augmented by higher stock-market valuation in the 1990s and residential housing values and tax cuts in the 2000s, contributes to widening the consumer goods share of the trade deficit.

The differences in relative price elasticities between the industrial and developing countries—with relative prices significant and of correct sign for industrial countries but not for developing countries—yields insights into how certain exchange rate regimes, pricing-to-market behavior, or other factors more prevalent to developing country exporters mute the price signal, which is consistent with recent work on disaggregate pass-through (Campa and Goldberg 2004; Marazzi et al. 2005).

The evidence from this analysis suggests that the matched-expenditure model for exports, disaggregated across commodity groups and income class (industrial versus developing), is worth continued investigation. Not only do the elasticities have more plausible values, particularly in the long-run, but also the equation performs better in-sample than the benchmark model for exports. Simultaneous specification with an equation for relative prices warrants consideration.

For imports, the matched-expenditure disaggregated model yields more plausible values for trade elasticities in the long run. However, the in-sample predictive performance is much worse than for the benchmark model because the short-run elasticities are very high. To understand the factors underpinning robust U.S. imports of consumer goods and autos, in particular, requires additional work. Future work will focus on narrowing the country set for trade in autos and investigating a more detailed variable for variety for consumer goods as well as incorporating a wealth variable into the consumption goods equation.

Going forward, these new elasticities have implications for demand management and exchange rate policies. In particular, slack U.S. exports appear importantly related to slack consumption and investment abroad and low long-term growth prospects in the major markets for U.S. exports, which have been masked by measures of GDP that incorporate net exports to the United States. On the other hand, factors beyond strong U.S. consumer demand or love of variety are bolstering U.S. imports of consumer goods. Different relative price elasticities between the industrial and developing countries suggest long-run implications for U.S. trade of certain exchange rate regimes. Exchange rate regimes that limit the transmission of relative price signals appear to have been important in the past. A change in these regimes will be an important part of the change in the trajectory of the U.S. trade deficit going forward.

Appendix

Table 7A.1 Definition of proxy end-use commodity groups

Autos	Capital goods	Consumer goods	Industrial supplies and materials
7810–7849, 7861, 7869: road vehicles and parts except motorcycles and bicycles and their parts. 6251, 6252: tires for road vehicles.	6253: tires for aircraft. 71–75: heavy machines for all industrial sectors and agriculture, office machines. 7641–7649: telecommunications and broadcasting equipment. 771–774, 778: electrical equipment and electronic equipment. 7911–7938: transport equipment other than road vehicles. 87: laboratory and medical and other scientific equipment; precision instruments.	1221–1223: tobacco manufactured. 5411–5419: pharmaceuticals and cosmetics. 5530–5543: perfumes, soaps and detergents. 6121–6129: articles of leather and footwear. 6354: manufactures of wood for domestic use. 6581–6597: textile and nontextile furnishing, floor coverings, rugs and other articles made from fabric. 6651–6674: china, glassware, precious stones. 6960–6978: household items made of metal. 7611–7631: televisions, radio, etc. 775: household appliances. 785: motorcycles, bicycles, and parts. 821: furniture. 8310: travel goods. 84–85: apparel and footwear. 88–89: photographic equipment, spectacles, watches, printed matter, and miscellaneous consumer goods.	Chapter 2: crude materials inedible, except fuels. Chapter 4: animal and vegetable oils and waxes. 51–53: organic and inorganic chemicals; dyeing, tanning, and coloring supplies. 551: Essential oils. 56–59: fertilizers, explosives, plastics, and miscellaneous chemical materials. 611, 613: leather and fu661–664: nonmetallic mineral products. r. 621, 628: rubber. 633–635: wood and cork manufactures (except 6354 for domestic use). 64: paper and pulp. 655–657: yarn and textiles. 67, 68: iron and steel and nonferrous metals. 691–695, 699: manufactures of metal. 776: semiconductors, cathodes, diodes, photocells, etc. 81: sanitary, plumbing, heating and lighting fixtures, and other building material.

Note: This table is constructed using the Standard International Trade Classification (SITC), Revision 2 (United Nations 1975).

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Comment Peter B. Kenen

I begin with thanks to the organizer of this conference and the authors of this paper—thanks to the organizer for the compliment implied by asking me to comment on a technically sophisticated paper, and thanks to the authors for a meticulous effort to answer some rather important questions.

There is a strong conceptual case for disaggregating trade flows, especially for the United States, which trades with many countries and in many goods. Otherwise, estimates of income and price elasticities may be badly biased by changes in the country and commodity composition of U.S. trade. I am not sure, however, that the paper by Mann and Plück deals decisively with that need. They do disaggregate by commodity group, which allows them to ask whether it is better to use different measures of economic activity for different commodity groups rather than follow the common practice of using GDP for each and every group. They also distinguish between U.S. trade with industrial countries and with developing countries. Nevertheless, their strategy and findings raise several questions.

The first question pertains to the treatment of industrial materials. Shouldn't the demand for those goods be more responsive to changes in industrial production than to changes in investment? Use of the two GDP components, consumption and investment, as explanatory variables is appealing; they are mutually exclusive categories, whereas industrial production may be destined for consumption or investment. Furthermore, their use of the two GDP components helps them to compare the trade-balance

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effect of a change in household consumption with the trade-balance effect of a change in business investment. Yet that comparison may be badly flawed insofar as trade in industrial materials truly reflects the *joint* effects of household and business demand for final products that embody large amounts of industrial materials. I wonder, moreover, whether the use of investment as the expenditure variable in the trade equations for industrial materials accounts for one of the striking results shown in table 7.4 of the paper; this is the only case in which the expenditure coefficient in the long-run demand equation for U.S. exports exceeds the expenditure coefficient in the long-run demand equation for U.S. imports.

The second question pertains to the pooling of time series and country data, which constrains the price and income elasticities to be the same for the thirty-one countries in their sample. To what extent does this blur the effects of changes in the country composition of U.S. foreign trade? In tables 7.5 and 7.6 of their paper, Mann and Plück present results for two groups of countries—industrial and developing countries. In a previous version of their paper, moreover, they presented separate results for U.S. trade with China.[1] It might be useful, however, to derive separate equations for some other countries, especially Canada and Mexico, given their very large trade with the United States, and to compare the resulting equations with those for other countries or country groups. Disaggregation by country or country group would be especially helpful when, as in the final part of the paper, Mann and Plück discuss the likely effects of various changes in economic conditions at home and abroad, including changes in exchange rates. Disaggregation by country or country group would be more useful for this purpose than disaggregation by commodity group.

The third question pertains to the effects of omitting completely trade in oil and food. Mann and Plück had to do that, for reasons explained in their paper. But they should perhaps have warned their readers that the exclusion of oil and food may impair the comparability of their regression results with those obtained by other studies. Could it perhaps help to explain why their results differ appreciably from those of the other three studies shown in table 7.3—why in particular they succeed in narrowing the Houthakker-Magee asymmetry, a matter to which I return in the following.

Thus far, I have focused on what Mann and Plück did. Let me turn now to some of the things they say, especially their quasi-normative use of the Houthakker-Magee asymmetry—the fact that, in most studies, as well as in most of their own trade equations, the income elasticity of the U.S. demand for imports exceeds the income elasticity of the foreign demand for U.S. exports. Citing Krugman and Baldwin (1987), they say that this finding is incompatible with a global long-run equilibrium:

1. See also footnote 22 to the present version.

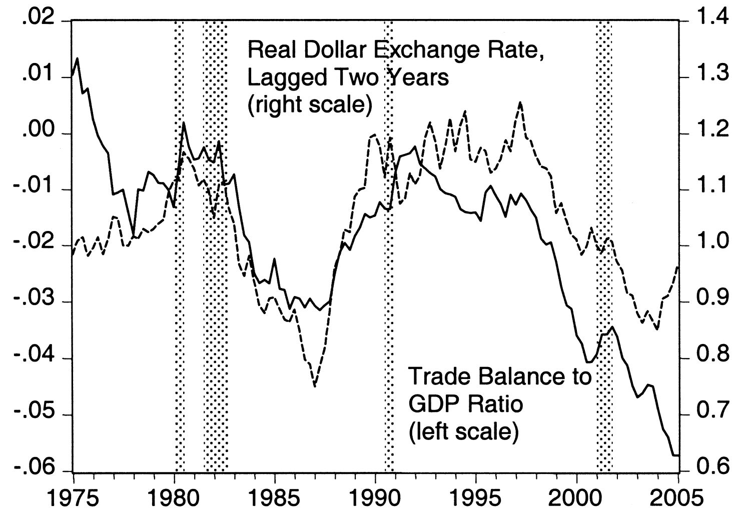

Fig. 7C.1 The trade balance to GDP ratio and the real dollar exchange rate, lagged two years

Source: Chinn (2005, 11). Reprinted with permission.

> The estimates imply that if the United States and the rest of the world grow at the same pace (long-run convergence), the U.S. trade deficit would worsen, absent a trend change in relative price—which is also inconsistent with long-run equilibrium.

The Houthakker-Magee asymmetry is, as they say, manifestly inconsistent with the long-run convergence of real incomes at constant relative prices. But a trend change in relative prices, while inconsistent with long-run convergence, is not inconsistent with long-run equilibrium. Recall the models developed by Harry Johnson and others many years ago, in which equal rates of growth in output, due either to capital accumulation or technical progress, can lead to continuing changes in relative prices (i.e., the terms of trade).[2] It may therefore be wrong to dismiss a robust empirical finding merely because it is inconsistent with uniform global growth at constant relative prices. A world displaying that property would be pretty indeed, but we should not be dismayed by a world that does not display it. Yet Mann and Plück, while not dismayed, tend too much to use the reduction of the Houthakker-Magee asymmetry as a normative criterion—to prefer empirical results in which it is smaller.

My chief concern, however, derives not from the author's treatment of the Houthakker-Magee asymmetry but from their results regarding the price elasticities of demand for U.S. exports and imports. The conventional

2. See, for example, Johnson (1959).

wisdom holds that a reduction of the U.S. current-account deficit requires a combination of expenditure changes and expenditure switching and that the latter can be achieved by dollar depreciation, which should have two effects—switching U.S. expenditure from traded to nontraded goods, and switching U.S. and foreign expenditure between U.S. tradables and foreign tradables. Mann and Plück express concern about the implications of their findings for the efficacy of the first type of switching, but I am more concerned about the implications for the second type.

Consider the price elasticities shown in table 7.3 of their paper. They are, without exception, lower than the ones obtained by the earlier studies listed in that table. The long-run price elasticities are much larger for U.S. imports of consumer goods, as shown in table 7.5 and likewise larger for U.S. imports of autos and parts (although the regression coefficient falls short of significance). But it is wrong-signed for industrial materials. And all of the price elasticities for U.S. imports from the developing countries are wrong-signed, while those for U.S. exports to developing countries in table 7.5 are not significantly different from zero.

I find it quite hard to square these results with the story told by figure 7C.1, which plots the U.S. trade balance relative to GDP along with the log of the U.S. real exchange lagged two years. How can these series be so closely correlated if the relevant price elasticities are as low as those in Mann and Plück's paper?

Finally, a policy question: given the large difference between the computed price elasticities for U.S. trade with industrial countries and those for U.S. trade with developing countries, are we perhaps expecting too much from any future appreciation of the Asian currencies? Papers elsewhere in this volume give good reasons for believing that the renminbi and other Asian currencies are undervalued; the huge accumulation of foreign-exchange reserves is itself indicative. But Mann and Plück's paper makes me wonder how much to expect from a significant appreciation of the Asian currencies and thus to repeat my previous suggestion that the authors look more closely at smaller country groups.

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8

Will the Euro Eventually Surpass the Dollar as Leading International Reserve Currency?

Menzie Chinn and Jeffrey A. Frankel

Might the dollar lose its status as unrivaled international reserve currency? Could it be "going the way of sterling, the guilder, the ducat and the bezant" (Kindleberger 1995, 6)? Some authors argued as much in the early 1990s.[1] The international use of the yen and mark had risen rapidly in the 1970s and 1980s, reducing the share of the dollar (see table 8.1 or figure 8.1).[2] Some suggested that the yen or mark might eventually overtake the dollar as the lead international currency. (See figures 8.2 and 8.3.)

By the turn of the millennium, that idea had come to sound far-fetched. In the meantime, both Japan and Germany had undergone a decade of remarkably low economic growth, the yen had declined, and the mark had

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The authors would like to thank Jaewoo Lee and participants at the NBER conference in Newport, Rhode Island, including, in particular, our discussant Ted Truman. We also thank Jay Shambaugh for providing data on currency peg arrangements.

1. Others who "cried wolf," besides Kindleberger, include Kunz (1995). The February 25, 1995, issue of *The Economist* included an article and leader arguing that "the dollar's dominance is waning" at the expense of the deutsche mark in particular. See also Ramon Moreno, "Will the Yen Replace the Dollar?" *Federal Reserve Bank of San Francisco Economic Letter,* no. 96-30, October 18, 1996.

2. In this study, we rely upon data available to us as of June 2005. Admittedly, there may be some distortions in the way the data have been recorded by the Fund. Ted Truman notes in his discussion that there is a potentially large impact from the establishment of the European Monetary Cooperation Fund. Dollars were swapped for the ECU, which appeared as a lower dollar share, and gold was also swapped for ecu which expanded the base and resulted in a lower dollar share.

Table 8.1 **Share of national currencies in total identified official holdings of foreign exchange, end of year (%)**

	1965	1973	1977	1982	1987	1992	1997	2003
U.S. dollar	56.1	64.5	79.2	57.9	53.9	48.9	59.1	63.8
Japanese yen	0.0	0.1	2.2	4.1	6.8	7.4	5.1	4.8
Pound sterling	20.0	4.2	1.6	1.8	1.9	2.6	3.3	4.4
Swiss franc	0.0	1.1	1.9	2.3	1.7	0.8	0.5	0.4
Euro	0.0	0.0	0.0					19.7
Deutsche mark	0.1	5.5	9.3	11.6	13.8	14	13.7	
French franc	0.9	0.7	1.1	1	0.9	2.6	1.5	
Netherlands guilder	0.0	0.5	0.7	1	1.2	0.7	0.5	
ECUs	0.0	0.0	0.0	13.8	13.6	9.7	5	
Unspecified currencies	22.9	23.6	4.1	6.5	6.4	13.3	11.3	6.8

Source: IMF data—updated version of statistics contained in the IMF *Annual Report.* 1997 and 2002 figures from 2004 *Annual Report.*

Notes: Shares of total currency holdings by central banks.

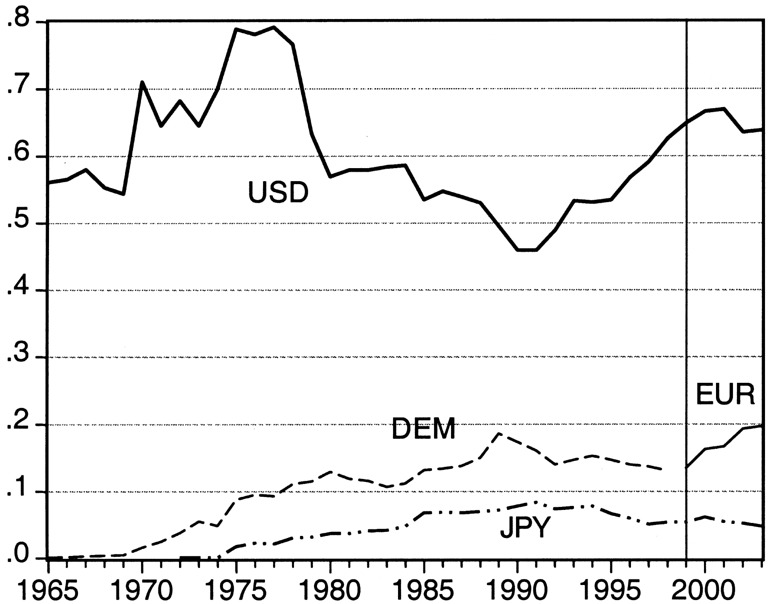

Fig. 8.1 Reserves held by central banks as shares of total—Major currencies

Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

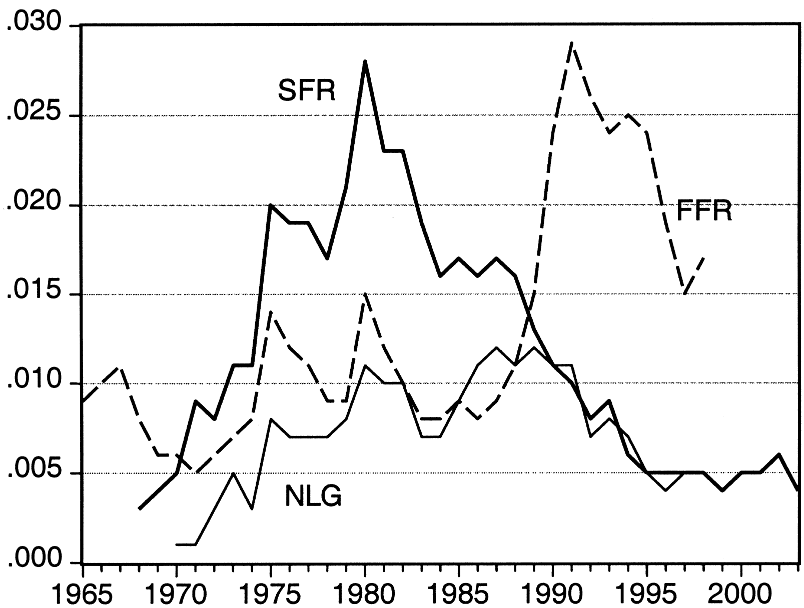

Fig. 8.2 Reserves held by central banks as shares of total—Smaller currencies

Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

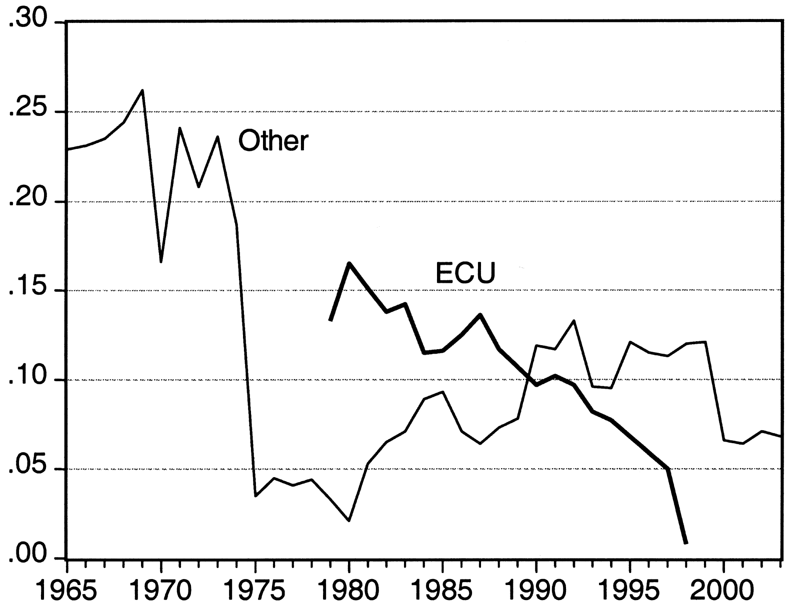

Fig. 8.3 Reserves held by central banks as shares of total—Other currencies

Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

disappeared altogether. Fears that the international currency status of the dollar was under challenge were premature, as should have been obvious at the time. Indeed, the international role of the dollar, at least as measured by its share of central banks international reserves, had stopped declining in 1990 and had begun to reverse in the early 1990s. (Again, refer to table 8.1 or figure 8.1.) Meanwhile, dollarization was increasing in Latin America and elsewhere.

These developments were overshadowed by exchange rate movements: the continuation of the dollar's post-1985 trend of depreciation, which lasted until 1995. Perhaps people have trouble distinguishing the question of whether a currency like the dollar is declining in international reserve currency status from the question of whether its foreign exchange value is falling. It seems that the question of whether the dollar might lose its privileged status as lead international currency comes up each time the dollar experiences a few years of depreciation (late 1970s, early 1990s).

The dollar underwent a new depreciation in 2002 to 2004. On the basis of this fact alone, one could have predicted that international economists might be once again called upon to try to answer questions regarding the international currency rankings.[3] Indeed, as the rise of the dollar-euro exchange rate reached its third year in late 2004, the financial press began to report that central banks were on the verge of large-scale diversification out of dollars.[4]

This time may be different than the earlier scares in the late 1970s and early 1990s. The difference is that the euro now exists as a plausible rival.[5] Notwithstanding the bumps in the road of European monetary integration and the doubts of many American economists, the European Monetary Union (EMU) became a reality in 1999, and the euro appeared in physical form four years later. The new currency passed the most fundamental tests: the transition was relatively smooth, twelve countries today use the euro (and only the euro), and the new currency has entered into international use as well.

3. "Sometime soon, newspaper stories will begin reporting that central banks in Asia and elsewhere are diversifying out of dollars into euros, and that the dollar is in danger of eventually losing its status as premier international currency" Frankel (2004).

4. For example, *The Economist* (12/04/04, 2/26/05); *Financial Times* (1/24/05, 3/8/05, 3/11/05, 3/19/05, 5/17/05, 5/19/05, 5/21/05); *New York Times* (3/11/05); and many others.

5. One of the present authors in the mid-1990s took a bullish position regarding the prospects for the dollar (e.g., in Frankel 1995): "It is unlikely that some other currency will supplant the dollar as the world's premier currency . . . There is no plausible alternative for the number one position" (Eichengreen and Frankel 1996, 363). But those papers also acknowledged "the possibility of a single currency coming into use throughout Europe, which would indeed pose a challenge to the supremacy of the dollar if it was to happen . . ." (366). "And as the euro becomes more important as a vehicle currency, it is likely to gain use as an intervention currency and to become an increasingly popular form in which other countries hold their reserves. Ultimately, the creation of the euro would mean a new and increasingly powerful rival for the dollar as the international monetary system's leading reserve currency." (372).

Table 8.2 **Roles of an international currency**

Function of money	Governments	Private actors
Store of value	International reserves	Currency substitution (private dollarization)
Medium of exchange	Vehicle currency for foreign exchange intervention	Invoicing trade and financial transactions
Unit of account	Anchor for pegging local currency	Denominating trade and financial transactions

In the first few years of its life, the euro did not receive much respect. This was largely related to its substantial weakness against the dollar. Certainly anyone who had predicted that on January 1, 1999, there would be a worldwide shift out of dollar reserves into the new alternative, and that the increased demand for euros might cause a large appreciation, was initially disappointed.[6] But subsequently this depreciation was fully reversed, and then some, in the strong appreciation of 2002 to 2004.

This paper will seek to ascertain the determinants of international reserve currency status and to make some predictions as to whether the euro might under some conditions eventually overtake the dollar and, if so, when.

8.1 International Currency Rankings

First are some definitions. An international currency is one that is used outside its home country. Reserve currency status is the main subject of this paper, but it is just one of a number of possible measures of international use. The others can be neatly summarized by means of a simple 2×3 table originally suggested by Benjamin Cohen (1971) and refined by Peter Kenen (see table 8.2). The classic three functions of money domestically—store of value, medium of exchange, and unit of account—can be transferred to the level of international money. Under each function, there are important examples of how government authorities and private actors sometimes choose to use a major international currency that is not their own. The subject of this paper appears in the first cell, the decision of central banks to hold their reserves in the form of particular currencies. But other possible

6. "There will probably be a portfolio diversification of $500 billion to $1 trillion into euros. Most of this shift will come out of the dollar. This in turn will have a significant impact on exchange rates during a long transition period. The euro will move higher than will be comfortable for many Europeans . . . The euro will probably be strong from its inception" Bergsten (1997, 84–85). Portes and Rey (1998), also writing at a time of dollar strength, suggested that American policymakers had been overly pessimistic about the euro's prospects. These authors were exceptional in their countercyclical faith in the euro.

criteria of an international currency also appear in the table: currency substitution (e.g., the circulation of dollar currency in Latin America and elsewhere), denominating or invoicing foreign trade, denominating or invoicing international financial flows, pegs for smaller countries' currencies, and foreign exchange trading.

We focus on reserve currency holdings for two reasons. First, annual data for all relevant currencies are available over the last thirty years or more; the other international roles that appear in table 8.2 are nowhere near as comprehensively quantifiable. A second reason for focusing on the reserve currency role is that it is more relevant than the others to the important questions of whether the United States will continue to be able to finance its current account deficit.

8.1.1 Should We Care about International Currency Rankings?

Is this question important? International currency status might seem to have fewer direct implications for the real economy than does the currency's exchange rate. But it is important nevertheless. To begin with, the exchange rate question and the international currency question have always been causally interrelated, notwithstanding some periods such as the early 1990s when they have moved in opposite directions. But the topic has become newly urgent in light of the question whether the U.S. current account deficit is sustainable. How long can it continue? The historical experiences of other countries with current account thresholds and reversals are not particularly relevant in that the argument for sanguinity relies on the special role of the dollar in the world financial system. This paper was written for a conference on the sustainability of the G7 current account imbalances, following two years when the major source of financing of the deficit was purchases of dollar assets by foreign central banks, especially in Asia. The sustainability of the U.S. current account deficit may depend on the continued willingness of foreign central banks to accumulate ever-greater quantities of U.S. assets, unless foreign private investors resume doing so. That, in turn, depends on two factors: (a) the desire of foreign central banks to continue intervening in foreign exchange markets to try to dampen or prevent the appreciation of their currencies against the dollar, and (b) the willingness of central banks to continue to hold the lion's share of their reserves in the form of dollars as opposed to some rival currency, that is, the euro. While the former question received a fair amount of attention in 2003 to 2004,[7] the latter question did not until 2005.[8]

7. For example, Dooley, Folkerts-Landau, and Garber (2003); Goldstein (2004).

8. Perhaps the question whether the currency preferences of central banks will continue to assign a special role to the dollar is not as important as the analogous question for private investors. But this is still a matter of the dollar's place as premier international currency, of which the reserve holdings is the most easily quantified aspect.

Advantages of Having an International Currency

One can think of four advantages to a country of having its currency play a large role in the world.

Convenience for the Country's Residents. It is certainly more convenient for a country's exporters, importers, borrowers, and lenders to be able to deal in its own currency than foreign currencies. The global use of the dollar, as with the global use of the English language, is a natural advantage that American businessmen tend to take for granted.

More Business for the Country's Banks and Other Financial Institutions. There need be no firm connection between the currency in which banking is conducted and the nationality of the banks (nor between the nationalities of the savers and borrowers and the nationality of the intermediating bank). Nevertheless, it stands to reason that U.S. banks have a comparative advantage at dealing in dollars, British banks at dealing in pounds, and so on.

Seignorage. This is perhaps the most important advantage of having other countries hold one's currency. They must give up real goods and services, or ownership of the real capital stock, in order to add to the currency balances that they use. Seignorage is not necessarily large if defined narrowly, as the low-interest loan accruing to the United States when foreign central banks hold their reserves as dollars. But it is much more important if defined broadly as America's "exorbitant privilege" of being able to borrow abroad large amounts in its own currency, especially while simultaneously earning much higher returns on foreign direct investment (FDI) and other investments in other countries. This was the basis of European resentment against the U.S. basic balance deficit in the 1960s and against the dollar standard to the extent that the European need to acquire dollars was the fundamental origin of the deficit. The willingness of Asians and others to continue financing the U.S. current account deficit in the future is certainly related to the dollar's continued role as premier international reserve currency. We are not necessarily talking about seignorage narrowly defined (foreign holdings of U.S. currency, which doesn't pay interest). More important is the U.S. ability to run up huge debts denominated in its own currency at low interest rates. The United States has consistently earned more on its investments overseas than it has had to pay on its debts, a differential of about 1.2 percent per annum (e.g., Cline, 45). Possibly this American role of the world's banker (taking short-term liquid deposits and lending long term in riskier higher-return assets) would survive the loss of the dollar as leading international currency. But it also seems possible that the loss of one would lead to the loss of the other.

Political Power and Prestige. Britain's gradual loss of key currency status was simultaneous with its gradual loss of political and military preeminence. As with most of the other benefits and conditions mentioned in the preceding, causality here flows in both directions. We shall come back to this issue in section 8.3.

Disadvantages of Having an International Currency

One can think of three disadvantages from the viewpoint of a key currency country. They explain why Japan and Germany were in the past reluctant to have their currencies held and used widely and why China worries about the implications of beginning to internationalize its currency.

Larger Fluctuations in Demand for the Currency. It is not automatically clear that having one's currency held by a wide variety of people around the world will result in greater variability of demand. Such instability is probably more likely to follow from an increase in the degree of capital mobility, than from key currency status per se. Nevertheless, the two are related. Central banks are sometimes concerned that internationalization will make it more difficult to control the money stock. This problem need not arise if they do not intervene in the foreign exchange market. But the central bank may view letting fluctuations in demand for the currency be reflected in the exchange rate as being just as undesirable as letting them be reflected in the money supply.

An Increase in the Average Demand for the Currency. This is the other side of seignorage. In the 1960s and 1970s, the Japanese and German governments were particularly worried about the possibility that if assets were made available to foreign residents, an inflow of capital would cause the currency to appreciate and render exporters less competitive on world markets. Again, this is also China's problem today.

Burden of Responsibility. The monetary authorities in the country of the leading international currency may have to take into account the effects of their actions on world markets, rather than being free to devote monetary policy solely to domestic objectives. The Federal Reserve probably cut interest rates more than it otherwise would have in the second half of 1982, and again in late 1998, in response to international debt problems in Latin America and elsewhere. At times Argentina or others have considered officially dollarizing; reluctance to accept any burden of responsibility, even if only implicit, explains the lack of enthusiasm from U.S. authorities.[9]

9. For example, De Long and Eichengreen (2002) or Frankel and Roubini (2003). Thanks to Ted Truman for reminding us of this point.

8.2 The Approach of the Paper

The paper seeks econometrically to ascertain the determinants of international reserve currency shares over the period 1973 to 1998, before the advent of the euro.[10] The exercise is largely parameter estimation and calibration, without a lot of hypothesis testing. We intentionally impose a lot of a priori information because we need to squeeze a lot out of a small sample.

The literature on what determines reserve currency status is fairly well established, if often lacking in quantification. There are three key points:

1. Long-term determinants are important. A list of determining factors appears subsequently, in section 8.5. The most important is the size of the country or region in which the currency is indigenously used, but there are others as well.

2. Network externalities or economies of scale and scope are important. Each country is more likely to use whatever currency is used by others. Thus international currency use is not linear in the determinants. Rather, there may be a *tipping phenomenon:*[11] if one currency were to draw even and surpass another, the derivative of reserve currency use with respect to its determining variables would be higher in that range than in the vicinity of zero or in the range when the leading currency is unchallenged. In that sense, the switch happens rapidly.[12]

3. In the chronological sense, however, the switch happens slowly. Whatever currency has been used in the past will continue to be used in the future. Thus *inertia* is great.

We thus have three tasks: (a) ascertain the most important determinants and their relative weights, (b) confirm that the function is nonlinear and settle on an appropriate functional form, and (c) estimate the extent of inertia, which we will represent by means of a lagged endogenous variable. Our data come from reserve currency holdings of central banks over the period 1973 to 1998. One cannot be confident that any given data set will contain enough information to answer the questions of interest. Unfortunately the available data do not extend anywhere near far back enough in history to observe the fall of the pound from its number one position of a century ago. But the beginning of our data set does capture the mark passing the pound for the number two slot, which may be a useful data point for

10. Among previous attempts to estimate determinants of reserve currency shares are Dooley, Lizondo, and Mathieson (1989) and Eichengreen and Mathieson (2000).

11. Tipping arises in many contexts (Schelling 1978; Gladwell 2000).

12. As Eichengreen (2005) points out, counteracting the arguments about network externalities and tipping, particularly in determining the reserve currency function, is an argument in favor of multiple simultaneous international currencies: competition for the affections of investors.

addressing the tipping phenomenon described in key point 2. We hope that there is enough variation among the other currencies and across the other years to obtain useful estimates of parameters of interest under key points 1 and 3.

The disappearance of the mark, franc, and guilder in 1999 and their replacement by the euro, constitute an irreparable break in the data series. But we hope to turn this obstacle to advantage. We obtain a check on the meaningfulness of the equation that was estimated on pre-1999 data by seeing whether it successfully predicts the direction of movement over the period 1999 to 2003. Then we use the equation to forecast the path of the currency shares of the dollar, euro, and other international currencies into the future, as a function of several different possible scenarios regarding, for example, whether the United Kingdom eventually joins the EMU. While we did not expect to predict that the euro could overtake the dollar anytime soon, we entered this exercise with a completely open mind regarding whether the euro might overtake the dollar in the longer term.

8.3 Brief History

There is of course an important historical precedent.[13] The pound sterling was the premier international currency of the gold standard period. Historians estimate, for example that 60 to 90 percent of the world's trade was invoiced in sterling in the nineteenth century (Broz 1997; Hale 1999). In 1899 the share of pound in known foreign exchange holdings of official institutions was more than twice the total of the next nearest competitors, the franc and the mark, and much greater than the dollar.[14]

8.3.1 When the Dollar Overtook the Pound

The U.S. economy in the late nineteenth century surpassed the British economy in size (1872).[15] United States's exports did not pull ahead of U.K. exports until World War I and did not do so on a permanent and substantial basis until World War II. (See figure 8.4.) The development of the financial system lagged further behind. One reflection is that the United States did not establish a central bank until 1913. During the years following 1914, the United States passed from net debtor to net creditor, while the United Kingdom moved in the opposite direction. This had much to do with British borrowing from the United States so as to fight World War I.

13. Alogoskoufis and Portes (1992) noted early on the precedent for the possible dethroning of the dollar.

14. $105.1 million in pounds, $27.2 million in francs, $24.2 million in marks, and $9.4 million in other currencies. In 1913, the ranking was the same: $425.4 million in pounds, $275.1 million in francs, $136.9 million in marks, and $55.3 million in other currencies (Lindert 1969, 16–22).

15. In 1990 International Gheary-Kamis dollars.

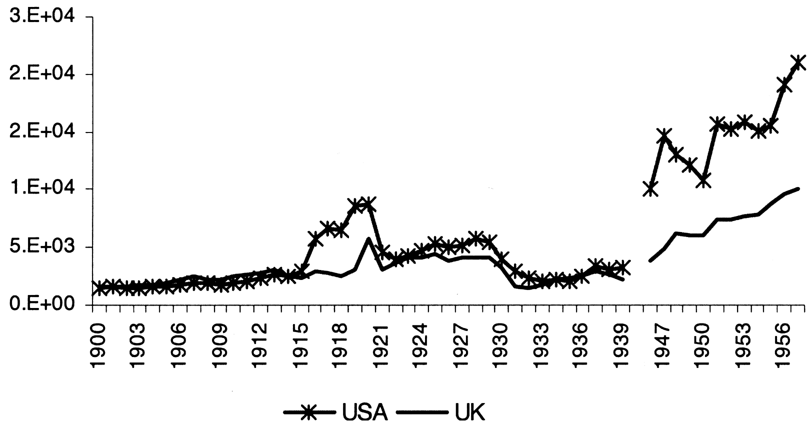

Fig. 8.4 U.S. and U.K. exports, 1900–1957 (in millions of dollars)
Sources: U.K. export data: Department of Trade and Industry, UK; U.K. exchange rate (1946–1970): Global Financial Data; U.S. Export Data: *Historical Statistics of the United States, Colonial Times To 1970,* published by the U.S. Census Bureau.

The dollar was the only currency to remain convertible into gold at a fixed price into the 1920s.[16]

As it emerged as a major international currency, the dollar's use in international trade and finance widened increasingly. The pound retained its dominant position as key currency in the interwar period, in large part due to the inertia in such arrangements that was noted previously. As late as 1940, the level of foreign-owned liquid sterling assets was still double the level of foreign-owned liquid dollar assets. By 1945, however, the position of the dollar and pound, as measured by this statistic, had precisely reversed.[17] World War II—entailing further U.S. lending, U.K. borrowing, and other economic consequences—had completed the dollar's rise to ascendancy.

The decline in the pound was clearly part of a larger pattern, whereby the United Kingdom lost its economic preeminence, colonies, military power, and other trappings of international hegemony. As some of us wonder whether the United States might now have embarked on a path of imperial overreach, following the British Empire down a road of widening federal budget deficits and overly ambitious military adventures in the Muslim world, the fate of the pound is perhaps a useful caution. The Suez crisis of 1956 is frequently recalled as the occasion on which Britain was forced under U.S. pressure to abandon its remaining imperial designs, but the important role played by a simultaneous run on the pound is often forgot-

16. For example, Nurkse (1944), Bergsten (1975, 53), and Eichengreen (1992).
17. See Aliber (1966, 19–20).

ten.[18] Paul Kennedy's (1989) suggestion of the imperial overreach hypothesis and its application to U.S. hegemony may have been essentially correct but ten years premature, much like the forecasts of those in the early 1990s who warned prematurely over the dollar's imminent demise.

8.3.2 The Dollar in the Bretton Woods Era

Though gold was the official international reserve asset of the monetary system that was established in 1944 at Bretton Woods, New Hampshire, the dollar was the true reserve asset of the postwar system. During the initial period of dollar shortage, the European and other currencies were not convertible into gold and so were not prized as the dollar was (Kindleberger 1950). The Europeans and others measured their economic recovery from the wartime destruction by their progressively greater ability to earn dollars through improving trade balances. By 1958 the balance of payments of the major European countries had improved sufficiently that they were able to restore convertibility (McKinnon 1979, 5).

No sooner had the system of fixed-rate convertible currencies come into operation than it was threatened by the onset of gradual rot. In 1958, the United States began to run large balance of payments deficits. Although these deficits were nothing other than the counterpart of the European surpluses, they presaged trouble as Robert Triffin (1960) pointed out. The world's demand for international reserves increases gradually in proportion to international income and trade. As the supply of gold was more or less fixed, the dollar would be increasingly used as a supplementary reserve asset by other countries' central banks under the Bretton Woods regime. But there was only one way that other countries could earn dollars: by running balance of payments surpluses with the United States. This led directly to what came to be known as the *Triffin dilemma.* Either the United States would take measures to limit its balance of payments deficit, or it would allow other countries to continue to accumulate claims against it. In the former case, the world would be deprived of its necessary reserves. In the latter case, the ratio of outstanding dollar liabilities to gold held in Fort Knox would rise without limit, provoking at some point a crisis in which private speculators (and Charles de Gaulle) would lose confidence and present the American authorities with more claims for payment than could be met.[19]

In the 1960s, the U.S. government adopted the stop-gap measure of putting controls on capital outflows. Meanwhile, economists debated three possible general solutions to the dilemma: raising the price of gold so as to increase the effective supply of reserves, creating a sort of paper gold as a

18. For example, Boughton (2001) and "From Suez to Baghdad," Charlemagne, *The Economist*, March 22, 2003 (47).

19. Kenen (1960) argued that central banks would be reluctant to hold reserves in the form of a currency like the dollar that was expected to lose value.

new reserve asset, or moving to floating exchange rates so as to reduce countries' demand for international reserves.[20]

The day of reckoning was in any case accelerated substantially by the expansionary U.S. fiscal and monetary policies of the Vietnam War era and the resulting widening of the balance of payments deficit. In August 1971, the United States unilaterally closed the official gold window, thereby ending the Bretton Woods regime. The attempt to patch up the fixed exchange rate system in the Smithsonian Agreement by devaluing the dollar against gold lasted only a short time. By March 1973, all the major industrialized countries had given up the effort to keep their currencies pegged to the dollar.

8.3.3 The Dollar in the Floating-Rate Era

One might have expected in the post-1973 decades a sharp downward shift in the demand for reserves by those major industrialized countries that moved to floating rates. There is indeed some evidence of a downward shift. But the demand for reserves nonetheless remained surprisingly high.[21] Even though the central banks are willing to tolerate a far higher degree of variability in their exchange rates than before 1973, it takes a much greater amount of intervention to achieve any given effect than in the period when international financial markets were less developed. This may explain the still-high demand to hold reserves.

The fraction of reserves held specifically in the form of dollars began to decline in the late 1970s. While it is important not to confuse a change in the use of a currency with a change in its exchange value against foreign currencies, the downward trend of the dollar was, in fact, partly a reflection of a decline in its value. The depreciation of the dollar was concentrated particularly in three major episodes, one per decade: 1977 to 1979, 1985 to 1988, and 1993 to 1995. In each episode, the dollar exchange rate became an issue of conflict between the United States and its trading partners, Europe in particular. American Treasury secretaries were periodically faulted for a policy of *benign neglect* of the dollar's value.

Benign neglect was also the policy in the period of dollar appreciation from 1980 to February 1985. A strong dollar has advantages for other countries—improved prospects for their firms that export to the United States or that compete with imports—as well as disadvantages—an adverse shift in their terms of trade, higher prices for imported inputs like oil that (in the short run) have their prices set in dollars, and upward pressure

20. McKinnon (1969) predicted, accurately as it turned out, that a move to floating rates, while it would reduce the *official* demand from central banks for the dollar as a key currency, would not reduce the *private* demand for an international currency. He also predicted that the dollar would remain the currency best suited to such a role.

21. For example, Heller and Khan (1978). From similar evidence, Frenkel (1980, 183) drew the observation that "economic behavior seems to be more stable than legal arrangements."

on wages. A weak dollar has the corresponding disadvantages and advantages. It is evident that the point of view in Europe that disparages both upswings and downswings must have as its objective a stable dollar. Beyond the usual costs that are claimed from a volatile exchange rate, variability in the dollar as the world's key currency was also blamed for a ratcheting up of the level of protectionist barriers (as the United States erects import barriers when the dollar is strong, and trading partners do the same when it is weak), variability in the world price level (as countries intervene to stabilize the exchange rate and suffer consequent movements in their money supplies), and an inflationary bias (the result of the absence of a world nominal anchor to take the place of gold, the pound, or the dollar).

The United States was accused, especially in the 1970s, of having neglected its social responsibility to supply the world with the public good of a stable international money. Such complaints pointed up the conflict inherent in the dual role of the dollar as America's currency and the world's currency. The charge also, in part, provided a rationale for the birth of the European Currency Unit (ECU) in 1979 as a rival currency, which eventually in 1999 became the euro.

8.4 International Use of the Euro So Far

There are a variety of indicators of international currency use. The sort that is available on the timeliest basis is the currency of denomination in cross-border financial transactions. The euro soon after its debut came into wide use to denominate bonds. Within Europe there was a substantial increase in issues of corporate bonds, denominated in euros, together with a rapid integration of money markets, government bond markets, equity markets, and banking. While the frenetic activity seemed to be related to the debut of the euro, it does not meet the definition of *international currency use* because it took place inside the currency's home region (Gaspar and Hartmann 2005; Rey 2005).

Outside Europe, the euro has been a success as well.[22] Detken and Hartmann (2000) studied the data from the euro's first year in operation, doing a careful job of netting out intra-euro-area holdings in order to be able to trace back a measure of euro-precursor currencies for five years before 1999 that is comparable with post-1999 numbers. They found more of an increase in the supply of euro-denominated assets outside of Europe than an increase in demand.[23] The stock of international debt denominated in

22. Even based on just 1999 data, "the euro has become the second most important currency in virtually all segments of international capital markets right from the start of stage 3" (Detkens and Hartmann 2000). Bishop states that "Regular emerging market issuers now seem to regard the euro market as a genuine alternative to dollar markets" (2000).

23. To be sure, unless these excess-supplied euros are piling up as dealer inventories, then arithmetically they must be matched by an increase in demand from European residents. A

euros increased from about 20 percent on the eve of the EMU, to 30 percent in 2003 (Rey 2005, 114).

The last column of table 8.1 reports the euro's share in central banks' foreign exchange reserves—19.7 percent in 2003.[24] Early estimates for 2002 equaled approximately the sum of the shares of the mark, French franc, and guilder just before the EMU, but is less than what one would get by adding in the share of ECUs. This is to be expected: before 1999, the twelve central banks had to hold foreign exchange reserves, including of each others' currencies; these disappeared at the stroke of a pen on January 1, 1999. One cannot simply compare pre- and post-1999 figures to learn if the advent of the euro has hurt the attractiveness of the dollar as international reserve currency.

International use of the euro continued to grow during the first five years of its life.[25] About half of euroland trade with noneuro area residents is invoiced in the new currency.[26] The euro's share in international debt securities has risen to above 30 percent (versus below 20 percent for the pre-1999 legacy currencies). The comprehensive triennial survey of foreign exchange trading volume put together by the Bank for International Settlements (BIS) showed the dollar still easily in first place in 2001, at 85 percent of all spot trades (out of 200 percent), followed by the euro at 43 percent and the yen at 26 percent.[27] The euro's share of foreign exchange transactions in 2003 reached one quarter (out of 100 percent) in Continuous Linked Settlement data. The most recent triennial BIS survey, covering April 2004, showed the dollar still at 85 percent of all spot trades and the euro at 44 percent. Including also forwards and swaps, the dollar was involved in 89 percent of all transactions, and the euro in 37 percent (Bank for International Settlements 2005).

In short, the euro is the number two international currency, ahead of the

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depreciation of the euro does not automatically follow. It depends which came first, the increase in supply of euro-denominated assets from nonresidents or the increase in demand from residents. Nevertheless, the finding is suggestive. At a minimum, it illustrates well the point that an increase in international use of a currency need not mean an increase in net demand for that currency or an appreciation.

24. There have been substantial revisions in the estimated euro shares. For instance, in November 2003, the IMF revised the 2002 estimate from 14.6 percent to 18.7 percent. (IMF 2003; ECB 2003); in the 2004 Annual Report, the 2002 share is 19.3. The results reported here use the revised data, spliced together with the old data before 1980 (whereas results reported in the July 2004 preconference and NBER Working Paper no. 11508 used the prerevised data).

25. The most recent annual report from the European Central Bank (2003), from which these statistics come, cites data through mid-2003.

26. Hartmann (1998) predicted that the share of the euro in trade invoicing would gradually increase, though starting out a distant second place to the dollar globally.

27. To compare foreign exchange trading volume in the euro with volume in its predecessor currencies, one must allow for the disappearance of intraeuro-twelve trading, as in Detken and Hartmann's (2002, 558–559) "simple arithmetic of EMU." They find that the observed decline is almost fully accounted for in this way.

Table 8.3 Size of United States vs. Europe (in trillions)

	2003	2004
United States	11.0	11.5
Euro-zone (12 countries)	8.8	9.0
Europe pre-5/1/2004 (15 countries)	11.3	11.5
Europe post-5/1/2004 (25 countries)	11.8	12.1

yen, and has rapidly gained acceptance, but is still far behind the dollar, which appears comfortably in the number one slot. We now turn to a consideration of the determinants of international currency status.

8.5 Factors that Suit a Currency for International Currency Status

The literature on international currencies has identified a number of determining variables.[28]

8.5.1 Patterns of Output and Trade

The currency of a country that has a large share in international output, trade, and finance has a big natural advantage. The U.S. economy is still the world's largest in terms of output and trade. By such measures, Japan is the second largest country. Alarmist fears of the early 1990s, notwithstanding, it was never very likely that Japan, a country with half the population and far less land area or natural resources, would surpass the United States in sheer economic size. But the euro is now the home currency to twelve countries. Their combined economic weight is much greater than Germany alone, or Japan. It is not quite as large as the United States, as table 8.3 shows. But it may be in the future. If the other three long-time EU members, United Kingdom, Sweden, and Denmark, were to join today, euroland would approximately equal the United States in economic size. If the ten countries that acceded to the EU in May 2004 (most of them in Central Europe) were also to join the EMU, the new monetary region would be larger than the U.S. economy. If any of these countries do join, it will be at least some years into the future. Thus, the question of relative size also depends on the growth rates of the U.S. and European economies. As an alternative to GDP, we could also look at countries' trading volume as another indication of their relative weights in the world economy.

28. Among the relevant references are Aliber (1966), Alogoskoufis and Portes (1992), Bergsten (1975), Black (1989), Eichengreen and Frankel (1996), Eichengreen and Mathieson (2000), Frankel (1992, 1995), Kenen (1983), Krugman (1984), Kindleberger (1981), Matsuyama, Kiyotaki, and Matsui (1993), McKinnon (1969, 1979), Portes and Rey (1998), Rey (2001), Swoboda (1969), Tavlas (1993), and Tavlas and Ozeki (1992).

For some measures of international currency use—how often a vehicle currency is used in the invoicing and financing of international trade—other aspects of the pattern of trade may also be relevant. The fact that much of Japan's imports are oil and other raw materials and that much of its exports go to the Western Hemisphere, for example, helps explain why a disproportionately small share of trade is invoiced in yen as opposed to dollars. Raw materials still tend heavily to be priced in dollars. Whenever the dollar depreciates for more than a few years, the Organization of the Petroleum Exporting Countries (OPEC) starts discussing switching to another currency of denomination. It hasn't happened yet. But it could if the dollar's primacy in other international roles were seriously challenged.

8.5.2 The Country's Financial Markets

To attain international currency status, capital and money markets in the home country must be not only open and free of controls, but also deep and well developed. The large financial marketplaces of New York and London clearly benefit the dollar and pound relative to the euro and its predecessor the deutschemark, as Frankfurt is still less well developed. Tokyo and Frankfurt financial markets have changed a lot over the last two decades. But they still lag far behind New York and London as financial centers.

It has also been argued that a strong central bank, and a large financial sector to counterbalance the political influence of the trade sector, are important. The point is to get support from Wall Street, to be able to resist political pressure from Main Street in favor of depreciating the currency to help sell goods.[29]

It is surprisingly difficult to come up with a proxy for size, depth, or development that is available for all the financial centers. We have opted to use as our primary measure data on foreign exchange turnover in the respective financial centers: New York, London, Frankfurt, Tokyo, Zurich, and so on. This measure differs from turnover *of* the currencies (dollar, pound, euro, etc.), a variable that would be much more simultaneous with the international currency status that we are trying to explain. It captures, for example, the preeminence of London, which continues despite the small role of the pound. This measure has the virtue of reflecting to some extent all kinds of international financial transactions (both long term and short term, banking and securities, bonds and equities). Moreover, it is possible to patch together a data set covering the desired countries and years—though just barely, and with increasing difficulty as one goes back through the 1970s. We have also tried an alternative proxy for the size of financial centers—the size of the countries' stock markets.

29. For example, Hale (1995) and Frieden (2000).

8.5.3 Confidence in the Value of the Currency

Even if a key currency were used only as a unit of account, a necessary qualification would be that its value not fluctuate erratically. As it is, a key currency is also used as a form in which to hold assets (firms hold working balances of the currencies in which they invoice, investors hold bonds issued internationally, and central banks hold currency reserves). Here confidence that the value of the currency will be stable, and particularly that it will not be monetized or inflated away in the future, is critical.[30] The monetary authorities in Japan, Germany, and Switzerland in the 1970s established a better track record of low inflation than did the United States, which helped their bids for international currency status. As recently as the 1980s, the mean and variance of the inflation rate in the United States were both higher than in those three hard-currency countries, though lower than in the United Kingdom, France, Italy, and many other countries.[31]

Given the good U.S. inflation performance in the 1990s, this is no longer such a concern as it was formerly. A more important negative for the dollar is the fact that the United States is now a large-scale debtor country.[32] Even if the Federal Reserve never succumbs to the temptations or pressures to inflate away the U.S. debt, the continuing U.S. current account deficit is always a possible source of downward pressure on the value of the dollar. Such fears work to make dollars unattractive.

8.5.4 Network Externalities

An international money, like domestic money, derives its value because others are using it. It is a classic instance of network externalities. In this sense, the intrinsic characteristics of a currency are of less importance than the path-dependent historical equilibrium. There is a strong inertial bias in favor of using whatever currency has been the international currency in the past.

One can make an analogy with language. If one sat down to design an ideal language, it would not be English. (Presumably it would be Esperanto.) Nobody would claim that the English language is particularly well suited to be the world's lingua franca by virtue of its intrinsic beauty, simplicity, or utility. It is neither as elegant and euphonious as French, for example, nor as simple and logical in spelling and grammar as Spanish or Italian. Yet it is certainly the language in which citizens of different countries most often converse and do business, and increasingly so. One

30. For example, Devereux and Shi (2005).
31. For example, Tavlas and Ozeki (1992).
32. The U.S. statistics on both net international investment position and net investment income have shown false alarms in the past. The numbers have repeatedly been revised to postpone the date at which, first the stock position and then the income balance, turn negative. But there is no doubt that the United States has since become the world's largest net debtor.

chooses to use a lingua franca, as one chooses a currency, in the belief that it is the one that others are most likely to use.

Krugman (1984) showed how there can be multiple equilibria in use of an international currency, developing some informal ideas of earlier authors such as Kindleberger (1981), McKinnon (1979), and Swoboda (1969). Matsuyama, Kiyotaki, and Matsui (1993) went to the next level of abstraction analyzing this problem with the theory of random matching games. Rey (2001) also shows the possibility of multiple equilibria in the internationalization of currencies as determined by network externalities and the pattern of international trade.

The implication is that small changes in the determinants will not produce corresponding changes in the reserve currency numbers, at least not in the short run. At a minimum, changes will show up only with a long lag. As noted, the pound remained an important international currency even after the United Kingdom lost its position as an economic superpower early in the century. In the present context, the inertial bias favors the continued central role of the dollar. Also, as already noted, economies of scale suggest that, even in the long run, measures of international currency use may not be linear in the determinants. There may be a tipping phenomenon when one currency passes another.

Another aspect of the network externalities is economies of scope. An individual (exporter, importer, borrower, lender, or currency trader) is more likely to use a given currency in his or her transactions if everyone else is doing so. If a currency is widely used to invoice trade, it is more likely to be used to invoice financial transactions as well. If it is more widely used in financial transactions, it is more likely to be a vehicle currency in foreign exchange trading. If it is used as a vehicle currency, it is more likely to be used as a currency to which smaller countries peg, and so forth. In this paper we content ourselves with trying to predict reserve currency holdings. But this will depend on some of the other measures of international currency use.[33]

8.6 Estimation

We use the International Monetary Fund (IMF) annual data on aggregate central bank holdings of the relevant major currencies. The data are

33. In some of our regression tests, we tried adding to our list of determinants a measure of the popularity of the major currencies as anchors for smaller currencies to peg to (as suggested by Eichengreen and Mathieson). An Asian country that is pegged to the dollar, for example, is likely to hold a larger share of its reserves in the form of the dollar. We recognize that the pegging decision may be endogenous, determined simultaneously with the reserve holding decision and the various other measures of international currency use. We did not find a significant positive effect. Perhaps this is just as well: it saves us the trouble of trying to deal with the endogeneity of the pegging decision. (One possibility would be to use an instrumental variable for pegging choices, such as past colonial status.) In what follows, we emphasize regressions without the pegging-anchor variable included.

not generally available according to holdings of individual central banks because most of them regard this as highly confidential.

8.6.1 Functional Form

The most important variables are illustrated in scatter plots: the currency shares and the logit transformation of these shares, against GDP at market rates, in figures 8.5 and 8.6, respectively. It appears from figure 8.5

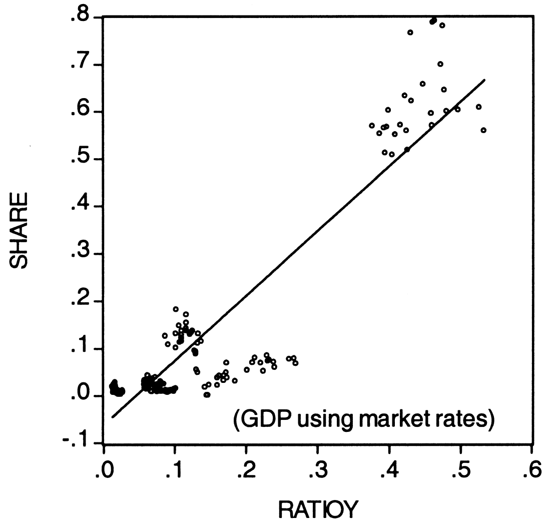

Fig. 8.5 Currency share versus GDP (market rates)

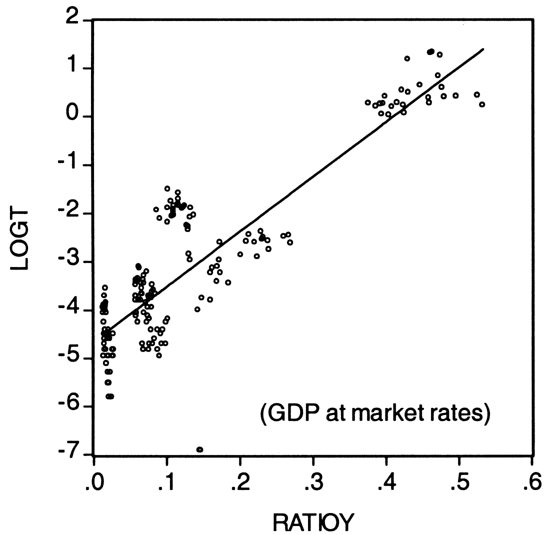

Fig. 8.6 Logistic share versus GDP (market rates)

Table 8.4 **Panel regression on shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)
GDPratio (y)	0.098*	0.123*	0.086*	0.115*	0.096*	0.085*
	(0.044)	(0.049)	(0.044)	(0.049)	(0.046)	(0.047)
Inflationdiff (π)	–0.071	–0.107*	–0.097*	–0.143*		
	(0.052)	(0.060)	(0.054)	(0.063)		
Depreciation (Δs)					–0.051	–0.094
					(0.070)	(0.074)
Exratevar (σ)	–0.028	–0.057*	–0.020	–0.055*	–0.033	–0.030
	(0.020)	(0.032)	(0.020)	(0.032)	(0.029)	(0.030)
Fxturnoverratio (to)		0.019		0.023	0.011	0.016
		(0.016)		(0.016)	(0.016)	(0.017)
GDPleader (leader)			0.023*	0.026*		0.023
			(0.013)	(0.014)		(0.014)
lagshare (sh_{t-1})	0.956*	0.944*	0.922*	0.904*	0.956*	0.923*
	(0.017)	(0.020)	(0.026)	(.029)	(.018)	(.027)
N	182	182	182	182	182	182
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.99	0.99	0.99	0.99	0.99	0.99

Notes: Dependent variable is sh (share). Estimated using OLS, no constant. All variables are in decimal form. GDP at market terms.

*Significant at the 10 percent level.

that the relationship between currency shares and GDP shares is nonlinear.[34] The data points representing the nondollar currencies seem to suggest a rather flat dependence on size; but the existence of the data points representing the dollar indicates that the curve must turn sharply upward somewhere in the middle.

Indeed, the functional form cannot literally be linear because the currency shares are bounded between 0 and 1, and not all the right-hand-side variables are similarly constrained. One common way of taking into account such a constraint is to use a logistic transformation of the shares variable.[35] The standard logistic transformation is symmetric and has a maximal slope at share equal 0.50. Figure 8.6 plots the logistic of the currency share against the size variables. The straight line now seems to fit the data much more comfortably, indicating that the logistic may be a good guess.

8.6.2 Basic Estimation Results, 1973–1998

A simple linear relationship is useful as a starting point, even though it cannot literally be correct. Table 8.4 reports results of regressions of cur-

34. It also appears that, for our purposes, it does not matter whether GDP is measured at market rates or in PPP terms.

35. Logistic = log[share/(1 – share)].

rency shares against the variables we have discussed.[36] In all instances a lagged endogenous variable is included to account for partial adjustment, which seems to be an important factor empirically.

Column (1) reports the outcome of a simple regression specification. The results indicate that income share enters positively and significantly, while inflation (expressed as the differential vis-à-vis average industrial country inflation) enters negatively, as does exchange rate volatility. When forex turnover is included, in the specification of column (2), the inflation and volatility effects are significant and in the directions anticipated. Augmenting the specification to include an indicator variable for the leader country (columns [3] and [4]) yields a statistically significant and positive coefficient estimate; but because the United States is the leader during the entire sample period, this variable reduces to a fixed effect for the United States.

Next, the results in columns (5) and (6) report specifications where the inflation variable is replaced by a long depreciation trend, estimated as twenty-year average rate of change of the value of the currency against the special drawing right (SDR). In neither case is this variable statistically significant, and indeed, very few variables appear significant in these cases.

One point of interest is that the coefficients on the lagged endogenous variable suggest a very slow adjustment rate. Only about 4 percent to 10 percent of the adjustment to the long run is estimated to occur in a single year. The half-life is on the order of seventeen years for this slower rate of adjustment.

Now consider the logistic transformation, which reflects the inherent nonlinearity of the problem. Immediately it is clear that, judged by the number of statistically significant coefficients, this is a more successful functional form. Columns (1) to (7) in table 8.5 are analogous to those in table 8.4. Most of the qualitative results are unchanged. The adjustment rate is now somewhat more rapid, about 12 percent per year.

Columns (5) and (6) report the logistic specification substituting a twenty-year depreciation trend for the inflation differential. The estimates are not significant, save for income and the lagged endogenous variable. A little investigation reveals that the results are particularly sensitive to the inclusion of the Japanese yen (which had a strong trend appreciation over the sample period, without ever attaining as big an international role as predicted by many). Excluding data for Japan yields the results in column (7), which indicates a significant role for long depreciation.

36. Seemingly unrelated regression (SUR) panel estimation yields qualitatively similar results. There is an obvious reason to expect a correlation of the error term across currencies: because the shares must sum to one, upward disturbances in one currency should be associated with negative disturbances on average across the others. ("Other currencies" and ecus are not included in the regressions, so the correlation is not perfect.) Because the results do not differ very much, we report the simple panel estimates.

Table 8.5 **Panel Regression on logit transformation of shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	–0.506*	–0.648*	–0.497*	–0.674*	–0.488*	–0.487*	–0.117*
	(0.123)	(0.154)	0.124*	(0.154)	(0.138)	(0.138)	(0.061)
GDPratio (y)	2.285*	2.768*	2.735*	3.690*	2.215*	2.775*	1.040*
	(0.564)	(0.643)	(0.781)	(0.923)	(0.616)	(0.854)	(0.288)
Inflationdiff (π)	–1.565*	–2.639*	–1.512*	–2.860*			
	(0.927)	(1.156)	(0.930)	(1.164)			
Depreciation (Δs)					–1.079	–0.920	–1.095*
					(1.294)	(1.306)	(0.594)
Exratevar (σ)	–0.445	–0.981*	–0.594	–1.395*	–0.583	–0.798	–1.251*
	(0.457)	(0.573)	(0.491)	(0.644)	(0.581)	(0.624)	(0.341)
Fxturnoverratio (to)		0.446		0.576*	0.208	0.252	0.427
		(0.289)		(0.303)	(0.302)	(0.305)	(0.145)
GDPleader (leader)			–0.125	–0.217		–0.150	
			(0.150)	(0.156)		0.159	
laglog($sh_{t-1}/1 - sh_{t-1}$)	0.879*	0.851*	0.882*	0.846*	0.881*	0.882*	0.957*
	(0.025)	(0.031)	(0.025)	(.031)	(.029)	(.029)	(.014)
N	182	182	182	182	182	182	156
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.97	0.97	0.97	0.97	0.97	0.97	0.99

Notes: Dependent variable: logit [log(sh/(1 – sh)] estimated using OLS. All variables are in decimal form. GDP at market terms. Column (7) omits Japanese yen, and is estimated using cross-section weighted standard errors.

*Significant at the 10 percent level.

Some readers, correctly noting that our regressions use value shares of reserves, point out two implications. One is that the current exchange rate appears as the valuation term on the left-hand side of the equation and in some cases appears on the right-hand side as well. The second is that changes in our dependent variable do not necessarily represent currency diversification in the sense of central banks physically selling some currencies and buying others. Our reply is that portfolio theory clearly says that shares should be valued at current exchange rates. That the exchange rate sometimes enters calculations of variables on the right-hand side at the same time as the left does not in itself necessarily mean that we have an econometric problem of endogeneity or simultaneity. For one thing, if the specification is correct, having the exchange rate on both sides need not imply simultaneity bias. For another thing, the contemporaneous exchange rate does not always appear directly on our right-hand side. Some equations include the long-run trend depreciation, where the contemporaneous exchange rate does represent the end point, but others do not. Also, while results reported here measure countries' relative GDPs at current exchange rates, we have also tried measuring GDP at purchasing power parity (PPP) rates. It does not seem to make much difference. That said, it might be interesting in future research to try regressions with reserve holdings measured just as quantities (it would probably have to be changes in quantities) to see if central banks are diversifying in this narrow sense of the word.

8.6.3 Postsample Test, 1999–2004

We have chosen one specification to evaluate the reliability of the models out of sample. The postsample period is quite short, comprising only five years worth of data. Hence, we cannot undertake formal out-of-sample tests for parameter stability. Furthermore, given the disappearance of the mark, franc, and other European currencies, we cannot make a prediction as to the levels of the currency shares of the euro and its rivals for the date of its debut. Given these constraints, we adopt a limited test. We conduct an ex post static simulation of the data to see if our parameter estimates can predict correctly the direction of movement of the currency shares looking forward from 1999. We use the coefficient estimates reported in column (2) of table 8.5, which have statistically significant and correctly signed coefficients in all cases save the forex turnover variable.

The results are presented in figures 8.7 and 8.8. They indicate that the models fit quite well. A good deal of work is being done by the lagged endogenous variable. But the important and reassuring point is that our

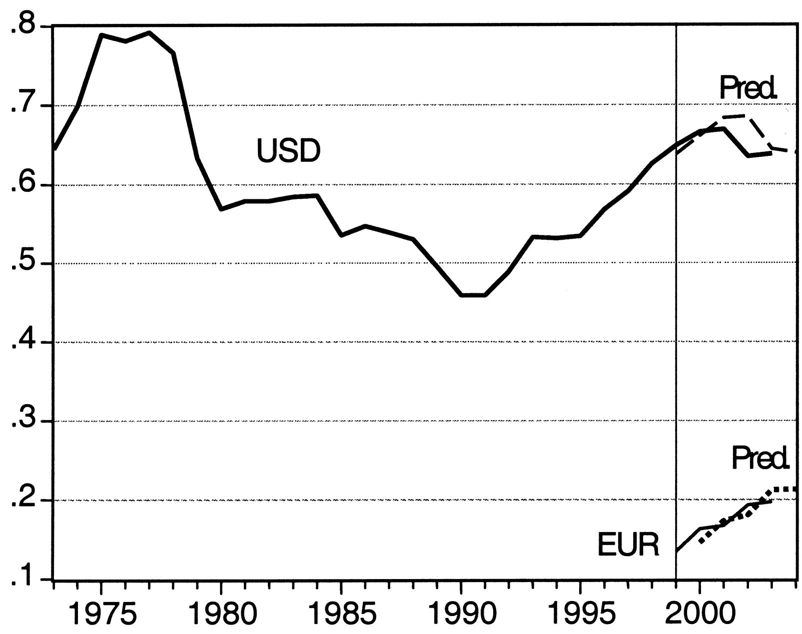

Fig. 8.7 Out-of-sample prediction of USD and EUR using logit without leader variable

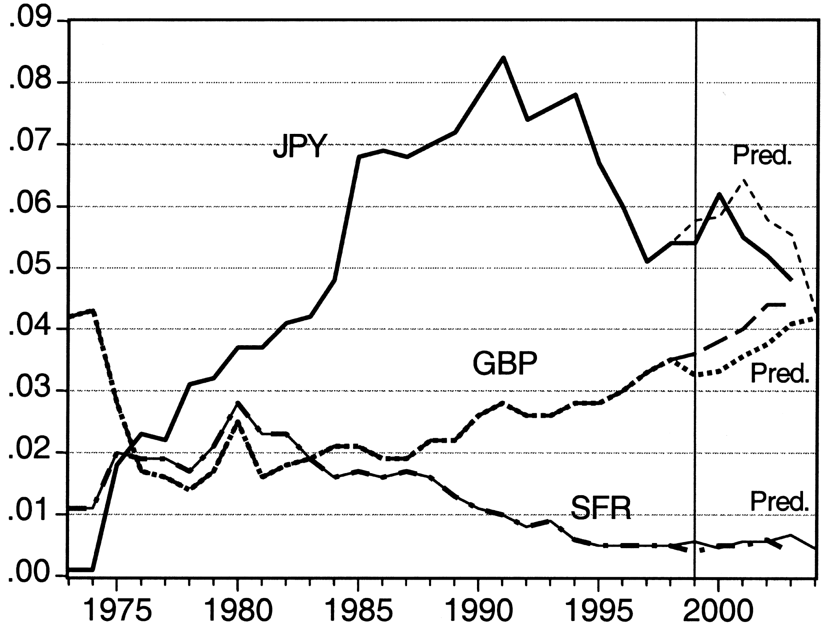

Fig. 8.8 Out-of-sample prediction of GBP, JPY, and SFR using logit without leader variable

equation correctly predicts the direction of movement after 1999 of the currency share: downward for the dollar and yen, and upward for the euro and pound.

We also checked the out-of-sample predictions produced from the specification in column (5), which used long-term trend depreciation rates as the rate-of-return variable in place of inflation rates. The results for the currency shares are similar to those presented in these graphs.

8.6.4 Sensitivity Tests

There is substantial latitude for deciding upon the best variables to include in the empirical specifications. We extended the investigation to include alternative variables. These results are reported in appendix table 1 of the working paper version of this chapter.[37] (We are not calling these robustness checks because we do not have the luxury of sufficient data to expect robust results, or even to dispense with a priori judgments in our basic specification.)

First, we tried a different measure of economic size, trade, in place of GDP. While the coefficient on exports exhibits approximately the same

37. See NBER Working Paper no. 11510.

level of statistical significance, the other variables do not. Gross domestic product is a more standard criterion for size in the literature on international currencies, so we see no reason to prefer the alternative scaling variable.

Another question pertains to network externalities or economies of scope. Does reserve currency use depend upon other instances of international currency status—such as how many currencies are pegged to that key currency? Small countries are more likely to hold their reserves in a given major currency if they are pegged to that currency. We added a variable defined as the share of the world's currencies pegged to a particular base currency as a proportion of all pegged currencies.[38] (At the same time, we omitted our forex turnover variable.) This new variable, capturing the peg anchor role, was not statistically significant. Surprisingly, it actually showed a negative sign, probably because the French franc ranks so high by this criterion and is not yet an important reserve currency.

We also wished to investigate the thesis that the use of a reserve currency could be negatively affected by a country's net debtor position. We did not have good data for these countries' net foreign asset position that was available for the entire sample. We used the cumulative current account balances reported by Lane and Milesi-Ferretti (2001). These results indicate a statistically insignificant relationship between net foreign assets and reserve currency use. Again, the coefficient is of a surprisingly negative sign, probably because the dollar's share continued strong in the 1990s even as the United States underwent its big swing from creditor to debtor.

As mentioned, one of the key determinants is the liquidity of a candidate's financial center, which we measured by turnover in the foreign exchange market. We investigated using alternative measures of financial market liquidity and depth. We considered three stock market measures: capitalization and total value traded, both of them defined as a share of GDP, and also stock market turnover. In no case did these variables enter with statistical significance. In two cases, value traded and turnover, they entered with the unexpected sign.

We also considered a measure of the depth of countries' bond markets but found no support for its role as a determinant of a reserve currency's use; data availability limited us to the 1990 to 1998 period, an admittedly short sample.

8.6.5 Results Using New Data Series

In September of 2005, the IMF released thoroughly revised data extending back to 1995. Unfortunately, these data are noncomparable to previously reported data. Of the three series the IMF reports—industrial country central bank holdings, developing country central bank holdings,

38. Eichengreen and Mathieson tried this peg-anchor variable.

Table 8.6 **Panel regression on industrial country reserve shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)
GDPratio (y)	0.156*	0.180*	0.126*	0.150*	0.156*	0.124*
	(0.057)	(0.061)	(0.059)	(0.064)	(0.058)	(0.062)
Inflationdiff (π)	–0.086	–0.127*	–0.112*	–0.153*		
	(0.072)	(0.082)	(0.073)	(0.083)		
Depreciation (Δs)					–0.081	–0.128
					(0.095)	(0.099)
Exratevar (σ)	–0.045*	–0.079*	–0.034	–0.067	–0.056	–0.046
	(0.027)	(0.042)	(0.028)	(0.043)	(0.039)	(0.040)
Fxturnoverratio (to)		0.022		0.022	0.016	0.019
		(0.021)		(0.021)	(0.022)	(0.022)
GDPleader (leader)			0.026	0.026		0.026
			(0.016)	(0.016)		(0.017)
lagshare (sh_{t-1})	0.930*	0.919*	0.902*	0.891*	0.930*	0.901*
	(0.020)	(0.023)	(0.027)	(0.029)	(0.022)	(0.028)
N	182	182	182	182	182	182
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.99	0.99	0.99	0.99	0.99	0.99

Note: See table 8.4 notes.
*Significant at the 10 percent level.

and aggregate central bank holdings—it turns out that only the industrial country central bank holdings is close to being consistent across the old and new series. This result is probably due to the fact that the less-developed country holdings have, in the past, incorporated much more estimation of the reserve composition.[39]

In order to see how much the newer data might alter the results, we re-estimated the specifications comparable to those in tables 8.4 and 8.5.[40] The results are reported in tables 8.6 and 8.7.

Briefly put, the shares regressions yield results largely unchanged from those using the aggregate, older data, although fewer statistically significant coefficients are in evidence. Logit regressions show larger impacts for GDP and the inflation differential than in the previous regressions. However, in contrast, the logit regressions involving twenty-year depreciation are not successful in general; perhaps this reflects the greater importance associated with inflation for industrial country central bank holdings.

39. "This year's data were compiled under a new rule that the estimation of the currency composition of reserves be limited to data gaps of less than four quarters. As a result, the aggregate currency composition is now calculated almost exclusively on the basis of reserves data reported by the authorities to COFER. Reserves held by nonreporting developing countries, for which the currency composition was previously estimated, have been moved to the new category 'Unallocated reserves'" (IMF 2005, 109).

40. As mentioned earlier, the industrial country central bank holdings underwent a much more minor revision. Hence, we spliced these series to the previously reported IMF series.

Table 8.7 **Panel regression on logit transformation of industrial country shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	–0.367*	–0.480*	–0.378*	–0.550*	–0.238	–0.258	–0.297
	(0.139)	(0.160)	0.148*	(0.165)	(0.163)	(0.164)	(0.186)
GDPratio (y)	1.432*	1.807*	2.202*	3.326*	0.904	1.738	1.368
	(0.705)	(0.752)	(1.048)	(1.193)	(0.806)	(1.173)	(0.952)
Inflationdiff (π)	–3.082*	–4.254*	–3.030*	–4.694*			
	(1.132)	(1.401)	(1.133)	(1.420)			
Depreciation (Δs)					–0.358	–0.226	–1.432
					(1.775)	(1.780)	(2.200)
Exratevar (σ)	–0.116	–0.685	–0.370	–1.388*	0.224	–0.112	–0.379
	(0.573)	(0.699)	(0.628)	(0.818)	(0.754)	(0.829)	(1.227)
Fxturnoverratio (to)		0.472		0.685*	–0.075	–0.003	0.167
		(0.334)		(0.357)	(0.383)	(0.390)	(0.519)
GDPleader (leader)			–0.180	–0.315		–0.192	
			(0.181)	(0.193)		0.196	
laglog($sh_{t-1}/1 - sh_{t-1}$)	0.935*	0.915*	0.933*	0.903*	0.956*	0.952*	0.941*
	(0.027)	(0.030)	(0.027)	(.031)	(0.032)	(0.032)	(.036)
N	182	182	182	182	182	182	148
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.98	0.97	0.97	0.98	0.97	0.97	0.97

Notes: Dependent variable: logit[log(sh/(1 – sh)] estimated using OLS. All variables are in decimal form. GDP at market terms.

*Significant at the 10 percent level.

8.7 Extrapolation to the Future

The goal of the project is to use the estimated parameters to forecast the shares of the dollar, euro, and other currencies in the coming decades. Under any plausible scenario, the dollar will remain far ahead of the euro and other potential challengers for many years. But we want to know if there are plausible scenarios that provide a different answer for twenty or thirty years into the future and, if so, what are the variables that are most important to this outcome. First, two caveats—these are simulations incorporating fairly mechanical variations. There are no interactions between, say, exchange rate depreciation and exchange rate volatility. We do not even attempt to predict the future course of these variables. Second, the simulations are, of course, only as good as the parameters that we estimated from the historical data, which are neither precise nor entirely stable.

8.7.1 Posited Scenarios

If none of the explanatory variables were to change in the future from its current values, then the long-run shares of the currencies could be estimated with no further inputs.[41] This will almost certainly show the dollar retaining the lead even in the long run. We regard this scenario as quite possible, but not the only one.

A high-euro scenario would have many European countries joining the EMU by the end of this decade. Most eager to join are the ten countries that joined the EU in May 2004 (eight of which are in Central Europe). It is also possible that the three remaining long-standing EU members, Denmark, Sweden, and the United Kingdom, might join at some point. All these countries together would make it likely that euroland exceeds the United States in income and trade. In that case, it becomes a real possibility that the euro would gradually gain on the dollar and eventually challenge it for the number one position. The key question is whether the United Kingdom joins, not just because it is the largest of them, but also because it would bring with it the London financial markets. By 2005, it did not look likely that Britain would join in the coming ten years. We are certainly not predicting that it will.

We could also experiment with different assumptions regarding the other explanatory variables. Real growth has been slower in Europe than in the United States for some years, largely due to lower population growth. If this trend in growth were to continue, it would retard the trend in currency use. United States's monetary policy in the first part of the current decade was looser than European Central Bank (ECB) monetary policy. Is it possible that the Fed will eventually come under pressure to monetize the growing U.S. national debt? Or that the exchange rate will become more volatile, in response to current account deficits or troubles in the Mideast? It may be worth exploring a few different scenarios.

8.7.2 Results of the Simulations

In order to focus on the dynamics between the two key reserve currencies, at this point we pare down the analysis to the dollar and the euro. We use a two-currency specification informed by what we have learned from our seven-currency regressions. In particular, we continue to transform the shares variable using the logistic function. Focusing on a two currency specification is helpful as (a) it is difficult to model the other reserve currencies with shares less than 10 percent, and (b) it allows us easily to impose the adding-up constraint.

The results are reported in table 8.8, for specifications involving inflation differentials and depreciation. Columns (1) and (3) report stripped down specifications involving only income and the inflation and depreciation variables. Columns (2) and (4) report the more comprehensive specifica-

41. As the reciprocal of one minus the speed of adjustment, times the value fitted from the rest of the variables and parameter estimates.

Table 8.8 **Two-currency system (pre-euro)**

	(1)	(2)	(3)	(4)[a]
Constant	–0.392*	–0.465*	–0.470*	–0.532*
	(0.132)	(0.167)	(0.159)	(0.165)
GDPratio (y)	0.762*	1.015	0.904*	0.974†
	(0.247)	(0.773)	(0.294)	(0.688)
Inflationdiff (π)	–0.554	–0.844		
	(1.247)	(1.259)		
Depreciation (Δs)			–3.497	–4.524†
			(3.642)	(3.337)
Exratevar (σ)		–2.375*		–2.381*
		(1.213)		(1.121)
Fxturnoverratio (to)		0.489		0.652†
		(0.487)		(0.454)
laglog($\mathrm{sh}_{t-1}/1 - \mathrm{sh}_{t-1}$)	0.829*	0.775*	0.830*	0.795*
	(0.043)	(0.085)	(0.043)	(.076)
N	26	26	26	52
Sample	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.86, 086	0.85, 0.87	0.86, 0.87	0.86, 0.87

Notes: See table 8.7 notes.

[a]Weighted least squares.

*Significant at the 10 percent level.

†Significant at 20 percent marginal significance level.

tions, including exchange rate variability and turnover. In these pared-down specifications, income and exchange rate variability are the most significant variables, although income is not always statistically significant even when the coefficient estimate is fairly large. The rise in standard errors in the two-currency estimation suggests that variation across currencies contributed substantial power to the seven-currency results reported earlier. In these specifications, depreciation shows up as borderline (20 percent) significant in column (4). We use this specification in the simulations that follow.

We consider four scenarios, defined by alternative assumptions regarding the relative size of the euro area and the United States. In case 1, the ten countries that joined the EU in 2004 join the EMU in 2010, and the United States grows slightly relative to world income, increasing its share by 2 percentage points over thirty years. In case 2, the United States only holds steady its proportion of world income, while the euro area grows by the ten accession countries.[42] In case 3, the accession countries join in 2010, and

42. We are being conservative as regards the new EU ten. Current plans are for the euro area to be expanded to fifteen members in 2006 and eighteen in 2007.

Sweden and Denmark in 2015. Finally, case 4 incorporates U.K. entry in 2020.[43]

For each of these cases, we consider four possibilities for exchange rate depreciation: scenario A involves the currencies depreciating (against the SDR) at the same trend rate that they did over the 1990 to 2004 period; this turns out to be virtually zero depreciation. Scenario B assumes the exchange rates stay at the end-2004 levels. Scenario C considers the possibility of the currencies continuing to depreciate at the twenty-year trend rates realized at the end of 2004. Finally, scenario D contemplates the persistence of the trends observed over the 2001 to 2004 period, when the dollar depreciated at a 3.6 percent rate per annum, and the euro appreciated at a 4.6 percent rate.

Table 8.9 summarizes the outcome of the simulations. Some scenarios lead to erosion of the dollar's position as the world's premier international reserve currency. Briefly put, if the United Kingdom joins the EMU (case 4), the euro becomes the dominant currency. The only U.K.-in scenario in which it does not is when twenty-year trend depreciation is assumed to drop to zero, which begins with an immediate jump in the dollar's value in 2005. If currency trends of the recent past persist (scenario D), the euro not only gains dominance, but does so rapidly—by 2019.

In the other combinations, the dollar retains the lead, although the degree of dominance depends upon the assumptions underlying the scenario and rate of currency depreciation. When the U.S. dollar retains its lead, it typically does so by about 30 to 35 percentage points. When the euro gains the lead, the lead can range from 10 percentage points (the scenario with no entry of the United Kingdom, Sweden, or Denmark; strong U.S. growth; and rapid dollar depreciation combined with euro appreciation) to 65 percentage points (U.K. entry and rapid dollar depreciation and euro appreciation).

Figures 8.9 to 8.12 display the simulated dynamics of the U.S. dollar (USD) and euro (EUR) holdings (here expressed as shares of the sum of USD and EUR reserve holdings). Figure 8.11 illustrates that when the euro area is composed of the current Euro-twelve and the accession countries (as of 2010), and the exchange rates remain at their end-2004 levels, the dollar retains its dominance. Figure 8.12 represents the scenario where Sweden and Denmark join the euro area in 2015 as well, and the currencies continue to depreciate or appreciate at the 20 year trends that held at the

43. As Ted Truman has noted, there will be some distortion of the ratios if and when the United Kingdom joins the euro area as its reserves of euro are extinguished as foreign currency reserves. Thus, the dollar amount of reserves will be unchanged (the numerator) but the dollar + euro amount (the denominator) will be reduced, so the dollar's share rises. This is also the reason why the dollar's share jumped in 1999 after the creation of the euro; the deutsche mark reserves held by euro area countries were extinguished.

Table 8.9 Summary of simulation results

	Rate of long depreciation equals 1990–2004 rate (0%) (Scenario A)	Level of exchange rate stays at end-2004 levels (Scenario B)	Rate of long depreciation remains at 2004 rates (Scenario C)	Rate of depreciation over 2001–2004 period continues (Scenario D)
United Kingdom, Sweden, and Denmark stay out, United States grows relative to Euro area (Case 1)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2024
United Kingdom, Sweden, and Denmark stay out of EMU (Case 2)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2023
United Kingdom stays out of EMU (Case 3)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2022
United Kingdom joins EMU in 2020 (Case 4)	USD retains dominance	Euro exceeds USD in 2022	Euro exceeds USD in 2022	Euro exceeds USD in 2020

Notes: Summary of outcomes for combination of Cases and Scenarios. USD = U.S. dollar. EMU = European Monetary Union. Case 1: Accession countries join EMU in 2010; U.S. share of world income rises by 2 percentage points over thirty years. Case 2: Accession countries join EMU in 2010; United States retains share of world income. Case 3: Accession countries join EMU in 2010; Sweden and Denmark join in 2015; United States retains share of world income. Case 4: Accession countries join EMU in 2010; Sweden and Denmark join in 2015; United Kingdom joins in 2020; United States retains share of world income. Scenario A: Twenty-year rate of depreciation stays at past rate (0 percent), requiring an appreciation after 2004. Scenario B: Exchange rates remain at end-2004 levels. Scenario C: Twenty-year rate of depreciation at end-2004 persists. Scenario D: Rate of depreciation/appreciation experienced over 2001–2004 continues after 2004.

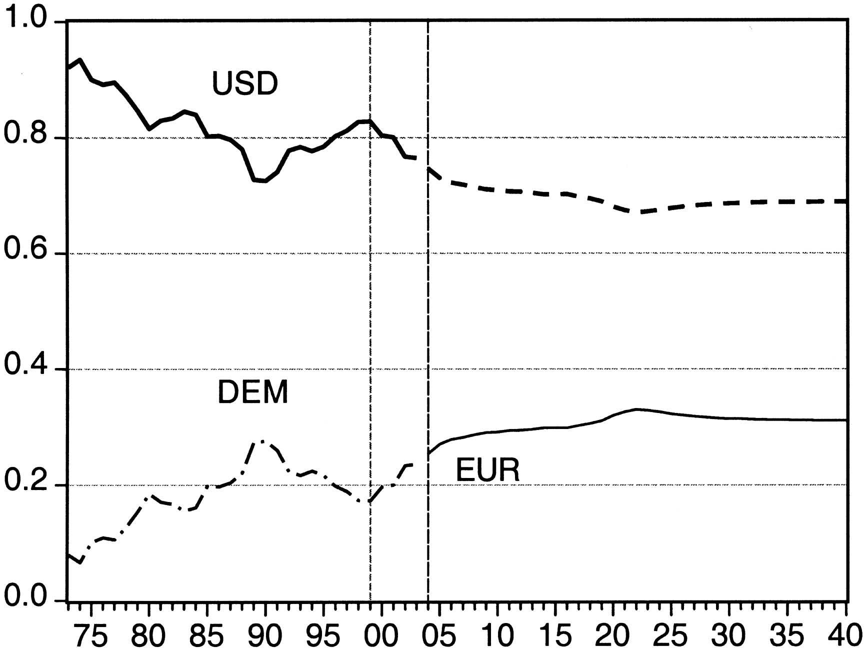

Fig. 8.9 Case 2, scenario B: Simulation of "No United Kingdom, Sweden, Denmark" and no further depreciation of the level of the exchange rate after 2004

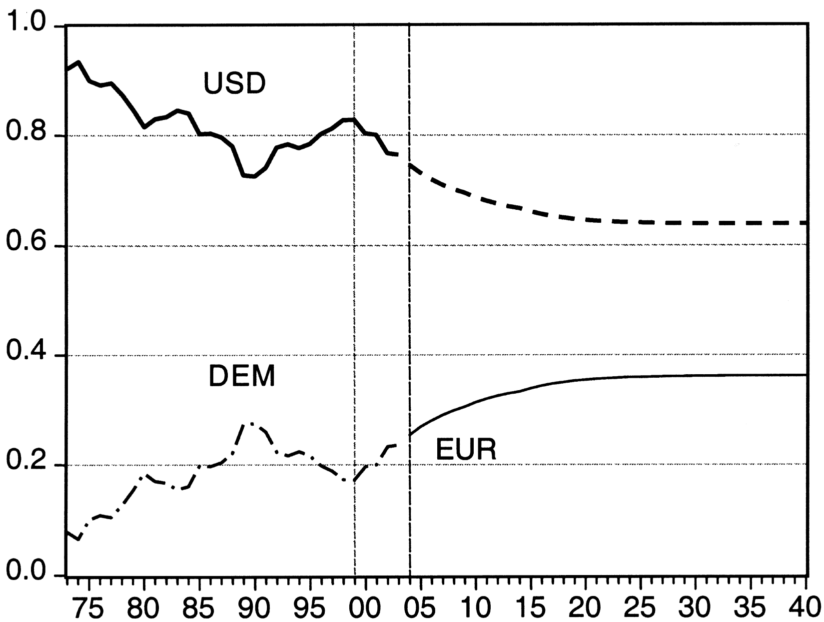

Fig. 8.10 Case 3, scenario C: Simulation of "No United Kingdom" and depreciation at 2004 twenty-year trend rate

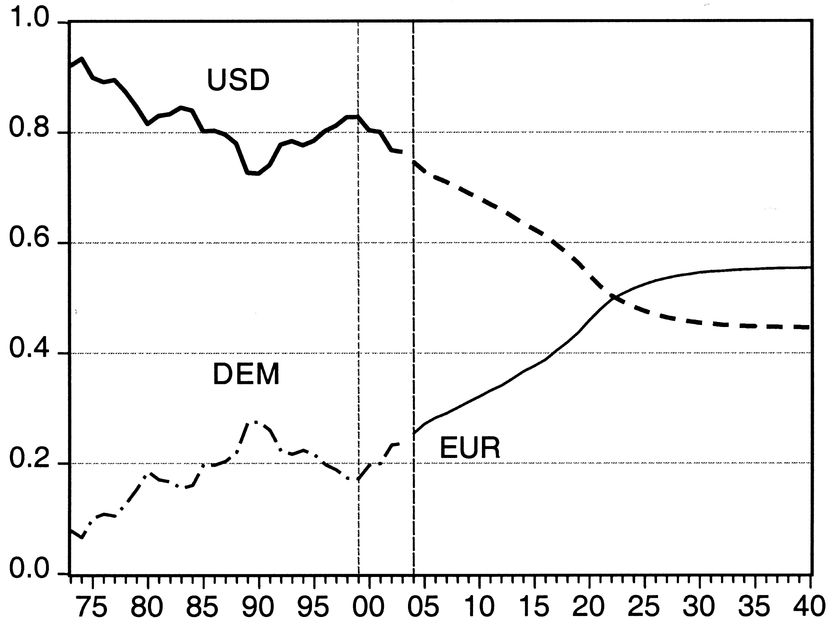

Fig. 8.11 Case 2, scenario D: Simulation of "No United Kingdom, Sweden, Denmark" and continued depreciation of the exchange rate at the 2001 to 2004 rate

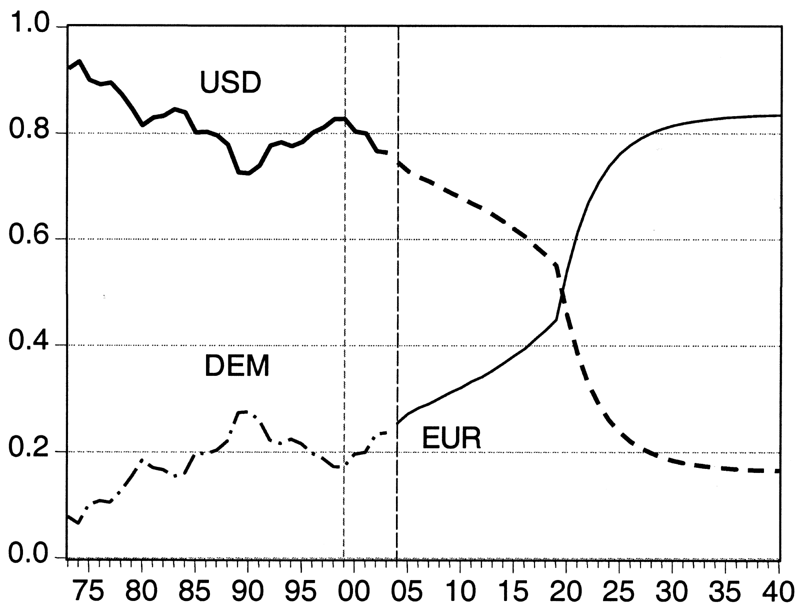

Fig. 8.12 Case 4, scenario D: Simulation of "U.K. entry" and continued depreciation of the exchange rate at the 2001 to 2004 rate

end of 2004. The dollar also retains its dominance here, but by a very slightly smaller amount. Euro dominance occurs (by 2023) if the currencies continue the trends experienced over the 2001 to 2004 period (3.6 percent depreciation for the dollar, 4.6 percent appreciation for the euro, both on an annualized basis).

The euro gains overwhelming dominance in the instance where the United Kingdom joins the euro area *and* rapid depreciation persists indefinitely. In this combination, the switchover occurs in 2020 and eventually the euro accounts for more than 80 percent of combined USD and EUR holdings.

8.8 Summary Conclusions

The major payoff of the paper is predictions about scenarios under which the euro might in the future rival or surpass the dollar as the world's leading international reserve currency. That question appears to depend most importantly on two things: (a) whether enough other EU members join euroland so that it becomes larger than the U.S. economy and, in particular, whether the United Kingdom comes in, with its large financial markets; and (b) whether U.S. macroeconomic policies eventually undermine confidence in the value of the dollar through inflation and depreciation. Whatever value this exercise has probably consists of estimating, contingent on those two things happening, how quickly the euro might rise to challenge the dollar. We find that if all thirteen EU members who are not currently in the EMU join it by 2020, including the United Kingdom, then the euro overtakes the dollar a few years later. We also find that even if some of these countries do not join, a continuation of the recent trend depreciation of the dollar, were it to occur for whatever reason, could bring about the tipping point even sooner.

Euro enthusiasts suffered some serious setbacks in 2005.[44] But most assessments of the sustainability and adjustment of the U.S. current account see a role for substantial depreciation of the dollar in the future, whether operating via expenditure switching or a valuation effect. Our results suggest that such dollar depreciation would be no free lunch: it could have consequences for the functioning of the international monetary system as profound as the loss of the dollar's preeminent international currency position, and along with it the exorbitant privilege of easily financing U.S. deficits.

44. This is due to a slowdown of some major European economies, gross violation of the Stability and Growth Pact, rejection of a new EU constitution in French and Dutch referenda, dispute over the EU budget, and a renewed depreciation of the euro.

Appendix

Data Description and Sources

Share is the proportion of currency holdings. *GDPratio* is the share of world GDP (evaluated at market exchange rates); *Inflationdiff* is the difference between a 5 year moving average of Consumer Price Index (CPI) inflation and industrialized country inflation; *Exratevar* is the trade weighted exchange rate volatility (monthly), measured as a five-year moving average; *Fxturnoverratio* is turnover is daily turnover divided by total five center turnover; *peg-anchor variable* is the proportion of pegged exchange rates linked to a particular currency.

Reserve Currency Holdings

These are official reserve holdings of member central banks, at end of year. The data used are a spliced version of updated 2003 data obtained July 1, 2004 (for 1980 onward) to unpublished data for 1965 to 2001. Not available (NA) observations set to 0 except for the euro legacy currencies. In logistic transformations, 0 entries set to 0.000001 (0.0001 percent). The source is the IMF *Annual Reports,* table I.2, and IMF unpublished data.

Ratio of GDP to Total World GDP

This is the ratio of GDP in USD (converted at official exchange rates) to GDP of world aggregate. Sources are the IMF *International Financial Statistics.* Euro-area, world GDP data are from IMF *World Economic Outlook.*

Inflation

This is calculated as log difference of monthly CPI, averaged. The five-year moving average is centered. Sources are the IMF *International Financial Statistics;* euro-area inflation for 1980 to 1998 is ECB data from Alquist and Chinn (2002).

Exchange Rate Volatility

This is calculated as the standard deviation of the log first difference of the SDR exchange rate. The source is IMF *International Financial Statistics.*

Forex Turnover

1989, 1992, 1995, 1998, and 2001 are from Bank for International Settlements (BIS) *Triannual Surveys.* Billions of dollars of daily turnover, in April. Data from 1977 to 1988 are from G30, New York Fed surveys, and central bank surveys. Observations in between survey years are loglinearly interpolated. For 1973 to 1979, interpolation is using 1977 to 1979 relationship.

Net International Investment Position Is Cumulated Current Account

These net investment positions are normalized by world GDP (converted at official exchange rates). The source is Lane and Milesi-Ferretti (2001).

Linked Currency Counts

For 1973 to 2000, tabulation is based on data from Shambaugh (2004). The source is personal communication from Jay Shambaugh. The variable used in the regression is the proportion of currencies linked to a particular base currency (USD, DEM, etc.) as a proportion of all pegged rates tabulated.

Financial Depth Variables

These are stock market capitalization to GDP ratio, stock market total value traded to GDP ratio, stock market turnover ratio, private bond market capitalization to GDP ratio, public bond market capitalization to GDP ratio. The source is Beck, Demirgüc-Kunt, and Levine (2000).

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Comment Edwin M. Truman

Introduction

Chinn and Frankel provide a clear, insightful, and provocative paper. They set themselves the daunting task of determining whether and, if so, when the euro will surpass the dollar as an international reserve currency. Along the way, they offer a number of insightful comments, including on the demise of sterling as an international and reserve currency as well as on the vicissitudes of the dollar over the past several decades.

Using aggregate data on the currency of denomination of IMF member countries' foreign exchange reserves from 1973 to 1998, covering about 85 percent of total foreign exchange reserves as of the end of 2003, Chinn and Frankel use a panel regression to estimate a nonlinear relationship to explain currency shares in those reserves.[1] They find that size (GDP), inflation, exchange rate depreciation or appreciation, exchange rate variability, and foreign exchange market turnover appear in various forms of the rela-

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1. The 85 percent figure comes from the companion IMF (2004, 104) table I.3 to table I.2 and similar tables in earlier *Annual Reports,* which is the source of the Chinn and Frankel data. Revised data, which Chinn and Frankel were unable to use in their paper because the series are incomplete, were published by the IMF in 2005. The new IMF (2005, 109) data cover only 70 percent of total foreign exchange reserves at the end of 2003.

tionship with various degrees of significance. Based on the coefficient on the lagged dependent variable, they also find considerable inertia in the currency composition of reserves—around 90 percent.

Finally, Chinn and Frankel estimate a two-currency model of foreign exchange holdings in U.S. dollars and deutsche marks from 1973 to 1998 using their favored explanatory variables. They employ those estimates to extrapolate the dollar-euro share of foreign exchange reserve holdings under different scenarios with respect to the size of the euro area and the behavior of the dollar. They conclude that if not only the ten newest members of the European Union but also Denmark, Sweden, and, in particular, the United Kingdom join the euro area at various points between now and 2020, the U.S. dollar will lose its dominance in international foreign exchange reserves. The only exception is the extreme case where the average rate of depreciation of the dollar is zero from 2004 onward.

At the other extreme, if the dollar continues to depreciate against the SDR over the next two decades at the same rate as it has over the past four years (3.6 percent a year) and the euro continues to appreciate at the same rate (4.6 percent a year), then the euro will replace the dollar with the largest share in international reserves by 2020 or a few years later depending on the size of the euro area. This calculation implies dollar depreciation against the SDR of 25 percent by 2020, which is not implausible, but is an extreme scenario as the dollar would have to depreciate by about 40 percent, on average, against the euro, yen, and pound sterling, given that the dollar currently has about a 39 percent effective weight in the SDR basket that Chinn and Frankel use for their calculations.[2] Similarly, a continued euro appreciation of 4.6 per year against the SDR implies an appreciation of 43 percent against the SDR and about 60 percent, on average, against the dollar, yen, and sterling, which is much less plausible.

Comments

My comments focus on (a) the estimates and the extrapolations, (b) whether Chinn and Frankel have asked and answered the most interesting question, and (c) the relevant model of foreign exchange reserve diversification by national monetary authorities.

Are the Estimates Credible?

Chinn and Frankel employ a carefully laid out analytical and empirical framework and produce bold quantitative extrapolations yielding clear answers to the questions they pose: the euro most likely will overtake the dollar as the leading reserve currency within two decades. The results are offered with two caveats: the extrapolations are purely mechanical, and

2. See Truman (2005b) on more plausible scenarios for prospective dollar depreciation.

they are based on historical estimated parameters that are neither precise nor entirely stable.

Those caveats point to a problem in interpreting the results of the paper. The point estimates are not credible except in the broadest terms: (a) the attractiveness of the euro for reserve holdings would rise if the United Kingdom joined the euro area and (b) sustained significant weakness of the dollar would reduce the attractiveness of the dollar for official foreign exchange reserve holdings. However, putting point estimates on the size of these effects is problematic.

First, the core conclusions about the importance of U.K. membership in the euro area and the role of continued dollar depreciation and euro appreciation are based on coefficients that are significant only at the 20 percent level. This is true for the size variable (GDP) and the foreign exchange turnover variable (calculated by market, not by currency).[3] These two variables drive the positive effect on the euro's share of international reserves associated with U.K. membership in the euro area.[4] The exchange rate depreciation variable also is only significant at the 20 percent level. Thus, notwithstanding the authors' transparent caveats, you have to have a lot of faith in these very weakly significant coefficients to buy the Chinn and Frankel results.

Second, in the case of the exchange rate variable, the coefficient is potentially biased in size and significance. The dependent variable is the dollar's value share in international reserves composed of dollars and deutsche marks.[5] But the dollar's depreciation against the SDR, though expressed as long-term average, is an explanatory variable. Thus, one should not be surprised that a depreciation of the dollar, expressed as the rise in the dollar price of the SDR, is loosely associated with a lower share of dollars in foreign exchange reserves. Figure 8C.1 shows the dollar's value share of foreign exchange reserves from 1973 to 2003.[6] It also shows an alternative quantity series.[7] Finally, it shows the dollar price of the SDR over

3. I am also skeptical whether the GDP variable is correctly specified in the multicurrency regressions. The scatter plots look more like two different populations.

4. As Chinn and Frankel acknowledge, they have not adjusted downward the euro's share of international reserves upon British entry into the euro area in 2020. As of the end of 2004, 55 percent of U.K. foreign exchange reserves were in euro-denominated assets, and these would be extinguished upon entry into the euro area, temporarily boosting the dollar's share; see table 8C.1.

5. We do not know for sure, but there is a strong presumption that most countries mark their foreign exchange reserves to market values when they report the currency composition of their foreign exchange reserves to the IMF.

6. The data on the dollar's share of foreign exchange reserves in figure 8C.1 are comparable to the data in the Chinn and Frankel figure 8.1, but they may not be identical because Chinn and Frankel had access to unpublished data.

7. These data are from the series reported in table I.3 and similar tables in IMF annual reports rather than table I.2 and similar tables, which are the source of the Chinn and Frankel data.

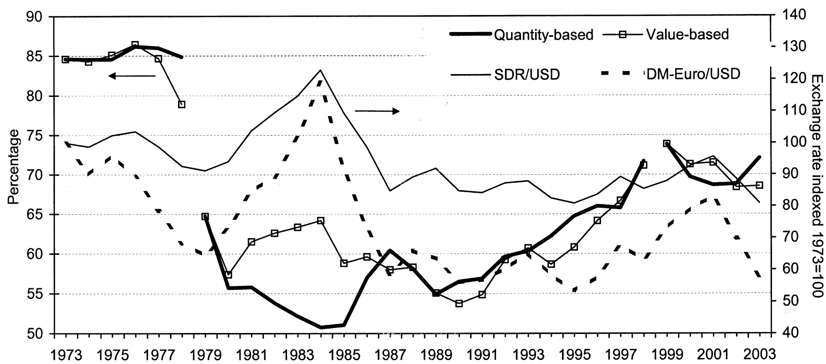

Fig. 8C.1 U.S. dollar's share of foreign exchange reserves (1973–2003)

Sources: IMF *Annual Report* (2004), table I.3 and similar tables in earlier *Annual Reports.*

Notes: The precipitous drop in both quantity- and value-based shares in 1979 reflects mainly deposits of U.S. dollars by members of the European Monetary System (EMS) in the European Monetary Cooperation Fund.

European Currency Units (ECU) were introduced in 1979 with the creation of the European Monetary Cooperation Fund. The IMF evaluated total quantity changes in ECUs issued against dollars by applying the SDR price of the U.S. dollar on the swap date to the estimated change in dollar holdings. Similarly, quantity changes in ECUs issued against gold were determined by applying the SDR price of the ECU on the swap data to the ECU price of gold used by the EMS and multiplying by the change in the number of ounces. However, the introduction of the ECU as treated by the IMF data distorted the IMF's data on the dollar's share of foreign exchange reserves because (a) the amount of dollar reserves declines and (b) the total amount of foreign exchange reserves increases. A rough estimate is that the combined influence of these two factors causes a drop of about 15 percentage points in the dollar's share shown in the figure, 5 percentage points from effect a and 10 percentage points from effect b. The basic data used by Chinn and Frankel are influenced only by the first effect, and it is unclear whether the revised data series they received from the IMF were adjusted to eliminate it.

The introduction of euro in 1999 led to a break in the quantity- and value-based series, with the new series based at 1999 year-end value.

this period and the dollar price of the deutsche mark. The latter, of course, moves much more than the former.

Figure 8C.1 illustrates that quantity shares do behave differently from value shares. Chinn and Frankel argue that it is value shares that are relevant in a portfolio-balance model. True, but is that the right model to use to answer these questions? It will reveal a tendency toward *passive* diversification out of a currency as it depreciates, but that is quite different from *active* diversification of current holdings—quantity shifts—that is the focus of most market observers of this phenomenon. I return to this issue below.

In addition, the use of the dollar price of the SDR as the exchange rate variable, rather than a broader exchange rate index, may adversely affect the results. In particular, this choice may affect the finding that exchange rate volatility measured in terms of the SDR is statistically significant. I would have preferred that Chinn and Frankel had used a broader index. They frequently speak about whether a currency is a "stable international money," but they do not say what they mean by the term. They do try inflation as an explanatory variable, but in the end they discard it. It is also curious that Chinn and Frankel do not employ any rate of return variables in their regressions other than changes in capital values associated with exchange rate movements.

Finally, it is well known that the IMF's data on the currency composition of international reserves are only as good as the information the Fund receives from members. It is also well known that the data for developing countries are particularly shaky. It is unfortunate that readers have to wait for the next Chinn and Frankel paper to learn whether regressions on the two separate components of the aggregate data set, once the IMF has produced consistent series, confirm the stability of the relationships for industrial and developing countries.

Is This the Most Interesting Question?

The most interesting question to ask in this area concerns the U.S. dollar's and the euro's future roles as international currencies, not about their respective shares in countries' foreign exchange reserves. Although Chinn and Frankel are careful to state that they are only investigating one of the six potential roles of an international currency (see their table 8.2, taken from Kenen [1983]), their discussion often conflates a currency's reserve role with its broader international role. Chinn and Frankel argue that the dollar's reserve role is central to the issue of the continued smooth financing of the U.S. current account deficits, the topic of the NBER conference, by official inflows. However, the importance of that channel is frequently exaggerated. It is true that the increase in foreign official assets in the United States financed 59 percent of the U.S. 2004 current account deficit, but it is equally true that the increase in foreign private assets in United States financed 152 percent of the deficit.

A currency's broader international role is much more interesting and economically significant. A relevant question is whether the two phenomena are related, but Chinn and Frankel do not explicitly consider this question. Moreover, in considering a currency's international role one should try to distinguish between a currency's use by agents of a country or area issuing the currency in dealing with other countries and that currency's use by agents of another country where no aspect of the transaction is connected to the country or area whose currency is involved. See Truman (1999, 2005a). Only the U.S. dollar is an international currency in this sense. A significant amount of trade that does not involve the United States is denominated in U.S. dollars. In addition, governments and private

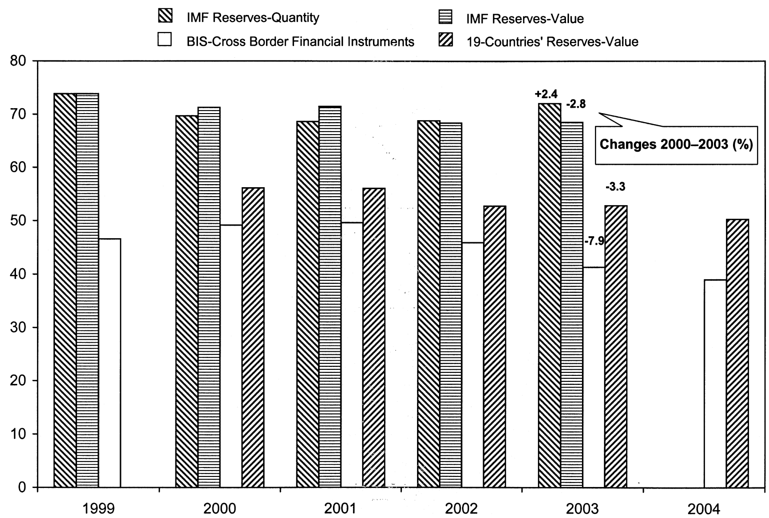

Fig. 8C.2 U.S. dollar's share

Sources: IMF *Annual Report* (2004), table I.3 and similar tables in earlier *Annual Reports* (IMF Reserves-Quantity and Value); BIS *Quarterly Review* (appendix tables 5 and 13); various central banks (nineteen countries' reserves).

agents in markets outside the United States issue a significant amount of dollar-denominated debt.[8]

We do not have a good data set to illustrate this point. Indeed, the BIS data depicted in figure 8C.2 exaggerate the role of the euro because, for example, they include as international debt instruments issued by euro-area countries within the euro area or in London.[9] Nevertheless, the data in figure 8C.2 are interesting because they show the contrast between the IMF data for the dollar's share in foreign exchange reserves (value and quantity shares) from 1999 to 2004, the BIS data on the currency composition of cross-border financial instruments, and data we have collected on currency composition of nineteen individual countries' foreign exchange reserves from 2000 to 2004.[10] From 2000 to 2003, the dollar's value share in the BIS data on financial market instruments declines by almost three times as much as in the IMF data on the dollar's value share of international re-

8. There is some issuance in euro as well, but most of that is issued in euro area or at least in EU financial markets, that is, London.

9. The BIS data combine information on the currency breakdown of (a) BIS reporting banks' liabilities to nonbanks, (b) international money market instruments (such as commercial paper), and (c) international bonds and notes.

10. Anna Wong painstakingly assembled these data. The list of countries is larger than reported in Truman (2005b).

serves. However, the dollar's quantity share of reserves actually increases in the IMF data by 2.4 percent. The change in the dollar's value share in the foreign exchange reserves of nineteen countries that publish these data is comparable to the change in IMF data on its value share. The change in the dollar's quantity share for the sample of nineteen countries is again an increase (2.7 percent), almost identical with the IMF series.

Chinn and Frankel might have tried to answer a more interesting question: whether the euro is likely to replace the dollar as an *international currency* and, if so, why and when? Short of that, they might have used one of the series on international currency shares, for example, the currency denomination of trade, to explain international reserves shares. Their implicit story is that a currency's broader international role depends on its reserve role.

For example, in their discussion of the advantages and disadvantages of having an international currency—the broader role—Chinn and Frankel speak of convenience for the country's residents, more business for the issuing country's banks and financial institutions, seignorage, and political power and prestige. It is not clear how or why any of those functions are related to the reserve role of the dollar. The partial exception is that seignorage derived from issuing low-risk debt that is attractive to foreign monetary authorities, which has nothing to do with the much larger amount of seignorage from the use of the U.S. currency in private international transactions.[11]

When they come to disadvantages, Chinn and Frankel again conflate the dollar's various roles. Fluctuations in the demand for the U.S. dollar, by which they mean dollar-denominated assets, do not affect the U.S. money stock except trivially in the case of currency, which is elastically supplied by the Federal Reserve in any case. An increase in foreign demand for assets denominated in a country's currency will tend to appreciate its exchange rate, but that demand can come from private as well as official sources. Chinn and Frankel do note a disadvantage associated with the dollar's international role: the Federal Reserve has to take account of feedback effects from its policy actions onto the attractiveness of dollar-denominated assets and the broader global financial market implications of its actions, for example, as was the case in the wake of the Russian default in 1998.[12]

11. Foreign official holdings of U.S. Treasury bills, bonds, and notes were $1.2 trillion as of March 2005. A generous estimate would be that the saving to the U.S. Treasury from foreign official demand for such low risk debt is 50 basis points, yielding $6 billion in seignorage. Estimates of seignorage from foreign private use of U.S. currency are about twice as large. The U.S. currency outstanding is about $700 billion. A conservative estimate in the data on the U.S. international investment position is that $33 billion in U.S. currency circulated abroad at the end of 2004. At an interest rate of 3 percent, another conservative number, the United States receives $10 billion in seignorage from the private international use of U.S. currency.

12. When the Bank of England raised rates in the fall of 1998, I asked a senior official of the Bank of England if the monetary policy committee had taken account of the international financial implications of their action. I was told that there were none. I was also told that the Bank of England hoped that the Federal Reserve, on the other hand, would take account of the international financial implications of its actions!

What Is the Right Model?

I am skeptical whether active reserve diversification, driven by the profit motive, is the right rubric to use in considering these issues. Moreover, recall that Chinn and Frankel test for only passive reserve diversification. The Chinn and Frankel results confirm the well-known observation that there is substantial inertia in international reserve holdings. The issue is what explains this inertia.

A number of explanations are possible, but I think the most plausible is the fact that as a first approximation most countries accumulate foreign exchange *reserves* as a by-product of another policy—pursuit of an exchange rate objective. Normally, a country does not have a quantity objective for its foreign exchange reserves. The country has a price objective for its foreign exchange *rate,* which means the monetary authority cannot simultaneously have a quantity objective, and, as well, it probably does not think primarily in portfolio-balance terms about the country's reserve holdings.[13] They want to peg their currency to another currency (for example, China and Hong Kong pegging their currencies to the U.S. dollar) or they want to resist the appreciation of their currency (for example, Japan, Korea, India, and even the United States when it built up its meager foreign exchange holdings in the late 1980s and early 1990s).

Occasionally, a country has a war-chest or quantity motive, as was the case for the United States in 1980 and early 1981, when the U.S. Treasury and Federal Reserve went on accumulating foreign exchange after having covered the repayment of the Carter bonds. A war-chest motive was involved for many East Asian economies in the immediate wake of the Asian financial crisis, but it is difficult to separate that motive from the motive to prevent currency appreciation that would weaken export-led growth. Moreover, the war-chest argument for reserve accumulation in East Asia had lost its potency after about 2001. Nevertheless, the major economies of non-Japan Asia increased their foreign reserves by more than 100 percent on average over the following three years. Japan also increased its foreign exchange reserves by more than 100 percent over the three-year period.

In this context, it is not surprising that the currency composition of a country's foreign exchange reserves is a secondary question, except in the case of a country that may be in the process of joining a monetary area, as is the case for a number of the countries listed in table 8C.1. As long as a country's foreign reserves are small, the authorities keep them in the most liquid assets; dollar assets are the most liquid. Moreover, the currency com-

13. At a later date, the authorities may begin to think in these terms. For example, the central banks of Australia, Iceland, and Israel state that they use a benchmark approach to the currency composition of their foreign exchange reserves.

Table 8C.1 **Diversification of foreign exchange reserves 2000–2004 (%)**

	U.S. dollar		Euro		Yen		Other currencies	
	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004
Lithuania[a]	4	–78	96	80	0	–1	0	–1
Romania	36	–37	59	35	0	0	5	2
Canada[b]	48	–27	49	27	4	0	0	0
Latvia	38	–16	59	26	3	–2	0	–9
Croatia	16	–10	84	14	0	0	0	–4
The Philippines	83	–9	10	8	4	–1	4	2
Slovenia	12	–9	83	11	0	0	4	–2
Switzerland	34	–7	48	3	0	–3	19	7
United Kingdom	30	–6	55	17	15	–12	0	0
Bulgaria	6	–4	91	3	0	0	3	2
Germany	98	–1	0	0	2	1	0	0
Finland	30	0	0	0	5	–10	65	10
Slovak Republic	22	0	78	3	0	–3	0	0
United States	0	0	57	10	43	–10	0	0
New Zealand	57	4	43	26	0	–31	1	1
Colombia	85	5	12	–3	3	–1	0	0
Australia	45	5	45	15	10	–20	0	0
Hong Kong[c]	79	11	11	–1	2	–2	9	–8
Norway	35	14	43	–3	6	–6	16	–4
Subtotal	50	–6	36	12	7	–5	7	–1
Uruguay[d]	82	n.a.	11	n.a.	4	n.a.	3	n.a.
Iceland[e]	40	n.a.	40	n.a.	5	n.a.	15	n.a.
Sweden[e]	37	n.a.	37	n.a.	8	n.a.	18	n.a.
Grand total	50	n.a.	36	n.a.	7	n.a.	8	n.a.
Memo: Peru[f]	90	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Sources: Central bank annual report (Bulgaria, Colombia, Finland, Germany, Hong Kong, Iceland, Lithuania, New Zealand, Norway, Peru, The Philippines, Romania); ministry of finance annual report (Canada); central bank web site (Sweden); IMF SDDS reserve template web pages (Latvia, Croatia, Uruguay); monthly statistical bulletin on central bank or ministry of finance web site (United States, United Kingdom, Switzerland, Australia, Slovak Republic, Peru).

[a]Assumes 2004 share is the same as in 2003.

[b]Canada holds only three currencies as foreign exchange reserves: U.S. dollar, yen, and euro. Prior to 2003, data published by Canada's ministry of finance only differentiate between U.S. dollar and non-U.S. dollar foreign exchange reserves. Hence, to derive the yen and euro shares for 2000–2002, we assume that the yen share during the period was the same as it was in 2003, and the rising euro share was derived as a residual.

[c]Since 2003, the Hong Kong Monetary Authority has grouped yen, euro, and other European currencies together into one category as "Non-U.S. dollar bloc." The 2003–2004 yen and euro shares in this table are derived by assuming that they remain the same as in 2002 in the "Non-U.S. dollar bloc," which has decreased as a share of the total since that time.

[d]Earliest data available are for August 2003.

[e]Data are available for only 2004.

[f]Earliest data available are for July 2002, but only differentiate between the U.S. dollar and other currencies (yen, euro, pound, and Canadian dollar).

position of the reserves of small holders is of little interest to or importance for the functioning of the international financial system.

The issue of reserve diversification focuses on a much smaller group of countries. As of the end of 2004, only eighteen countries held more than SDR 25 billion ($39 billion) in foreign currency reserves. Of course, those eighteen countries face another problem if their authorities begin to view their reserves not as the by-product of an exchange rate objective but as a portfolio of assets to manage, paying due attention to risk and return. Their portfolio decisions may interfere with their exchange rate objectives. If China were to begin to sell dollar investments on a large scale and replace them with euro or yen investments, the People's Bank of China might find itself in effect buying back some of those dollars. The portfolio-balance type of explanation is that some of the dollar assets China would have sold to invest in euro or yen would be unwanted at the current dollar exchange rate with the Chinese yuan and would be recycled by the financial markets back to China. Of course, the Japanese ministry of finance and euro-area finance ministers would also not be too happy about the resulting upward pressure on their currencies.

It is for this reason that I have proposed (Truman 2005b) an international initiative with respect to reserve diversification. It includes five elements.

First, as a supplement to the "Data Template on International Reserves and Financial Liabilities" (reserve template) of the IMF's Special Dissemination Standard (SDDS), the major industrial countries should commit to providing regular, for example, at least quarterly with a one-month lag, information on the currency composition of their individual holdings of foreign exchange reserves (off-balance sheet as well as on-balance sheet). At least twenty-three of the forty-eight countries that subscribe to the reserve template of the SDDS and that have committed to supplying historical data on their reserves also now voluntarily provide periodically (at least annually) specific information on the currency composition of their foreign exchange reserves.[14] Those countries that voluntarily disclose some information on the currency composition of their foreign exchange reserves include eleven industrial countries (Australia, Canada, Finland, Germany, Iceland, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States) and twelve emerging market

14. Full compliance with the reserve template requires the periodic disclosure of international reserves broken down by currencies in the SDR basket as a group (the euro, Japanese yen, U.K. pound, and U.S. dollar) and those not in the SDR basket. Additional disclosure of the currency composition of foreign exchange reserves is optional. The forty-eight countries comply by providing historical data their reserves including information on the type of investments held, for example, securities, bank deposits (in domestic or foreign banks, onshore and offshore), equities, as well as on-balance-sheet and off-balance-sheet assets and liabilities. An additional thirteen countries subscribe to the SDDS and must comply with the reserve template going forward, but do not supply historical data.

economies (Bulgaria, Croatia, Colombia, Hong Kong, Latvia, Lithuania, Peru, the Philippines, Romania, Slovenia, the Slovak Republic, and Uruguay). See table 8C.1.[15] Together, their foreign exchange reserves were \$532 billion as of July 2005, or 15 percent of the global total of \$3.5 trillion.[16]

This is an excellent start on transparency in this area. Increased transparency would reduce financial market uncertainty regardless of whether the other elements of my proposal were adopted. What is important to recall is that the development of the original reserve template that was incorporated into the SDDS was a project of the G10 central banks meeting under BIS auspices. Expanding that template to *mandate* the disclosure of the currency composition of foreign exchange reserves should similarly be an exercise in central bank cooperation under the aegis of the BIS logically involving the G20 countries, which hold two-thirds of global foreign exchange reserves.

As a second step, a standard for reserve diversification should be established. One starting point might be one-third U.S. dollar, one-third euro, and one-third yen for countries other than the United States, Japan, and those in the euro area. The standard for the euro area, Japan and the United States, might be fifty-fifty. In both cases, countries could be permitted discretion of up to, say, plus or minus 10 percentage points. Alternatively, each country could declare a different benchmark as long as it disclosed its benchmark and its compliance going forward and as long as the country committed in advance to a smooth adjustment to any new benchmark.

Third, Japan and the euro area should agree to an off market transaction to swap dollars for euro and yen assets, respectively, to achieve the fifty-fifty standard. The United States is close to fifty-fifty; see table 8C.1.

Fourth, Japan and the euro area should agree to feed the swapped dollars into the market on daily basis over a period of at least five years. Assuming that each holds only dollars today, which is an extreme estimate, the total dollar holdings to be disposed of would be \$500 billion, or \$100 billion a year, or about \$400 million a day. The resulting effects on foreign exchange rates of the regular daily sales of \$400 million are likely to be triv-

15. The countries listed in table 8C.1 include a few, as noted in the table, that disclose only the break between their U.S. dollar and non-U.S. dollar reserves.

16. The twenty-three countries include seven of the twenty-one with significant holdings of foreign exchange reserves (more than SDR 25 billion at the end of July 2005): Australia, Germany, Hong Kong, Norway, Switzerland, the United Kingdom, and the United States. The eleven industrial countries hold 24 percent of the total foreign exchange reserves of industrial countries, with Japan with 63 percent of industrial countries' foreign exchange reserves the only major holdout. Six G10 countries are on the list, accounting for 18 percent of G10 countries' foreign exchange reserves. Five G20 countries are on the list, accounting for 7 percent of their combined foreign exchange reserves.

ial in a market for which daily turnover was $1.9 trillion per data in April 2004.[17]

Fifth, other countries should be encouraged immediately to diversify their current marginal purchases of dollars according to the standard or their benchmark. They also should be encouraged to adjust their existing portfolios smoothly over a five-year period following the suggested examples of Japan and the euro area. If the Japanese and euro-area authorities wanted to facilitate this process by other countries or to stretch it out for more than five years, they could engage in swaps of their currencies for the dollars held by other countries and, thus, remain in control. They might be motivated to do so out of concern over their respective dollar exchange rates.

The full establishment and implementation of this standard not only would increase transparency but also would remove considerable uncertainty overhanging international financial markets without causing large effects on exchange rates.

Table 8C.1 provides some context on the diversification of foreign exchange reserves over the past four years. At the end of 2004, the U.S. dollar's value share in the reserves of the twenty-three countries was 50 percent. This is substantially less than the share estimated by the IMF for 2003 (IMF 2005, 109), which was 65.9 percent. The difference reflects the underrepresentation Asian and Latin American countries in the data in table 8C.1.

Over the past four years, the euro's share in the foreign exchange reserves of the nineteen countries for which we have reasonable time series data has risen by 12 percentage points. However, the decline in the U.S. dollar's share accounts for only half of the increase. The yen and other currencies contribute 5 and 1 percentage points, respectively.

Five countries have increased the dollar's share in their foreign exchange reserves: New Zealand, Colombia, Australia, Hong Kong, and Norway. Meanwhile, Lithuania, Romania, Canada, Latvia, and Croatia have substantially reduced the dollar's share in their reserves—by more than 10 percentage points. The declines for the other countries principally reflect valu-

17. Hildebrand (2005) describes a similar transparent program of gold sales by the Swiss National Bank, which appears to have had essentially no market impact. On the other hand, Blanchard, Giavazzi, and Sa (2005) estimate that if China and Japan were unexpectedly to shift half of their foreign exchange reserves, which they also assume are now all in U.S. dollars, into other currencies, the dollar's share in global portfolios would decline from 30 to 28 percent, which is a substantial shift within their framework, leading to a decline in the dollar possibly as large as 8.7 percent if the full adjustment was anticipated to occur over a period of one year. Their model is built on the assumption of imperfect asset substitution; the closer the parameterization is to perfect substitutability, the smaller the initial exchange rate adjustment and the more prolonged the adjustment process. In the limit, the model degenerates, and the speed of adjustment goes to zero.

ation effects. These data are value shares, and the presumption is that most countries mark the value of their foreign exchange holdings to market.

Seven countries have had large increases (15 percentage points or more) in the euro's share: Australia, Canada, New Zealand, the United Kingdom, Latvia, Lithuania, and Romania. The adjustments by the last three countries no doubt are responses to those countries' increasingly close ties to the European Union.

Three countries have reduced the yen's share substantially (by more than 10 percentage points): Australia, New Zealand, and the United Kingdom. Presumably these adjustments were responding, in part, to the low yield on yen-denominated assets. However, they also reflect relative value effects.

In the case of the United States, the euro's share rose by 10 percentage points between 2000 and 2004, and the yen's share declined by the same amount. Over the period, the United States made no purchases of euro or yen, earned a higher yield on euro-denominated assets than on yen-denominated assets, and the euro appreciated more against the dollar than the yen; this explains the decline in the yen's share in U.S. foreign exchange reserves.

Conclusion

Chinn and Frankel have written a provocative and interesting paper. Their central result is that the dollar will be replaced by the euro as the leading international reserve currency within two decades, especially if the United Kingdom joins the euro area and the U.S. dollar continues to depreciate at its recent pace against the SDR. The forces behind a decline in the dollar's share are plausible, but the dating of the takeover by the euro is empirically unconvincing. A better bet is not in this century.

Chinn and Frankel might have addressed a more interesting question. The more economically relevant question is the dollar and the euro's broader roles as international currencies, rather than their narrow roles as reserve currencies. Furthermore, the authors in their discussion often conflate the two roles rather than exploring their interaction.

Finally, the implicit framework—active reserve diversification—that Chinn and Frankel employ is probably flawed even if they had applied it appropriately by looking at quantity shares of international reserves, which they did not. The accumulation of foreign exchange reserves is driven primarily by price (exchange rate) considerations linked to other economic policy objectives, not by considerations associated with profit maximization using a portfolio-balance framework.

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III

Theoretical Perspectives on Current Account Sustainability and Adjustment

9

The Unsustainable U.S. Current Account Position Revisited

Maurice Obstfeld and Kenneth Rogoff

Five years ago, we published a paper (Obstfeld and Rogoff 2000a) arguing that the U.S. current account deficit—then running at 4.4 percent of gross domestic product (GDP)—was on an unsustainable trajectory over the medium term and that its inevitable reversal would precipitate a change in the real exchange rate of 12 to 14 percent if the rebalancing were gradual, but with significant potential overshooting if the change were precipitous. Though the idea that global imbalances might spark a sharp decline in the dollar was greeted with considerable skepticism at the time, the view has since become quite conventional. Indeed, when Federal Reserve Chairman Alan Greenspan gave a speech in November 2003 arguing that the U.S. current account would most likely resolve itself in quite a benign manner, his once conventional view was greeted as contrarian.[1]

In addition to updating the earlier calculations, this paper extends our previous analytical framework in some important dimensions, including

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1. See Greenspan (2004).

taking into account general equilibrium considerations resulting from the United States's large size in the global economy. We also generalize our model to incorporate terms of trade changes (changes in the relative price of exports and imports) in addition to changes in the relative price of traded and nontraded goods. These analytical changes point to a substantially steeper dollar decline. (In another paper, Obstfeld and Rogoff [2005], we extend the present analysis in a number of dimensions, including, especially, analyzing alternative scenarios for how the requisite real decline in the dollar might be distributed across Asian and non-Asian currencies.)

Under most reasonable scenarios, the rise in relative U.S. saving required to close up the current account deficit implies a negative demand shock for U.S.-produced nontraded goods. The same forces, however, imply a positive demand shock for foreign nontraded goods, and this general equilibrium effect turns out to imply an even larger depreciation in the real dollar exchange rate—as much as double that in our earlier partial equilibrium calculation. Overall, taking into consideration current data as well as our improved analytical framework, we conclude that U.S. current account adjustment entails a larger potential decline in the dollar than we had earlier speculated. Moreover, we now believe that some of the potential rebalancing shocks are considerably more adverse than one might have imagined in 2000 (in view of the increased long-term security costs that the United States now faces as well as its open-ended government budget deficits and its precariously low, housing-bubble distorted personal saving rate). Thus, our overall take is that the U.S. current account problem poses even more significant risks today than it did when we first raised the issue five years ago.[2]

The general equilibrium perspective of this paper also offers helpful insights into what sorts of traumas the United States and foreign economies might experience, depending on the nature of the shocks that lead to global current account rebalancing. For example, a common perception is that a global rebalancing in demand risks setting off a dollar depreciation that might be catastrophic for Europe and Japan. Fundamentally, this view is correct in that Europe's product and labor markets and Japan's credit markets are much less flexible than those in the United States, and hence these regions have more difficulty adjusting to any kind of shock, exchange rate or otherwise. However, as the model makes clear, a global rebalancing of demand would also yield some benefits. It is true that a dollar depreciation will likely shift demand toward U.S. exports and away from exports in the rest of the world, although this effect is mitigated by the well-documented home bias in consumers' preferences over tradables. However, ceteris paribus, global rebalancing of demand will give a large boost to foreign nontraded goods industries relative to United States nontraded goods in-

2. For another early examination of U.S. external deficit sustainability, see Mann (1999).

dustries, and this has to be taken into account in assessing the overall impact of the dollar depreciation. Another widespread belief in the policy literature is that a pickup in foreign productivity growth rates, relative to U.S. rates, should lead to a closing of global imbalances. Our analytical framework shows that would only be the case if the relative productivity jump were in nontradable goods production, rather than tradable goods production where generalized productivity gains often first show up. Therefore, contrary to conventional wisdom, as global productivity rebalances toward Europe and Japan, the U.S. current account deficit could actually become larger rather than smaller, at least initially.

In the first section of the paper we review some basic statistics on the size and current trajectory of the U.S. current account deficit, the country's net international investment position, and the dollar's real exchange rate. Compared to similar charts and tables in our 2000a paper, we find that the U.S. current account position has worsened somewhat, whereas the broadly trade-weighted dollar has moved by a comparatively small amount (appreciating until February 2002, depreciating to somewhat below its 2000 level since). The path of U.S. net international indebtedness has been somewhat different from that of cumulated measured current accounts, due largely to the rate-of-return effect highlighted by Gourinchas and Rey (2005): that U.S. current account deficits historically predict high future dollar returns on U.S. foreign assets compared to U.S. foreign liabilities.[3] As Tille (2003, 2005) and others have observed, the composition of U.S. foreign assets and liabilities—with U.S. assets only partly linked to the dollar and liabilities almost entirely dollar-denominated—implies that a depreciation of the dollar helps strengthen the U.S. net foreign asset position.[4] In the United States, the bond-market rally associated with the onset of recession in 2001 worked to increase net foreign debt, an effect that will play out in reverse as long-term dollar interest rates rise relative to foreign rates. While these considerations are important for determining the timing of the U.S. current account's ultimate reversal, our results here (and the more detailed analysis in Obstfeld and Rogoff 2005) suggest that they are of secondary importance in determining the ultimate requisite fall in the dollar whenever global current accounts finally close up. This turns out to be the case regardless of whether the driving force is shifts in savings (say, due to a flattening or collapse in U.S. housing prices) or in productivity trends (due to a catch-up by the rest of the world in retailing productivity). The reason is that the main impact on the dollar comes from a global rebalancing

3. In general, the rate of return on U.S. foreign assets has exceeded that on U.S. foreign liabilities; see Lane and Milesi-Ferretti (2004), Obstfeld and Rogoff (2005), and the chapters by Gourinchas and Rey and by Lane and Milesi-Ferretti in this volume. On the valuation of net foreign assets, see also IMF (2005b).

4. Lane and Milesi-Ferretti (2001) have attempted to adjust for such asset-price changes in constructing their series of countries' foreign assets and liabilities.

of trade, rather than any change in the transfer necessitated by interest payments on global debt positions.

A few further points merit mention, both by way of introduction to the present analysis and clarification of our earlier (2000a) paper. First, our framework should not be thought of as asking the question: "How much depreciation of the dollar is needed to rebalance the current account?" Though pervasive in the press and the mostly model-free policy literature, this view is largely misguided. In fact, most empirical and theoretical models (including ours) suggest that even very large (say, 20 percent) autonomous change in the real trade-weighted dollar exchange rate will only go a fraction of the way (say, 1/3) towards closing the better than 6 percent U.S. current account deficit. The lion's share of the adjustment has to come from saving and productivity shocks that help equilibrate global net saving levels and that imply dollar change largely as a by-product (though our model, of course, implies simultaneous determination of exchange rates and current accounts). In particular, although we allow the terms of international trade to respond to current account adjustment, the relative price of imports and exports is only one element underlying the overall real exchange rate response and not the dominant element from a quantitative viewpoint.

Second, it is important to note that our model assumes that labor and capital cannot move freely across sectors in the short run. To the extent factors are mobile, domestically as well as internationally, and to the extent that the closing of the current account gap plays out slowly over time (allowing factors of production more time to relocate), the real exchange rate effects of global rebalancing will be smaller than we calculate here. A related issue that we leave aside is the possibility of change in the range of goods produced and exported by the United States. Although that effect realistically is absent in the short run, over the longer run it might soften the terms of trade effects of various economic disturbances.

Third, the sanguine view that capital markets are deep and the U.S. current account can easily close up without great pain ignores the adjustment mechanism highlighted here, which depends more on goods-market than capital-market integration. The U.S. current account may amount to only 6 percent of *total* U.S. production, but it is likely 20 percent or more of U.S. *traded* goods production (at least according to the calibration suggested by Obstfeld and Rogoff 2000b). Our view is consistent with the empirical findings of Edwards (2004). His survey of current account reversals in emerging markets finds an economy's level of trade to be the major factor in determining the size of the requisite exchange rate adjustment, with larger traded-goods sectors implying a smaller currency adjustment on average. Calvo, Izquierdo, and Talvi (2003), who adopt a framework nearly identical to that of Obstfeld and Rogoff (2000a), arrive at a similar conclusion. Parenthetically, we note that most studies of current account reversals (including International Monetary Fund [IMF; 2002] or Croke, Kamin, and

Leduc [2005]) focus mainly on experiences in relatively small open economies. But as our model shows, the fact the United States is a large economy considerably levers up the potential exchange rate effects. Indeed, as Edwards (2005) shows, the recent trajectory of U.S. deficits is quite extraordinary and, both in terms of duration and as a percent of GDP, far more extreme that many of the cases considered in the previously cited IMF and Federal Reserve Studies—even ignoring the United States's mammoth size.

Finally, we caution the reader that while our analysis points to a large potential move in the dollar—over 30 percent in our baseline long-term calculation, but potentially larger if the adjustment takes place quickly so that exchange rate pass-through is incomplete—it does not necessarily follow that the adjustment will be painful. As we previously noted, the end of the 1980s witnessed a 40 percent decline in the trade-weighted dollar as the Reagan-era current account deficit closed up. Yet the change was arguably relatively benign (though some would say that Japan's macroeconomic responses to the sharp appreciation of the yen in the late 1980s helped plant the seeds of the prolonged slump that began in the next decade). However, it may ultimately turn out that the early-1970s dollar collapse following the breakdown of the Bretton Woods system is a closer parallel. Then, as now, the United States was facing open-ended security costs, rising energy prices, a rise in retirement program costs, and the need to rebalance monetary policy.[5]

9.1 The Trajectory of the U.S. Current Account: Stylized Facts

Figure 9.1 shows the trajectory of the U.S. current account as a percentage of GDP since 1970. As is evident from the chart, the recent spate of large deficits exceeds even those of the Reagan era. Indeed, in recorded history, the U.S. current account never appears to have been as large as the 4.7 percent experienced in 2003, much less the 5.7 percent recorded in 2004 or the 6.1 percent projected by the IMF (September 2005) for 2005 and 2006. Even in the late nineteenth century, when the United States was still an emerging market, its deficit never exceeded 4 percent of GDP according to Obstfeld and Taylor (2004). Figure 9.2 shows the net foreign asset position of the United States, also as a percentage of GDP. The reader should recognize that this series is intended to encompass all types of assets, including stocks, bonds, bank loans, and direct foreign investment. Uncertainty about the U.S. net foreign asset position is high, however, because it is diffi-

5. Though there is no official Bretton Woods system today, some have argued (Dooley, Folkerts-Landau, and Garber 2003 and 2004 as well as those authors' chap. 3 in this volume) that the current Asian exchange rate pegs constitute a Bretton Woods II system. Perhaps, but their analysis—which emphasizes Asia's vast surplus labor pools—applies more readily to China and India than to demographically challenged, labor-starved Japan and Germany, which each account for a much larger share of global current account surpluses.

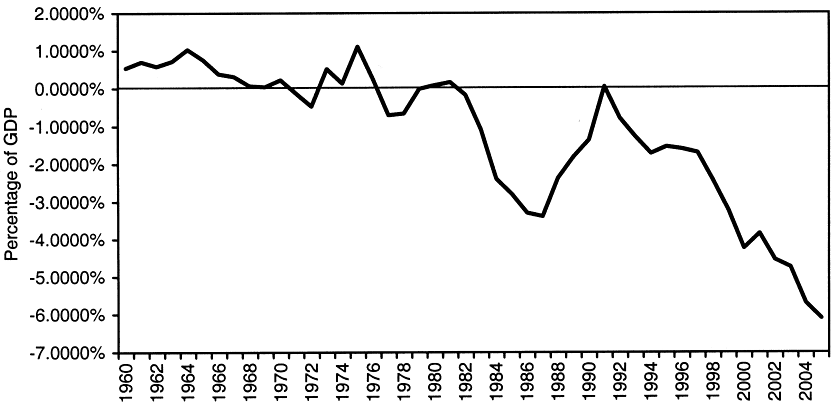

Fig. 9.1 U.S. current account balance, 1960–2005
Source: BEA; IMF *World Economic Outlook* projection for 2005.

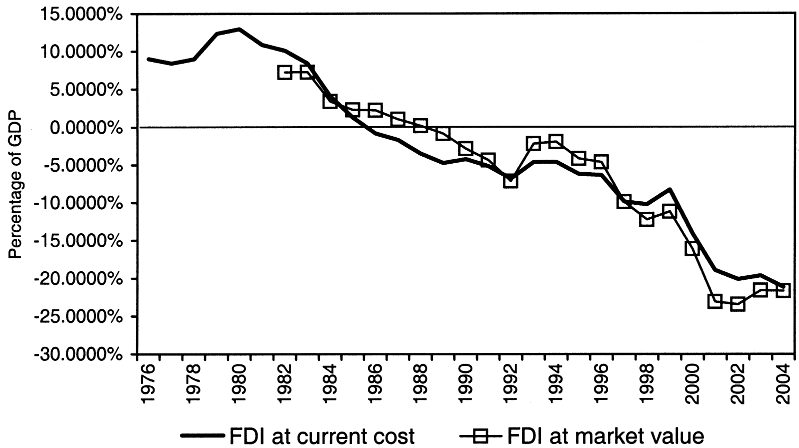

Fig. 9.2 U.S. net international investment position, 1976–2004
Source: BEA.

cult to firmly ascertain capital gains and losses on U.S. positions abroad, not to mention foreign positions in the United States. But the latest end-2004 figure of 22 percent is close to the all-time high level that the United States is estimated to have reached in 1894, when assets located in the United States accounted for a much smaller share of the global wealth portfolio. Figure 9.3, which updates a similar figure from our 2000 paper, shows the likely trajectory of the U.S. net foreign asset position, assuming external deficits of 6 percent of GDP indefinitely and continuing 6 percent nominal GDP growth. The graph also shows a few benchmarks reached by other, much smaller countries, in some cases prior to major debt problems.

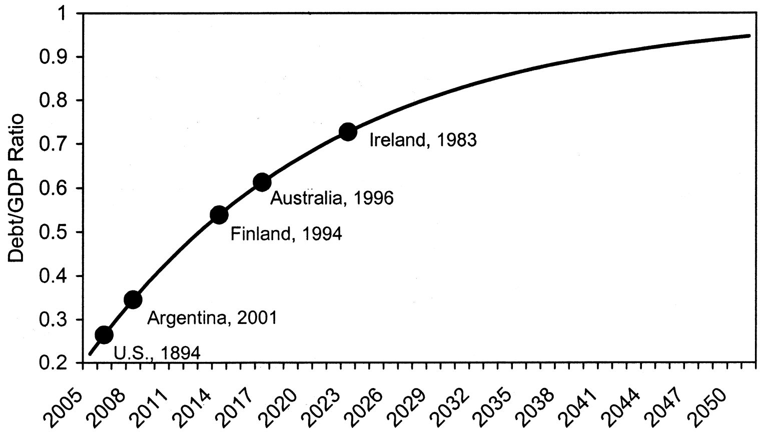

Fig. 9.3 Up the debt ladder? A hypothetical U.S. debt trajectory

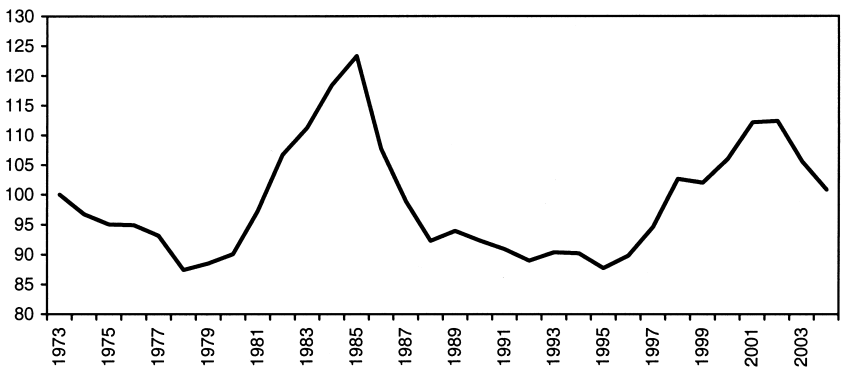

Fig. 9.4 U.S. dollar real exchange rate, broad index, March 1973 = 100
Source: Board of Governors of the Federal Reserve System.

We do not anticipate the United States having a Latin-style debt crisis, of course, and the United States's unique ability to borrow almost exclusively in domestic currency means that it can choose a backdoor route to default through inflation as it has on more than one occasion in the past (including the high inflation 1970s, the revaluation of gold during the Great Depression, and the high inflation of the Civil War era). Nevertheless, these benchmarks are informative. We note that our figure does not allow for any exchange rate depreciation that—assuming foreign citizens did not receive compensation in the form of higher nominal interest payments on dollar assets—would slow down the rate of debt accumulation along the lines emphasized by Tille (2003) and by Gourinchas and Rey (2005).

Figure 9.4 shows the U.S. Federal Reserve's "broad" real dollar exchange-rate index, which measures the real value of the trade-weighted dollar against a comprehensive group of U.S. trading partners. As we asserted in the introduction, the index has fallen only modestly since we published our 2000 paper—by roughly 8 percent from November 2000 to November 2005—though it should be noted that the decline has been more substantial against the major currencies such as the euro, sterling, and the Canadian dollar. Although the nexus of current accounts and exchange rates has changed only modestly over the past four years, however, other key factors have changed dramatically.

Figure 9.5 highlights the dramatic changes witnessed in the fiscal positions of the major economies. The swing in the U.S. fiscal position has been particularly dramatic, from near balance in 2000 to a situation today where the consolidated government deficit roughly matches the size of the current account deficit. That fact is highlighted in figure 9.6, which breaks down the U.S. current account deficit trajectory into the component attributable (in an accounting sense) to the excess of private investment over private saving and the component attributable to government dissaving. One change not indicated in this diagram is the changing composition of the private net saving ratio. From the mid-1990s until the end of 1999, the U.S. current account deficit was largely a reflection of exceptionally high levels of investment. Starting in 2000, but especially by 2001, investment collapsed. Private saving also collapsed, however, so there was no net improvement in the current account prior to the recent swelling of the fiscal deficit. (The personal saving rate in the United States was only 1 percent in 2004, having fallen steadily over the past twenty years from a level that had been relatively stable at 10 percent until the mid-1980s. A major factor, of

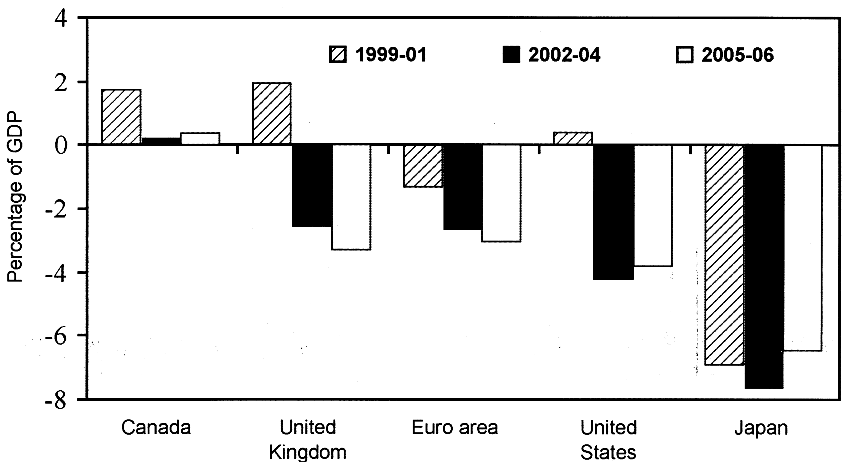

Fig. 9.5 Fiscal balances in major economies
Source: IMF *World Economic Outlook* database.

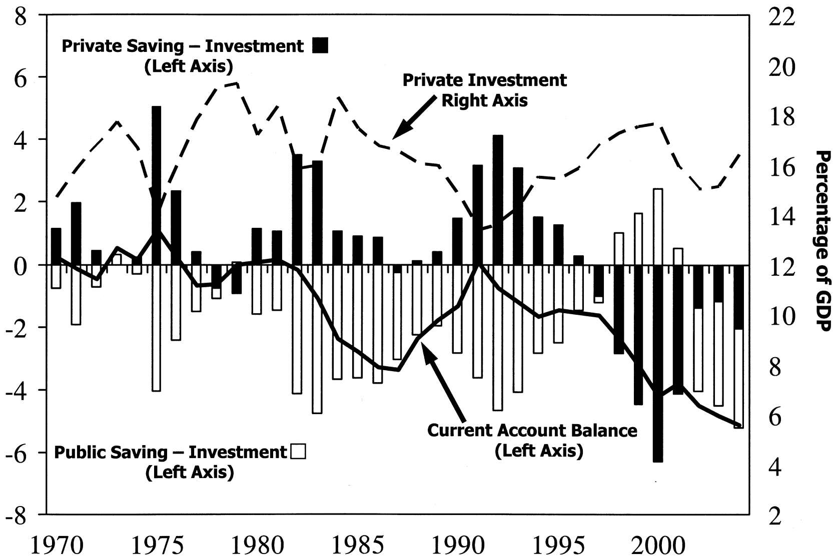

Fig. 9.6 U.S. current account and saving investment

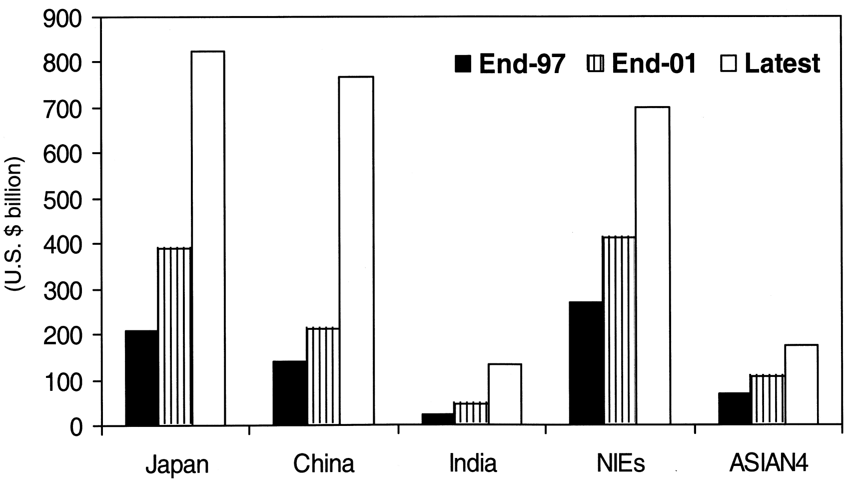

Fig. 9.7 Foreign exchange reserves

Source: International Financial Statistics and *Economist* magazine.

course, has been the sharp rise in personal wealth, resulting first from the equity boom of the 1990s and later from the sustained housing boom. Without continuing asset appreciation, however, the current low savings rate is unlikely to be sustained.)

Finally, figure 9.7 illustrates another important change, the rising level of Asian central bank reserves (most of which are held in dollars). At the end of 2004, foreigners owned 40 percent of all U.S. treasuries held outside the Federal Reserve System and the Social Security Administration Trust Fund. In addition, foreigners hold more than 30 percent of the combined debts of the giant mortgage financing agencies, Fannie Mae and Freddie Mac. These quasi-government agencies, whose debt is widely viewed as carrying the implicit guarantee of the U.S. federal government, have together issued almost as much debt as the U.S. government itself (netting out intergovernmental holdings). Indeed, netting out the treasuries held by the U.S. Social Security Trust administration and by the Federal Reserve System, the remaining treasuries held privately are of roughly the same order of magnitude as foreign central bank reserves. These reserves are held mostly by Asia (though Russia, Mexico, and Brazil are also significant) and held disproportionately in dollars. Indeed, over the past several years, foreign central bank acquisition of treasuries nearly equaled the entire U.S. current account deficit during a number of sustained episodes.

We acknowledge that these data in no way prove that U.S. profligacy needs to come to an end anytime soon. It is conceivable that the deficits will go on for an extended further period as the world adjusts to more globalized security markets, with foreign agents having a rising preference for holding U.S. assets. We do not believe, however, that this is the most likely scenario, particularly given that the composition of foreign flows into the United States remains weighted toward bonds rather than equity (at the end of 2004, only 38 percent of all foreign holdings of U.S. assets were in the form of direct investment or equity). The current trajectory has become particularly precarious now that the twin deficits problem of the 1980s has resurfaced. One likely shock that might reverse the U.S. current account is a rise in U.S. private saving—perhaps due to a slowdown or collapse in real estate appreciation. Another possible trigger is a fall in saving rates in Asia, which is particularly likely in Japan given its aging population and the lower saving rates of younger cohorts. Another, more imminent potential shock would be a rise in investment in Asia, which is still low even compared to investment in the late 1980s and early 1990s, even excluding the bubble level of investment in the mid-1990s just before the Asia crisis.

In the next section of the paper, we turn to an update of our earlier model that aims to ask what a change in the U.S. current account might do to global demand and exchange rates. We note that the model is calibrated on a version of our six puzzles paper (Obstfeld and Rogoff 2000b) that attempts to be consistent with observed levels of Organization for Economic Cooperation and Development (OECD) capital market integration and saving-investment imbalances. Less technically oriented readers may choose to skip directly to section 9.3.

9.2 The Model

The model here is a two-country extension of the small-country endowment model presented in Obstfeld and Rogoff (2000a) in which one can flexibly calibrate the relative size of the two countries. We go beyond our earlier model by differentiating between home and foreign produced tradables in addition to our earlier distinction between tradable and nontradable goods. (As we show in more detail in Obstfeld and Rogoff [2005], the traded-nontraded goods margin is considerably more important empirically when taken in isolation than is differentiation between imports and exports. However, the interaction between the two magnifies their joint effect.) We further extend our previous analysis by exploring more deeply the alternative shocks that might drive the ultimate closing of the U.S. current account gap.

Otherwise, the model is similar in spirit to our earlier paper on this topic. We draw the reader's attention to two features. First, by assuming that endowments are given exogenously for the various types of outputs, we are implicitly assuming that capital and labor are not mobile between sectors in the short run. To the extent global imbalances only close slowly over long periods (admittedly not the most likely case based on experience), then factor mobility across sectors will mute any real exchange rate effects (Obstfeld and Rogoff 1996). Second, our main analysis assumes that nominal prices are completely flexible. That assumption—in contrast to our assumption on factor mobility—leads one to sharply understate the likely real exchange rate effects of a current account reversal. As we discuss later, with nominal rigidities and imperfect pass through from exchange rates to prices, the exchange rate will need to move much *more* than in our baseline case in order to maintain employment stability.

The Home consumption index depends on Home and Foreign tradables, as well as domestic nontradables. (Think of the United States and the rest of the world as the two countries.) It is written in the nested form

$$C = [\gamma^{1/\theta} C_T^{(\theta-1)/\theta} + (1-\gamma)^{1/\theta} C_N^{(\theta-1)/\theta}]^{\theta/(\theta-1)},$$

where C_N represents nontradables consumption and C_T is an index given by

$$C_T = [\alpha^{1/\eta} C_H^{(\eta-1)/\eta} + (1-\alpha)^{1/\eta} C_F^{(\eta-1)/\eta}]^{\eta/(\eta-1)},$$

where C_H is the home consumption of Home-produced tradables, and C_F is home consumption of Foreign-produced tradables. Foreign has a parallel index, but with a weight α^* ($\alpha^* > 1/2$) on consumption of its own export good. This assumption of a relatively high domestic preference weight on domestically produced tradables, as opposed to the more common assumption of identical tradables baskets, generates a home consumption bias within the category of tradable goods.[6] The assumption can also be viewed as a stand-in for the explicit introduction of trade costs for tradable goods, which are omitted from the present model.

The values of the two parameters θ and η are critical in our analysis. Parameter θ is the (constant) elasticity of substitution between tradable and nontradable goods. Parameter η is the (constant) elasticity of substitution between domestically produced and imported tradables. The two parameters are important because they underlie the magnitudes of price responses to quantity adjustments. Lower substitution elasticities imply that sharper price changes are needed to accommodate a given change in quantities consumed.

The Home consumer price index (CPI) corresponding to the preceding consumption index C, measured in units of Home currency, depends on the prices of tradables and nontradables. It is given by

$$P = [\gamma P_T^{1-\theta} + (1 - \gamma)P_N^{1-\theta}]^{1/(1-\theta)},$$

where P_N is the Home-currency price of nontradables and P_T, the price index for tradables, depends on the local prices of Home- and Foreign-produced tradables, P_H and P_F, according to the formula

$$P_T = [\alpha P_H^{1-\eta} + (1 - \alpha)P_F^{1-\eta}]^{1/(1-\eta)}.$$

In Foreign there are an isomorphic nominal CPI and index of tradables prices, but with the latter attaching the weight $\alpha^* > 1/2$ to Foreign exportable goods. These exact price indexes are central in defining the real exchange rate.

Though we consider relaxing the assumption in our later discussion, our formal analysis assumes the law of one price for tradables throughout. Thus $P_F = \varepsilon P_F^*$ and $P_H^* = P_H/\varepsilon$, where ε is the Home-currency price of Foreign currency—the nominal exchange rate. (In general we will mark Foreign nominal prices with asterisks.) The terms of trade are

$$\tau = \frac{P_F}{P_H} = \frac{P_F^*}{P_H^*}$$

and the real exchange rate is

6. Warnock (2003) takes a related approach. In an earlier version of the paper, we assumed "mirror symmetric" preferences, such that α was also the weight of Foreign tradables in the Foreign tradable consumption basket. In the following simulation, however, the United States is only about one quarter of the world economy, so it is more reasonable to think that $1 - \alpha^*$, the weight that Foreigners attach to imports from the United States, will be smaller than $1 - \alpha$, the weight that U.S. residents attach to their own imports from the rest of the world. This modification tends to increase the terms-of-trade effect of current account adjustment as well as the overall resulting real depreciation. We thank Chris Erceg for suggesting this modification. The framework of Obstfeld and Rogoff (2005) models a world economy consisting of three equally sized regions.

$$q = \frac{\varepsilon P^*}{P}.$$

Note that because of the home bias in consumption of tradables, purchasing power parity does not hold for the differing preferred baskets of tradables in each country, even if the law of one price holds for individual tradable goods. That is, $P_T \neq \varepsilon P_T^*$. Indeed, the ratio $\varepsilon P_T^*/P_T$ is given by

$$\frac{\varepsilon P_T^*}{P_T} = \frac{[\alpha^* \tau^{1-\eta} + (1-\alpha^*)]^{1/(1-\eta)}}{[\alpha + (1-\alpha)\tau^{1-\eta}]^{1/(1-\eta)}},$$

while the real exchange rate is

$$q = \frac{\varepsilon P_T^*}{P_T} \times \frac{[\gamma + (1-\gamma)(P_N^*/P_T^*)^{1-\theta}]^{1/(1-\theta)}}{[\gamma + (1-\gamma)(P_N/P_T)^{1-\theta}]^{1/(1-\theta)}}.$$

Given our assumption of home-export consumption preference, the measured real exchange rate depends positively on the terms of trade (that is, $dq/d\tau > 0$).

Because the assumed utility functions imply constant elasticity of demand for each of the endowment goods, we can conclude that the global market for the home produced good clears when

$$Y_H = \alpha\gamma\left(\frac{P_H}{P_T}\right)^{-\eta}\left(\frac{P_T}{P}\right)^{-\theta} C + (1-\alpha^*)\gamma\left(\frac{P_H/\varepsilon}{P_T^*}\right)^{-\eta}\left(\frac{P_T^*}{P^*}\right)^{-\theta} C^*,$$

where Y_H is home's endowment of its tradable good. There is a corresponding market-clearing condition for the foreign tradable supply, Y_F. For Home nontradables we have

$$Y_N = (1-\gamma)\left(\frac{P_N}{P}\right)^{-\theta} C,$$

and, of course, there is again a corresponding Foreign condition.

Let us abstract from the underlying determinants of domestic and foreign saving and consumption. Thus, we take as given C and C^*, along with the endowments Y_H, Y_F, Y_N, and Y_N^*. Then the preceding market-equilibrium conditions allow us to solve for relative prices. For example, we can rewrite the equilibrium condition for the home export's market as

$$Y_H = \alpha\left(\frac{P_H}{P_T}\right)^{-\eta} C_T + (1-\alpha^*)\left(\frac{P_H/\varepsilon}{P_T^*}\right)^{-\eta} C_T^*,$$

implying that the price indices must be governed by

$$P_H Y_H = \alpha\left(\frac{P_H}{P_T}\right)^{1-\eta} P_T C_T + (1-\alpha^*)\left(\frac{P_H}{\varepsilon P_T^*}\right)^{1-\eta} \varepsilon P_T^* C_T^*. \tag{1}$$

Residually, we can calculate Home's current account surplus CA, measured in Home currency, as

$$\mathrm{CA} = P_H Y_H + iF - P_T C_T,$$

where F denotes Home net foreign assets and i (which we take as given) denotes the interest rate (both in Home currency units). For Foreign, the corresponding relationship is

$$\varepsilon \mathrm{CA}^* = \varepsilon P_F^* Y_F - iF - \varepsilon P_T^* C_T^* = -\mathrm{CA}.$$

As a first pass to understanding the exchange rate impact of global current account rebalancing, we begin by solving analytically for the effects of shocks that make CA = 0. (If there is no production effect, such shocks are best thought of as shocks to relative Home and Foreign demand. When we move later to consider supply shocks, we will allow relative outputs to move simultaneously.) Substituting for $P_T C_T$ and $\varepsilon P_T^* C_T^*$ in equation (1) and its Foreign-tradable analog, one gets

$$(2) \qquad P_H Y_H = \alpha\left(\frac{P_H}{P_T}\right)^{1-\eta}(P_H Y_H + iF - \mathrm{CA}) + (1-\alpha^*)\left(\frac{P_H}{\varepsilon P_T^*}\right)^{1-\eta}(P_F Y_F - iF + \mathrm{CA}),$$

$$P_F Y_F = (1-\alpha)\left(\frac{P_F}{P_T}\right)^{1-\eta}(P_H Y_H + iF - \mathrm{CA}) + \alpha^*\left(\frac{P_F}{\varepsilon P_T^*}\right)^{1-\eta}(P_F Y_F - iF + \mathrm{CA}),$$

for tradables, while for the nontradables markets, one can show that

$$(3) \qquad P_N Y_N = \frac{1-\gamma}{\gamma}\left(\frac{P_N}{P_T}\right)^{1-\theta} P_T C_T = \frac{1-\gamma}{\gamma}\left(\frac{P_N}{P_T}\right)^{1-\theta}(P_H Y_H + iF - \mathrm{CA}),$$

$$(4) \qquad \varepsilon P_N^* Y_N^* = \frac{1-\gamma}{\gamma}\left(\frac{P_N^*}{P_T^*}\right)^{1-\theta}(\varepsilon P_F^* Y_F - iF + \mathrm{CA}).$$

Of the preceding conditions, three are independent, allowing solution for the terms of trade τ, P_N/P_T^*, P_N^*/P_T^*, and hence the real exchange rate, q. Notice the presence of a transfer effect in the equations above. Because we assume $\alpha + \alpha^* > 1/2$, the stock of net foreign assets influences equilibrium relative prices. It will be most helpful to rewrite the equations in terms of ratios to nominal tradable GDPs ($P_H Y_H$ and $P_F Y_F$), the ratios of nontradable to tradable supplies, and the relative sizes of the two countries' tradables sectors. Let ca = CA/($P_H Y_H$) and $f = F/(P_H Y_H)$. Let $\sigma_T = Y_N / Y_F$, $\sigma_N = Y_N / Y_H$, and $\sigma_N^* = Y_N^* / Y_F$. Finally, let $x = P_N/P_T$ and $x^* = P_N^*/P_T^*$. Then we can write the three independent equations (2) to (4) as

$$(5)\qquad 1 = \alpha \frac{1}{[\alpha + (1-\alpha)\tau^{1-\eta}]}(1 + if - \text{ca})$$
$$+ (1-\alpha^*)\frac{1}{[\alpha^*\tau^{1-\eta} + (1-\alpha^*)]}\left(\frac{\tau}{\sigma_T} - if + \text{ca}\right),$$
$$\sigma_N = \left(\frac{1-\gamma}{\gamma}\right)x^{-\theta}[\alpha + (1-\alpha)r^{1-\eta}]^{1/(1-\eta)}(1 + if - \text{ca}),$$

and

$$\sigma_N^* = \left(\frac{1-\gamma}{\gamma}\right)(x^*)^{-\theta}[\alpha^* + (1-\alpha^*)\tau^{-(1-\eta)}]^{1/(1-\eta)}\left(1 - i\frac{\sigma_T}{\tau}f + \frac{\sigma_T}{\tau}\text{ca}\right).$$

The real exchange rate q is given by

$$(6)\qquad q = \frac{[\alpha^*\tau^{1-\eta} + (1-\alpha^*)]^{1/(1-\eta)}}{[\alpha + (1-\alpha)\tau^{1-\eta}]^{1/(1-\eta)}} \times \frac{[\gamma + (1-\gamma)(x^*)^{1-\theta}]^{1/(1-\theta)}}{[\gamma + (1-\gamma)x^{1-\theta}]^{1/(1-\theta)}}.$$

A helpful approximation to equation (6) is given by

$$(7)\qquad \Delta \log q \approx \gamma(\alpha + \alpha^* - 1)\Delta \log \tau + (1-\gamma)\left[\Delta \log\left(\frac{P_N^*}{\varepsilon P_N}\right)\right].$$

The preceding expression relies, in turn, on an estimate of the change in relative tradables price indexes, $\Delta \log(\varepsilon P_T^*/P_T) \approx (\alpha + \alpha^* - 1)\Delta \log \tau$. As expression (7) illustrates, the larger the share of nontraded goods $(1 - \gamma)$ in consumption, the bigger the effect of changes in the relative international price of nontraded goods. Similarly, the effect of the terms of trade on the real exchange rate q depends on the degree of home bias, captured by $\alpha + \alpha^* - 1$. Absent home bias ($\alpha = \alpha^* = 1/2$), the terms of trade cannot affect the real exchange rate in (7), because τ affects both countries' consumption deflators in the same way. Note that the preceding decomposition is essentially an accounting relationship, not a behavioral one. Of course, $\Delta\,\tau$ will be smaller the more substitutable are tradable goods (the higher is η) and the greater is the degree of home bias in tradables consumption, whereas the change in the relative price of nontraded goods across countries is smaller the greater the elasticity of substitution between traded and nontraded goods, θ.

With these analytical results in hand, we now proceed to study the model's quantitative implications.

9.3 The Exchange Rate Impacts of Rebalancing Global Current Accounts

One can potentially do a number of alternative experiments within the preceding framework. For example, as already discussed, just letting CA go to zero effectively captures a pure relative demand-driven current account reduction (that is, rebalancing of current accounts because U.S. aggregate demand falls while foreign aggregate demand rises). And, as we have also already alluded, one can simulate any accompanying effects of a relative productivity shocks by varying Home and Foreign relative output at the same time as we let the current account go to zero.[7]

Other exercises include trying to simulate the effects of a rise in U.S. government war expenditures. To parameterize that exercise, we need to ask how military spending is allocated between tradables and nontradables as well as between Home and Foreign. We are assuming that international debt is denominated in dollars, but that assumption is easily relaxed.

In our calibration we assume that $P_H Y_H/(P_H Y_H + P_N Y_N) \approx 0.25$ so that a deficit-to-tradables ratio of $\mathrm{CA}/P_H Y_H = -0.2$ approximates the current external deficit of the United States. We take net U.S. foreign assets (in dollars), F, divided by the dollar value of traded goods output, $P_H Y_H$, to be –0.8 and assume a nominal interest rate of 0.05 per year. Also, under the assumption that $Y_H/Y_F = 0.22$, the dollar value of tradables produced by the United States fluctuates between about 20 and 25 percent of global dollar sales of tradables (depending on the terms of trade).[8] We take $\eta = 2$ or 3, $\gamma = 0.25$, $\alpha = 0.7$, and $\alpha^* = 0.925$. For the most part, this calibration is broadly consistent with the one that we deduced in Obstfeld and Rogoff (2000b), where we argued that realistic trade costs (here, a large share of nontraded goods in consumption) can explain the degree of international capital-market integration that we actually observe among the OECD countries. We have taken the international trade elasticity η to be quite a bit lower than the value of $\eta = 6$ assumed in Obstfeld and Rogoff (2000b), however, both because short-run trade elasticities are smaller and because estimates based on microdata are quite a bit larger than those estimated to apply to aggregated U.S. trade flows.[9] Our calibration also requires an assumption about the elasticity of substitution in consumption between tradables and nontradables, θ. In our 2000a paper, we argued that a unit elasticity was a reasonable base case and that the empirical literature would support even a lower estimate. Because it will turn out that the exchange rate change is larger the smaller θ and because we want to include a conservative benchmark, we allow for θ as large as 2 in order to see how

7. Chapter 10 by Faruqee et al. in this volume studies current account adjustment scenarios within a dynamic multiregion model.

8. We assume that $Y_N/Y_H = Y_N^*/Y_F = 1$. The precise choices of these numbers have no bearing on the logarithmic changes in ratios of nontradable to tradable prices. Within rather large limits of variation, they have little effect on the change in the overall real exchange rate. The results are very close, for example, if we instead take $Y_N/Y_H = Y_N^*/Y_F = 3$, as in Obstfeld and Rogoff (2005).

9. See, for example, Gagnon (2003). Chapter 7 by Mann and Plück in this volume presents a critical assessment of trade elasticity estimation.

Table 9.1 **Return to external balance with outputs, NFA constant**

θ	η	Fall in terms of trade (%)	Real dollar depreciation (%)
1	2	15.8	32.3
1	3	9.4	26.4
2	2	15.8	19.1
2	3	9.4	14.4
0.5	2	15.8	64.4
1	1,000	0.0	17.6

a higher elasticity of intranational substitution (that is, between tradables and nontradables) might moderate the exchange rate effects, but we also briefly look at the case $\theta = 0.5$, which certainly is consistent with several of the empirical estimates reported in the literature (see the references in Obstfeld and Rogoff 2005).[10]

In table 9.1, we ask what happens if the U.S. accounts for roughly a quarter of world GDP and a relative demand shock abruptly closes its current account deficit from 5 percent of GDP to full balance. (We use 5 percent as a conservative figure; nearly identical results would ensue if the deficit ratio fell from, say, 6 percent to 1 percent.) Suppose, for example, that an end to the housing boom in the United States reduces consumption there, while improving growth expectations lead to higher consumption levels in Europe, Japan, and China.

In our first (low-elasticity) case of $\theta = 1$, $\eta = 2$, the real exchange rate needs to move by about 32.3 percent (computed as a log difference), more than double the effect we found in our earlier small-country model with flexible prices. (Our favored estimate, which allows for nominal rigidities and incomplete pass-through in the short run, is going to be higher still, see the following.) Why is the effect so large? One part of it comes from the fact that we are now allowing for terms of trade changes, which reinforce and magnify the effects of the relative price of nontraded goods on the real exchange rate. (The shift in the locus of global demand away from the United States leads to a relative drop in demand for U.S. traded goods because U.S. citizens are assumed to have a relative preference for U.S.-produced tradables. Thus, as table 9.1 also illustrates, the U.S. terms of trade fall sub-

10. Solution of the model is straightforward. To handle its nonlinearity, we write equation (2) in the form

$$1 = \alpha\frac{1}{z}(1 + if - \mathrm{ca}) + (1 - \alpha^*)\left[\frac{1-\alpha}{\alpha^*(z-\alpha) + (1-\alpha)(1-\alpha^*)}\right]\left(\frac{\tau}{\sigma_T} - if + \mathrm{ca}\right),$$

where $z \equiv [\alpha + (1-\alpha)\tau^{1-\eta}]$. Given τ, this is a quadratic equation in z. One can solve for z using the quadratic formula, then extract the implicit solution for a τ using the definition of z, then substitute the τ solution back into the quadratic, solve again for z, and iterate until convergence is achieved.

stantially, by about 15.8 percent.) Some of the difference comes from the fact that whereas the U.S. current account was 4.4 percent of GDP in 2000, it is over 6 percent today, so closing up the gap leads to a bigger exchange rate movement.

A final but key difference compared with the small-country case arises, however, because we are now allowing for general equilibrium effects due to price movements outside of the United States. To see the effect of this change most clearly, abstract temporarily from terms of trade changes. Within the United States, the elimination of the current account deficit implies something like a 20 percent fall in the demand for traded goods (as the current account deficit is 5 percent of GDP, while traded goods production accounts for about 25 percent of GDP). Thus, the relative price of nontraded goods needs to fall by 20 percent when the elasticity of intranational substitution is 1. But now, we must also take into account the fact that abroad, the price of nontraded goods must *rise* in parallel to the effect in the United States. If the world economy's two regions were roughly equal in size and there were no terms of trade effects, then in our general equilibrium model, the real exchange rate change would have to be twice that in the partial equilibrium model. But if the U.S. accounts for only 1/4 of global traded output—so that a U.S. current account deficit of 5 percent of GDP corresponded to a foreign current account surplus of 1.67 percent of foreign GDP—the effect would be about 33 percent instead of 100 percent larger—a change of about 26.6 percent (= 20 percent × 1.33) in the component of the dollar real exchange rate attributable exclusively (that is, ignoring terms-of-trade effects) to relative nontradable and tradable prices at home and abroad.

A convenient if rough way to get a handle on the sizes of the total real exchange rate change (including terms-of-trade effects) is to rewrite (7) in the equivalent form

$$\Delta \log q \approx (\alpha + \alpha^* - 1)\Delta \log \tau + (1 - \gamma)\left[\Delta \log\left(\frac{P_N^*}{P_T^*}\Big/\frac{P_N}{P_T}\right)\right]$$

which once again is based on the approximation $\Delta\log(\varepsilon P_T^*/P_T) \approx (\alpha + \alpha^* - 1)\Delta \log \tau$.[11] In our simulation $\alpha + \alpha^* - 1 = 0.625$, $1 - \gamma = 0.75$, and $\Delta \log \tau$

11. It is instructive to compare the preceding approximation to the equivalent equation (7). The preceding version makes it obvious that, *given* relative prices of tradables and nontradables, the change in relative tradables price indexes feeds through one-for-one into the real exchange rate and not merely by the fraction γ one might guess from a hasty glance at equation (7). Holding all else constant in equation (7), we can see, for example, that a percent rise x in $\varepsilon P_T^*/P_T$ will have not only a *direct* effect on q equal to γx percent, but, in addition, an *indirect* effect equal to $(1 - \gamma)x$ percent due to the induced changes in the relative international prices of nontradables. Engel (1999) uses a similar decomposition in his empirical study of the U.S. dollar's real exchange rate.

= 15.8%. We substitute above the back-of-the-envelope guess of 26.6 percent for $\Delta \log[(P_N^*/P_T^*)/(P_N/P_T)]$ to get

$$\Delta \log q \approx (0.625)(0.158) + (0.75)(0.266) = 9.9\% + 20.0\% = 29.9\%.$$

This answer is only about 8 percent off of the model's exact prediction of 32.3 percent. The minor discrepancy is the net result of algebraic approximations, the initial divergence between tradables consumptions and tradable endowments, and additional terms-of-trade effects that enter the equilibrium conditions (3) and (4).[12]

With higher elasticities all around, for example, as in the fourth row of table 9.1, changes in terms of trade and real exchange rates are naturally smaller. When $\theta = 2$ and $\eta = 3$, the terms of trade fall by only 9.4 percent, whereas real dollar depreciation is 14.4 percent. Lowering the tradable-nontradable substitution elasticity θ has a particularly dramatic effect on real dollar depreciation. The fifth row of table 9.1 alters the case in the first row by taking $\theta = 0.5$; in this case, the real exchange rate change is 64.4 percent, double what it is when $\theta = 1$.

We emphasize that in a quantitative decomposition of the overall real exchange rate response, substitution between U.S.-produced and foreign traded goods can be less important empirically than substitution between traded and nontraded goods. This imputation is due in part to the large share of nontradables in the CPI. Our mode of analysis, therefore, stands in marked contrast to the bulk of applied policy work on international trade flows, which asks only how relative *traded* goods prices must change in order to eliminate a given external trade imbalance. To ascertain the quantitative importance of the intranational substitution margin, the last row of table 9.1 looks at the case of a very high international substitution elasticity, $\eta = 1000$, in which case the terms of trade change is virtually nil. In that case, real dollar depreciation is still 17.6 percent, which equals a fraction 17.6/32.3 = 54.5 percent of its value when $\eta = 2$. Thus, in the case shown in the first row of table 9.1, only a minority of the overall real exchange rate change is attributable to the terms of trade. The terms-of-trade effect could dominate if the elasticity of substitution between traded and nontraded goods were higher or that between imports and exports lower, but this may not be the most likely scenario. Nevertheless, adding the

12. Using equation (4) for Home, the proportional fall in tradables consumption, given the initial current account deficit and external debt, is approximated by

$$\hat{C}_T \approx \frac{\Delta \mathrm{ca}}{1 + if - \mathrm{ca}} - (1 - \alpha)\hat{\tau} \approx -(0.86)(20\%) - (0.3)(15.8\%) \approx -22\%.$$

Thus, taking account of the corresponding effects in Foreign, a lower-bound estimate of the real exchange rate component $\Delta \log[(P_N^*/P_T^*)/(P_N/P_T)]$ would be (1.33)(22%) = 29.3% rather than the 26.6% applied in the preceding text. Using this number instead, the total real exchange rate change is approximated by (0.625)(0.158) + (0.75)(0.293) = 9.9% + 22.0% = 31.9%.

Table 9.2 **Return to external balance, U.S. tradable output expands by 20 percent**

θ	η	Fall in terms of trade (%)	Real dollar depreciation (%)
1	2	22.4	24.0
1	3	13.5	15.9
2	2	22.4	18.1
2	3	13.5	11.5

terms-of-trade channel does substantially magnify the requisite exchange rate change, both through its direct effect and through its interaction with the relative price of nontraded goods.

Table 9.2 asks what happens if the shock that closes up current accounts is associated with a large relative *rise* (20 percent) in U.S. productivity in tradables. This will, of course, mute the real exchange rate effect: higher production of tradables allows the United States to cut its current account deficit without a correspondingly large cut in consumption. In our base case, $\theta = 1$, $\eta = 2$, the dollar depreciates in real terms by only 24 percent as compared with the 32.3 percent in table 9.1; but remember, this is in the face of a huge increase in traded goods production that depresses the U.S. terms of trade by 22.4 percent. The effect is approximately linear, so for more realistic values of the productivity shock (e.g., $\Delta Y_H / Y_H = 0.02$), the effect would be to reduce the exchange rate movement implied by full current account adjustment by a fairly insignificant amount. For higher elasticities, both the terms-of-trade decline and the real dollar depreciation are smaller. A corollary of our approach is that the precise factors that change the current account have a central bearing on the accompanying real exchange rate response.

It may seem anomalous to the reader that it takes a *rise* in relative U.S. productivity in tradables to dampen the exchange rate effect of a reduction in the U.S. deficit; however, this is perfectly logical. Policy analysts frequently argue that a rise in relative productivity in the rest of the world will mute the exchange-rate impact of global current account rebalancing. But this is correct only if the foreign productivity rise is concentrated in the nontradables sector—for example, if foreign retailing productivity levels start to catch up to those of the United States, which has experienced a retailing productivity boom over the past twenty years. Indeed, our model suggests that the U.S. nontraded-goods productivity boom could help explain the widening of the U.S. current account deficit.[13] We hope to explore the issue in a follow-up paper.[14]

13. According to Gordon (2004), over 50 percent of the U.S.-Europe productivity differential over the past decade is due to retailing, with another 25 percent due to wholesale.

14. For foreign productivity growth in tradables to promote real dollar appreciation, we would need an implausible combination of higher home consumption bias in tradables, a larger overall consumption share of tradables, and lower trade elasticities.

Table 9.3 **Return to external balance, outputs constant, NFA endogenous**

θ	η	Fall in terms of trade (%)	Real dollar depreciation (%)
1	2	13.4	27.3
1	3	8.2	22.8
2	2	14.4	17.3
2	3	8.8	13.3

Table 9.4 **Return to external balance, military spending expands permanently**

θ	η	Fall in terms of trade (%)	Real dollar depreciation (%)
1	2	16.5	35.3
1	3	9.9	29.1
2	2	16.5	20.6
2	3	9.9	15.7

Table 9.3 allows the real dollar depreciation to reduce the real value of the U.S. net foreign debt, in line with Tille's (2005) estimates of U.S. foreign assets and liabilities denominated in foreign currencies.[15] As suggested previously, the effect on the extent of depreciation is not large, even when the reduction in net foreign debt is substantial. (This is only to be expected: even for gross foreign assets and liabilities as large as those of the United States, debt reduction cannot be significant when the exchange rate change is small.) For example, in the first row of table 9.3, the net foreign debt of the United States is reduced from 0.8 to only 0.18 of nominal tradables output, yet the degree of real dollar depreciation is still 27.3 percent (as compared with 32.3 percent in table 9.1), and the fall in the terms of trade is 13.4 percent (as compared with 15.8 percent in table 9.1). For higher elasticities, the debt reduction is smaller, as is the effect on the ultimate equilibrium relative-price changes.[16]

A final exercise, reported in table 9.4, assumes that the closing of the deficit is accompanied by a shift to permanently higher military and security expenditures, for example, due to an open-ended commitment of American force in Iraq. (In table 9.4, we do not endogenize net foreign assets.) Nordhaus's (2002) estimates suggest that roughly 3 percent of U.S. tradables would be required annually for this purpose. We assume that all the resources used are tradables, drawn roughly half out of U.S. tradables

15. The revaluation calculation assumes that nominal and real depreciation coincide, as is justified in the following.

16. The exercise of allowing for valuation effects is executed in much more detail in Obstfeld and Rogoff (2005), who similarly find that valuation effects can only temper the exchange rate adjustments by roughly 1/5. Notice that now, the extent of real depreciation affects the equilibrium terms of trade change because net foreign assets influence spending on tradables.

and half out of foreign tradables. In the low-elasticity case of $\theta = 1$ and $\eta = 2$, both the real depreciation and the terms-of-trade decline are greater than in table 9.1, but not hugely so: a 35.3 percent versus 32.3 percent depreciation and a 16.5 percent versus 15.8 percent terms-of-trade decline. The differential effects are smaller at higher elasticities, as expected.

Some readers will be more interested in understanding what happens to the nominal exchange rate as opposed to the real exchange rate. To make this translation, we must, of course, make an assumption about monetary policy. The simplest assumption is that central banks target CPI inflation rates in which case, under flexible prices, $\Delta \log \varepsilon = \Delta \log q$. (Allowing for the case of GDP deflator targeting is a bit more complicated but turns out to make only a marginal difference, so we do not report the results here.)

All of the above analysis assumes flexible prices and complete pass-through from exchange rates to final goods prices. While we do not explore price rigidities and imperfect pass-through explicitly in this paper, we can draw some preliminary conclusions from the results of our earlier small-country model. If pass-through from exchange rates to prices is 50 percent (as we assumed in our 2000a paper), the requisite change in the exchange rate will have to be roughly double the ones calculated in the tables, assuming that central banks target overall inflation and allow the exchange rate to move to maintain full employment in the nontraded-goods sector. In fact, newer estimates suggest that for the United States, pass-through is less than 50 percent after one year and only 25 percent in the short run (see Campa and Goldberg 2002), in which case the immediate overshooting would be twice as large. Because the pass-through following a very large exchange rate change probably is higher, we might take 50 percent as a conservative estimate to use for the medium-term pass-through to import prices.

9.4 Parallels with the Early 1970s

Given our analysis, why then do some, such as Greenspan (2004), argue that a decline in the U.S. current account deficit is likely to be benign? Greenspan points to the fact that capital markets are becoming increasingly integrated and cites reductions in home bias in equities; the secular waning of the Feldstein-Horioka puzzle; and other factors considered in our 2000b paper on the six major puzzles in international macroeconomics, which are also in our 2000a paper. But our calibration here is totally consistent with the current degree of integration of capital markets and, indeed, is consistent with the calibration of our earlier paper. What matters for the exchange rate effect here is not the depth of international capital markets but the costs of adjusting to lower tradables consumption in the *goods* markets. Given our assumptions here the nontraded goods account for 75 percent of GDP (as we found in our earlier calibrations) and that there is home bias in tradable-goods consumption (as is consistent with a broad variety of evidence from the trade literature), then U.S. current account adjustment necessarily requires a significant exchange rate adjustment. True, the adjustment is smaller the smaller the adjustment in the current account (our model, for realistic parameters, exchange rate adjustments are approximately linear in trade balance adjustments). But even a closing up of the U.S. current account from 6 percent to 3 percent would require very substantial exchange rate adjustments, especially if one takes the likely effects of exchange rate overshooting into account.

The real question is not whether there needs to be a big exchange rate adjustment when the U.S. current account goes from its current unsustainable level to a lower, more sustainable one. For most plausible shocks leading to global rebalancing, this is a given. The real question is how drastic the economywide effects are likely to be. This is an open question. We agree with Greenspan's (2004) argument that some markets are becoming more flexible and that this should allow the world economy to absorb the blow better than it might have otherwise. But whereas U.S. markets may have achieved an impressive degree of flexibility, Europe (and, to a lesser extent, Japan) certainly has not. The rest of the world is not going to have an easy time adjusting to a massive dollar depreciation. It is also the case that world derivatives markets have exponentially expanded in comparison with even ten years ago. The increasing diversity of banks' counterparty risk (see, for example, the International Monetary Fund's *Global Financial Stability Report,* 2005a) raises the chances that a massive dollar movement will lead to significant financial problems (events along the lines of the collapse of long-term capital management in 1998). Such problems are inherently difficult to foresee until they suddenly unfold.

Of course, the optimists can point to the dollar's relatively benign fall in the late 1980s (though arguably it was a critical trigger in the events leading up to Japan's collapse in the 1990s). But perhaps the greatest concern is that today's environment has more parallels to the dollar collapse of the early 1970s than to the late 1980s. We hope to address this analogy in future research.[17] For now, however, we note some broad similarities. During the years 1971 to 1972 (in the run-up to the November 1972 election), the United States had relatively loose fiscal policy (fueled particularly by a generous election-year increase in social security benefits), soft monetary policy, and faced open-ended security costs. Back then it was Vietnam; today it is Iraq and homeland security, the combined costs of which could easily match the cumulative 12 percent of gross national product (GNP) that the Vietnam War cost or the 15 percent of GNP that financed the Korean War (see Nordhaus 2002). There were twin deficits (albeit significantly smaller

17. Chapter 6 in this volume by Adalet and Eichengreen and chapter 4 by Freund and Warnock survey the empirical characteristics of past current account adjustment episodes.

in the 1970s than they are today), and energy prices were a major factor (although the 1974 oil price hike was much greater, when measured in real terms, than anything see yet in 2004). The year 1973 saw a breakdown of the Bretton Woods fixed exchange rate system (mainly involving European countries), but today there is a quasi-fixed exchange rate system between the United States and much of Asia.

Broadly speaking, one has to be concerned that if the U.S. current account closes up under a backdrop more like the 1970s than the 1980s, the outcome may be much more severe than it seemed to be during the 1980s dollar descent. Aside from a boomerang effect of slow foreign growth on U.S. exports, there are further risks of rising inflation and interest rates and perhaps even a significant financial crisis (see Obstfeld and Rogoff [2005] for further discussion).

9.5 Conclusions

In the paper, we have generalized our discussion in Obstfeld and Rogoff (2000a) to take account of general equilibrium effects and terms of trade changes. Both are important. First, the large size of the United States in the world economy (about 22 percent of global GDP) implies that when the U.S. current account shrinks, the same price dynamic needed to induce U.S. citizens to tilt consumption toward nontraded goods must play out in reverse in the rest of the world. As a consequence, the requisite dollar depreciation is larger than if the United States were a small country. A number of factors may mitigate the required degree of depreciation (a higher elasticity of substitution between tradables and nontradables than in our baseline and a greater degree of factor mobility across sectors). Notwithstanding these qualifications, and given the depreciation that has already occurred in the last couple of years, it still seems quite conservative to suppose that the trade weighted dollar needs to depreciate at least another 20 to 25 percent as the current account rebalances. If the rebalancing takes place over a very long period, the change could be significantly less as factor mobility allows real adjustment to mitigate the need for price adjustment. On the other hand, if the adjustment were to take place quickly (a definite risk), then there could be a large potential overshoot in the event of a rapid reversal causing the trade-weighted dollar to fall by 40 to 50 percent or more.

Second, taking into account terms-of-trade effects (the relative price of a country's imports and exports) also levers up the required depreciation of the dollar when the U.S. current account closes up, though this effect is quantitatively somewhat smaller than the one implied by the requisite movements in relative prices of traded and nontraded goods. (There is also an interaction between the two effects, though it is smaller than the direct impacts.)

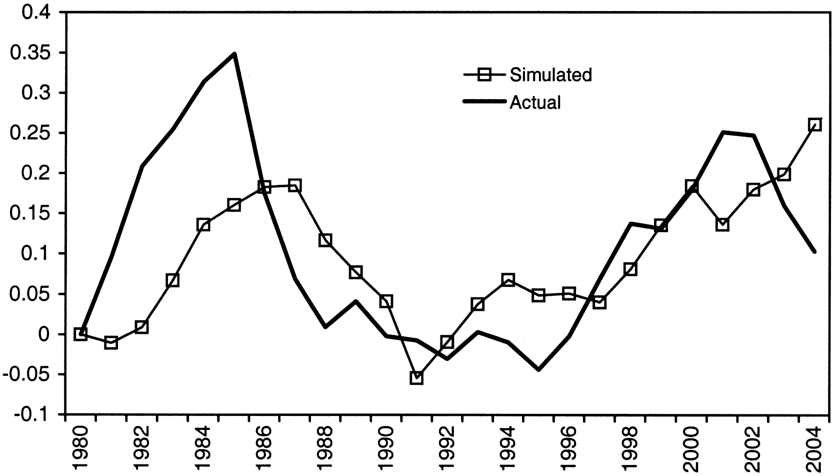

Fig. 9.8 Simulated versus actual log U.S. dollar real effective CPI exchange rate: Effects of current account (CA) and net foreign assets (NFA) only ($\theta = 1$)

One way to assess the general plausibility of the central mechanism driving our model's exchange rate prediction is to compare the model's retrospective predictions with history.[18] We do this in an extremely simple way. We solve for changes in the equilibrium dollar real exchange rate abstracting from all other than the current account balance and the stock of net foreign assets. For the parameter values assumed previously (with $\theta = 1$, $\eta = 2$), figure 9.8 shows the resulting simulated and actual log real exchange rate paths, both normalized to zero in 1980, a year of approximate external balance for the United States. Perhaps surprisingly in view of the many potential caveats listed in the preceding, the model indeed tracks the broad movements in the dollar, with the exception of the most recent depreciation cycle. Perhaps the most glaring discrepancy is the much-studied episode starting in 1985, when the dollar's descent from its peak, driven by market anticipations as well as concerted policy initiatives, began several years in advance of the current account's turn toward balance. The last few years' experience looks similar, with the U.S. current account worsening (albeit more sharply) as the dollar dives. Of course, figure 9.8 raises quite starkly the question of when the current account will adjust and what the consequences for the dollar might be if it does not do so soon.

While predicting a dollar cycle in the 1980s, figure 9.8 does not capture its magnitude. Figure 9.9, however, shows that with the still empirically plausible assumption of $\eta = 0.6$, the model does capture the Reagan-era

18. We thank Mick Devereux for suggesting this exercise and implementing a preliminary version of it.

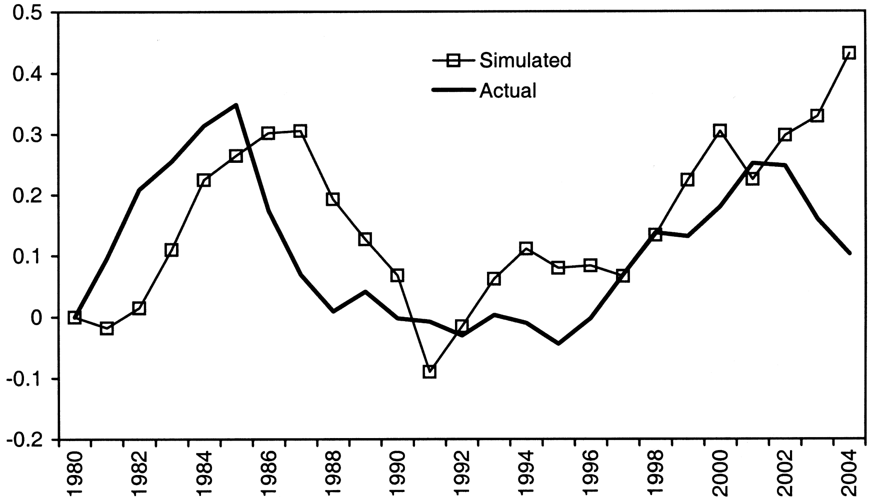

Fig. 9.9 Simulated versus actual log U.S. dollar real effective CPI exchange rate: Effects of CA and NFA only ($\theta = 0.6$)

cycle quantitatively. Under this parameterization, however, the discrepancy of the last few years is accentuated, with a large and growing divergence between actual dollar depreciation and the appreciation predicted by the model in the face of a growing external deficit. Possibly the dollar's fall in the last few years reflects anticipations of the eventual current account adjustment, a short-run factor not present in our model. Over the last two decades of the twentieth century, such anticipations were correct over the longer term. The anomalous post-2002 divergence in figure 9.9 suggests that if U.S. spending does not fall more into line with income soon, inflationary pressures will gather momentum.

Our discussion has not touched explicitly on issues of capital-market integration and instead has focused on the relative price movements needed to preserve goods-market equilibrium in the face of a current account adjustment. The extent of capital-market integration would enter the market primarily through the rate of interest that the United States must pay foreigners on its external obligations. Even if the United States can greatly expand its foreign debts without triggering a sharp rise in its cost of foreign finance, our analysis implies that when U.S. current account adjustment comes, the exchange rate effects may be massive. Unless gross debts rise further or the U.S. external borrowing rate rises sharply, however, the reduction in the current account itself will still be the dominant factor altering international relative prices.

Of course, as we noted previously, it is difficult to say with certainty when the U.S. current account adjustment will commence or whether it will be gradual or abrupt. With lower integration in the world capital markets, abrupt current account adjustment, sooner rather than later, is more likely. If greater financial integration allows bigger and more protracted U.S. deficits, however, the ultimate relative price adjustments will have to be more extreme. In other words, further deepening of global capital markets may postpone the day of reckoning. But as long as nontraded goods account for the lion's share of U.S. output, a sharp contraction in net imports—a significant closing of the U.S. current account—will lead to a large exchange rate adjustment under most plausible scenarios. That adjustment will be sharper the longer is the initial rope that global capital markets offer to the United States, though the main variable will be the type of shock that sets off adjustment (for example, a housing price crash or an abrupt change in foreign central bank portfolio demand) and the speed with which the trade balance is forced to adjust.

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Comment Kristin J. Forbes

Introduction

Authors in Victorian England often released one chapter of a new novel at a time as part of a weekly or monthly periodical—a format known as *serial publishing.* The author would then have a chance to gauge the public's reaction to the latest installment and adjust the storyline. The public would not know how the story would evolve—and, instead, would have to keep buying the periodical, installment by installment, continually reassessing how the novel might end.

Reading the latest variant of the Obstfeld and Rogoff analysis of the U.S. current account position reminded me of what it must have felt like to read a chapter of the latest Dickens novel in the weekly periodical. Each version of the Obstfeld and Rogoff analysis is more sophisticated, as the authors incorporate the feedback and suggestions from earlier versions.[1] With each version the U.S. current account situation also becomes more serious—and you can't help but think that the storyline is near its climax and some sort of resolution must occur soon. Will the U.S. current account deficit improve in conjunction with a gradual depreciation of the dollar and a period of strong growth—similar to the benign adjustment in the United States during the 1980s? Or will the story end with sharp exchange rate movements, slower growth, and higher inflation—as occurred during the more disruptive period in the 1970s?

My comments on Obstfeld and Rogoff are divided into three main sections. First, I discuss several key insights from the paper that deserve to be highlighted and that have important policy implications. Second, I briefly mention several issues that could have meaningful implications for the analysis but that are not addressed in the paper. Third and finally, I propose two reasons why the conclusions and key results in the paper may be too negative. The authors end the paper implying that the U.S. current account is likely to unwind in a scenario that Charles Dickens might have labeled as "the worst of times," but is there reason to believe that this story could instead end as "the best of times"?

Three Important Contributions of Obstfeld and Rogoff

Obstfeld and Rogoff develops a general equilibrium model to show how an unwinding of the U.S. current account deficit will affect currency movements. Then it performs simulations to assess the magnitude of these effects under different scenarios. The model is fairly straightforward, but

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1. Also see Obstfeld and Rogoff (2000, 2005).

yields very powerful results and is a useful framework to explore several policy implications. While the paper presents a number of insights, I will highlight three: the way in which current account adjustments affect exchange rates (in contrast to how exchange rates affect current account balances), the role of flexibility in product markets, and the role of different types of productivity growth.

One contribution of Obstfeld and Rogoff is that the framework used in the paper forces us to rethink causality and the relationship between trade balances and exchange rates. Most people discussing the subject of global imbalances begin by focusing on the different factors that will reduce the U.S. trade deficit (such as raising savings in the United States or a large dollar depreciation). Instead, Obstfeld and Rogoff start by simply assuming that the current account deficit is reduced and then analyze how this affects real and monetary variables, including the exchange rate. In other words, Obstfeld and Rogoff take the opposite approach from most analyses by asking how a reduction in the U.S. current account will affect the U.S. exchange rate, rather than how the U.S. exchange rate will affect the U.S. current account deficit.

This approach of focusing on the real exchange rate as an outcome, instead of a cause, of an adjustment in the U.S. current account deficit is particularly useful because it highlights the real adjustment that must take place in the U.S. economy when the current account deficit shrinks. The analysis shows that any reduction in the U.S. current account deficit will cause a substantial depreciation of the dollar. Many policymakers tend to focus on other cures for the U.S. current account deficit—such as raising U.S. national savings or structural reform in Europe. These policymakers generally believe that accomplishing these goals would reduce the need for a dollar depreciation. Although these goals are all worthwhile and will facilitate any adjustment, Obstfeld and Rogoff show that these adjustments will not, in and of themselves, be sufficient. Even if the United States increases national savings and Europe and Japan adopt structural reforms to raise productivity growth in nontradables, a dollar depreciation will still occur.

A second important contribution of Obstfeld and Rogoff is that it highlights the importance of flexibility in product markets to facilitate a smooth adjustment of global imbalances. The economic literature has a long history of exploring the importance of flexibility for economies to adjust to a variety of shocks—so the importance of flexibility is not surprising. Obstfeld and Rogoff's model, however, not only highlights the importance of flexibility to the adjustment process, but also provides a useful framework to assess the magnitude of these effects. For example, when Obstfeld and Rogoff drop their baseline assumption of full pass-through and instead assume that pass-through from exchange rates to prices is 50 percent, then the corresponding impact of reducing the U.S. current account deficit on exchange rates roughly doubles. In other words, focusing on the four scenarios that provide the baseline case in table 9C.1, the impact of reducing the U.S. current account deficit to zero would correspond to a 14 percent to 32 percent depreciation of the dollar under the case of full pass-through, but a 29 percent to 65 percent depreciation assuming 50 percent pass-through. Moreover, even an assumption of 50 percent pass-through may be too high. A study by authors at the Federal Reserve Board estimates that the pass-through of exchange rates to import prices in the United States was about 20 percent over short-time horizons in the past decade (Faust et al. 2005).

This conclusion that greater flexibility in product markets will reduce the exchange rate impact of an adjustment in global imbalances has important policy implications. Countries with more rigid product markets will face an important tradeoff. If they are concerned about the impact of a dollar depreciation on their exports and growth, one solution to minimize the impact is to reduce product market rigidities. Countries that are unable or unwilling to tackle reform will face a greater currency appreciation. Neither option is politically popular, but Obstfeld and Rogoff suggest that a choice must be made.

A third contribution of Obstfeld and Rogoff is that it clarifies exactly how productivity growth can help reduce global imbalances—and especially the role of the type of productivity growth. More specifically, the paper shows that stronger productivity growth in major non-U.S. economies, such as Europe and Japan, would not necessarily lead to a reduction in the U.S. current account deficit. In fact, higher productivity growth in the tradable sector in countries outside the United States could actually have the opposite effect and increase the U.S. current account deficit. Instead, it is only higher productivity growth in the non-tradable sector (outside of the United States) that would help reduce global imbalances. This is an important distinction—and one that is often overlooked.

This insight that the form of productivity growth can have important effects on global imbalances has important implications. For example, as Obstfeld and Rogoff point out, strong productivity growth in the U.S. non-tradable-goods sector since the middle of the 1990s may have been an important factor in explaining the widening of the U.S. current account deficit over this period. The authors write that they hope to explore this issue in a follow-up paper, and I encourage them to follow through on this issue. A closely related implication is that reducing global imbalances while simultaneously raising growth in non-U.S. economies is possible and feasible. Japan and most countries in Europe have not benefited from the rapid productivity growth in the nontradables sector experienced in the United States over the past decade, but they can learn and benefit from the U.S. experience. With appropriate policies, countries can not only reap similar gains as in the United States, but also even reap faster gains as they can simply adopt first-best practices that were only learned over time in the United States.

Other Issues to Explore

Although Obstfeld and Rogoff address a number of key aspects of any adjustment in the U.S. current account deficit, their modeling framework does not include several factors that could affect the adjustment process and the central results. In particular, the paper downplays the role of global financial markets—especially how different actors could respond to a rapid adjustment in the dollar. The paper simulates how a dollar depreciation affects asset market valuations and argues that the magnitude of these effects is second order. There are, however, a number of other ways in which financial markets, foreign actors, and investors could respond to the adjustment in the U.S. current account deficit and affect the depreciation of the dollar.

For example, if the dollar depreciated rapidly, it is likely that foreign central banks would loosen monetary policy to stimulate growth and stem the appreciations of their currencies. How would this affect the results? Similarly, at least 26 percent of net capital flows into the United States in 2004 were purchased by official institutions (largely central banks)—a market participant that may behave differently than profit-maximizing investors.[2] Will the way in which the U.S. current account deficit is financed (such as through portfolio inflows versus foreign direct investment versus government bond purchases) affect the adjustment process? Also, as Bernanke (2005) highlights, low interest rates in the United States reflect high savings (relative to investment) in the rest of the world. In the framework used in the paper, it is difficult to see how changes in savings and investment abroad will affect the results. If foreigners became alarmed about a dollar depreciation, they might increase private savings. How would this complicate the adjustment process?

A final issue that is not directly addressed in the paper is the possibility of nonlinearities or *breaks* in the simulated relationships. Although Obstfeld and Rogoff's model is not developed as a linear model, most of the effects discussed in the paper appear to be roughly linear. Although this result is reasonable for moderate movements in the key variables, large movements of key variables (such as the exchange rate) would likely generate substantially different relationships between these variables. For example, a sudden and rapid depreciation of the dollar could generate massive sales by market participants that had to cover losses—especially hedge funds

2. The source is Treasury International Capital (TIC) flow data. The actual value of purchases of U.S. assets by official institutions is likely larger than the reported figure as purchases by official institutions through private institutions are not classified as "official" purchases.

and other leveraged institutions. On the other hand, a sudden and rapid depreciation could also generate responses by other countries—such as interventions in exchange markets or changes in monetary policy (as discussed previously). These nonlinear responses are even more likely when evaluating the case of the United States, due to its large size and the magnitude of the required adjustment relative to the size of the global economy. If the dollar depreciated by 40 percent in a short amount of time—one of the scenarios considered in the paper—there would likely be shifts in some of the underlying parameters of the model. These potential nonlinearities may be difficult (if not impossible) to include in the model, but it would be helpful to have a discussion of how they might occur and how they would affect the central results.

To be fair, one of the strengths of Obstfeld and Rogoff is the simplicity in the model. Moreover, a number of other papers in this volume have focused on asset market effects of an adjustment to the U.S. current account deficit, while Obstfeld and Rogoff introduce a number of points not made in the other papers. Incorporating many of the points discussed above would undoubtedly complicate the model and estimation. Nonetheless, it would be useful for the authors to briefly discuss how each of these factors might affect the central results and implications of the paper.

Are the Conclusions Overstated?

When Obstfeld and Rogoff presented the earliest version of this paper, the U.S. current account deficit had just reached 3.7 percent of GDP in 1999. Many people thought their estimates of the forthcoming dollar depreciation were too large and unrealistic. Since then, the dollar has depreciated by 7 percent against a broad basket of currencies (according to the broad dollar index calculated by the Federal Reserve Board), but the U.S. current account deficit increased to 5.7 percent in 2004. U.S. net external debt levels have also increased sharply. The current version of the paper predicts an even greater depreciation of the dollar will occur when the U.S. current account deficit declines. Are these predictions overstated?

The top of table 9C.1 summarizes the estimates from Obstfeld and Rogoff's tables of the real dollar depreciation that would occur if the U.S. current account deficit shrank from 5 percent of GDP to zero under a variety of assumptions.[3] The right side of the table also includes the comparable estimates from Obstfeld and Rogoff's model under the more realistic assumption of 50 percent pass-through (instead of full pass-through). This summary shows that Obstfeld and Rogoff focus on scenarios in which the dollar falls between 12 percent and 35 percent in the case of full pass-

3. It focuses on the range of parameters used for the analyses throughout the paper, with $\theta = 1$ or 2 and $\eta = 2$ or 3.

Table 9C.1 Real dollar depreciation under various assumptions

	Full pass-through		50% pass-through	
	$\theta = 2, \eta = 3$	$\theta = 1, \eta = 2$	$\theta = 2, \eta = 3$	$\theta = 1, \eta = 2$
Base case from Obstfeld-Rogoff: Current account falls to 0				
Outputs constant	14.4	32.3	28.8	64.6
20% rise in U.S. tradables output	11.5	24.0	23.0	48.0
Allowing exchange rate to revalue NFA	13.3	27.3	26.6	54.6
Permanent rise in military spending	15.7	35.3	31.4	70.6
Range	11.5	35.3	23.0	70.6
Range if current account falls to:				
2.0% of GNP	6.9	21.2	13.8	42.4
2.5% of GNP	5.8	17.7	11.5	35.3
3.0% of GNP	4.6	14.1	9.2	28.2

through, or between 23 percent and 71 percent in the case of 50 percent pass-through (which may even be conservative).[4] These estimates of a large future depreciation of the dollar are bound to cause alarm.

A number of the parameters in Obstfeld and Rogoff are difficult to estimate precisely, and it is obviously possible to use different estimates of these parameters to attain larger or smaller estimates of the expected dollar depreciation. Obstfeld and Rogoff use reasonable estimates (to the best of my knowledge). The one key assumption that I believe is problematic, however, is that each result is based on the U.S. current account moving to balance. Although the U.S. current account deficit will need to fall in the future in order for U.S. net external debt levels to stabilize, there is no reason that the U.S. current account deficit needs to fall to 0 percent of GDP. Instead, sustained growth in the United States close to potential would allow the United States to have moderate current account deficits (albeit smaller than today) for an extended period of time.

More specifically, a simple back-of-the-envelope calculation suggests that the United States does not need to reduce its current account deficit to zero in order to have sustainable debt dynamics. Assume that several variables are defined, such that

N is the nominal value of U.S. net foreign liabilities.

Y is nominal GNP.

g is the percentage growth of nominal GNP.

C is the nominal U.S. current account deficit.

4. The smallest estimates are from the simulation assuming a 20 percent rise in home tradables output, with $\theta = 2$ and $\eta = 3$; the largest estimates are from the simulation assuming a permanent rise in military spending with $\theta = 1$ and $\eta = 2$.

$c = C/Y$ is the current account deficit as a percent of GDP.

$n = N/Y$ is the U.S. debt to GNP ratio.

Then U.S. external debt will stabilize if $ng = c$.[5] If $ng < c$, then the U.S. external debt to GNP ratio is rising, and vice versa. Using this simple framework, assume that the United States has real annual GNP growth of 3 percent and inflation of 2 percent so that nominal GNP growth is 5 percent. Then if the U.S. current account deficit fell to 2.5 percent of GNP, U.S. net foreign liabilities would stabilize at 50 percent of GNP—a ratio that appears to be manageable for developed economies. If the U.S. current account deficit fell to 2.0 percent of GNP, U.S. net foreign liabilities would stabilize at 40 percent of GNP. If the U.S. current account deficit fell to only 3 percent of GNP, U.S. net foreign liabilities would stabilize at 60 percent of GNP. Although it is difficult to know exactly what ratio of net foreign liabilities is safe, a ratio of 50 percent of GNP should be manageable for a developed economy such as the United States that borrows largely in its own currency.

Using the conservative estimate that U.S. net foreign liabilities stabilize at 50 percent of GNP implies that the U.S. current account deficit would only need to fall from 5.0 percent (the starting point of the simulations in the paper) to 2.5 percent of GNP—instead of to 0 percent of GNP. Assuming that the Obstfeld and Rogoff estimates are roughly linear, the estimated exchange rate depreciations would therefore be only half of the reported estimates. In other words, Obstfeld and Rogoff's simulations suggest that the dollar would only depreciate by 6 percent to 18 percent (instead of 12 percent to 35 percent) assuming full pass-through, or by 12 percent to 35 percent (instead of 23 percent to 71 percent) assuming 50 percent pass-through. Or, if U.S. net foreign liabilities stabilized at 40 percent of GNP, the dollar would only depreciate by 7 percent to 21 percent assuming full pass-through, or by 14 percent to 42 percent assuming 50 percent pass-through. These results are summarized at the bottom of table 9C.1, and although these results still imply a substantial depreciation of the dollar, the magnitude is less alarming.

Adding fuel to the fire, Obstfeld and Rogoff do not simply end with these predictions of a large dollar depreciation that would occur if the U.S. current account deficit moves to balance. Instead, the paper closes by speculating if the predicted depreciation will occur in a period similar to the mid-1970s or the 1980s. In the mid-1970s, the dollar depreciation occurred in conjunction with the breakup of Bretton Woods and a period of high inflation and lower real growth. In contrast, the dollar adjustment in the 1980s was fairly gradual and occurred during a period of fairly strong

5. This framework ignores changes in asset valuations due to capital gains and losses on existing holdings. This exercise is similar to that in Mussa (2005).

growth and moderate inflation. In the abstract, the paper states: "Whereas the dollar's decline may be benign as in the 1980s, we argue that the current conjuncture more closely parallels the 1970s, when the Bretton Woods system collapsed."

Although Obstfeld and Rogoff raise the important point that the unwinding of large current account deficits can be benign or disruptive, the short verbal discussion of the 1970s, 1980s, and current period does not make a strong case that the current episode more closely resembles the 1970s than the 1980s. Obstfeld and Rogoff just quickly cite a few reasons why the current situation may be closer to the 1970s: loose fiscal policy, soft monetary policy, open-ended security costs, twin deficits, and high energy prices. A closer look at the data, however, suggests that this quick comparison may be overstated.

Table 9C.2 examines the statistics mentioned by Obstfeld and Rogoff as well as other factors that will determine the impact of a current account adjustment on the U.S. economy. It focuses on the year in which the current account deficit reached its peak in each decade. In the 1970s, the peak current account deficit was only 0.7 percent of GDP (in 1977)—much smaller than the peak 1980s deficit of 3.4 percent of GDP (in 1987) and 5.7 percent of GDP in 2004. Moreover, the U.S. budget deficit (as a percent of GDP) in 1977 was only about half the size in 1987 and 2004. Although inflation picked up slightly in 2004, it is still well below the level in 1977 and closer to the level in 1987. Military spending as a percent of GDP is actually lower today than in 1977 and 1987. The strongest similarity between 2004 and 1977 is the sharp rise in oil prices. Moreover, several of the variables listed at the bottom of table 9C.2 (and not discussed in Obstfeld and Rogoff) in-

Table 9C.2 Historical comparison of the U.S. economy during peak current account deficits (%)

	Year of peak current account deficit		
Variable	1977	1987	2004
Current account balance (% of GDP)	–0.7	–3.4	–5.7
Fiscal balance (% of GDP)[a]	–2.2	–4.3	–4.3
CPI inflation	6.5	3.6	2.7
Military spending (% of GDP)[b]	4.7	5.8	3.7
Real change in oil prices[c]	62	–25	37
Total trade (% of GDP)[d]	16.8	18.4	25.2
Global real GDP growth	4.4	4.0	5.1

[a]Consolidated government balance on receipts and expenditures.

[b]Federal government outlays (on-budget and off-budget) for national defense.

[c]Cumulative real change in oil prices over the past three-years. Spot oil price for West Texas Intermediate, deflated by the CPI-U Energy.

[d]Current value of imports and exports divided by current GDP.

dicate that any adjustment of the U.S. current account deficit could be smoother—instead of more disruptive—than in the past, such as the higher share of trade to GDP and the stronger rate of global GDP growth.

Therefore, although the current episode does have some similarities with the 1970s—especially the increase in oil prices—it has even more similarities with the 1980s. The current episode also has unique characteristics not previously experienced in the United States, such as the size of the current account deficit and U.S. net foreign liabilities. Therefore, although it is useful to examine history and attempt to draw lessons from the past, this brief discussion suggesting that an adjustment of today's current account deficit will be closer to the disruptive 1970s than the benign 1980s is not very illuminating. It is possible that the authors have examined this question more closely elsewhere, but any such analysis is lacking in this paper. The short statistical summary in table 9C.2 suggests a more thorough case should be developed in order to claim that "the current conjuncture more closely parallels the 1970s, when the Bretton Woods system collapsed."

Because the rest of Obstfeld and Rogoff is a carefully written, precise paper, this final section of the paper is not a worthy ending of an otherwise insightful paper. Although Dickens and the Victorian authors that used serial publishing may have believed that crises and catastrophes were necessary to keep the public reading, Obstfeld and Rogoff do not need to follow this approach. This paper is perceptive and informative, and even if there is not a disruptive ending to the U.S. current account deficit, we will keep reading the various installments and updates of this analysis.

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10

Smooth Landing or Crash? Model-Based Scenarios of Global Current Account Rebalancing

Hamid Faruqee, Douglas Laxton, Dirk Muir, and Paolo A. Pesenti

10.1 Introduction

Widening external imbalances have been a defining feature of the global landscape in recent years and, for many, constitute a key macroeconomic risk for the world economy. But the debate is far from settled. Two issues are central. First, is the present global pattern of current account imbalances sustainable and for how long? Second, if these positions require unwinding, can an orderly rebalancing be achieved without substantial disruption to global growth, international trade, and capital flows, and under what circumstances?

At the center of concern is the massive U.S. current account deficit and whether its resolution foreshadows a hard landing for the dollar. For example, while the dollar has steadily depreciated (in real effective terms) since 2002, the U.S. deficit and external surpluses elsewhere (e.g., Japan and emerging Asia) have only widened further. How much farther will the

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dollar need to fall? The cautionary tale of past external adjustments focuses our attention on the wider ramifications of large, unsustainable current account deficits for exchange rates, domestic demand, and growth.[1] Moreover, the prospect of large, disorderly swings in the value of the dollar—given its dominant role in the international monetary system—presents an additional financial risk with potentially far-reaching consequences, and where the regions that may be most deeply affected lie well beyond U.S. shores.[2]

Leaving the possible fallout aside, how did we arrive at this point? A decade ago, the current account deficit of the United States stood around 100 billion dollars or 1.5 percent of annual output. Over the ensuing ten years, that deficit would balloon sixfold to over 600 billion dollars or 1.5 percent of world output, designating the world's wealthiest nation as its largest external borrower (by far). In terms of U.S. saving and investment, the initial leg of burgeoning deficits was led by brisk capital spending in the mid- to late-1990s, which retreated after the equity bust began around the turn of the century. At that same time, declining national saving—headlined by growing public deficits and mounting debt—assumed a lead role in the further expansion of the U.S. current account deficit in the years that followed up to the present day.

In historical perspective, the large U.S. external deficit is unprecedented. With reference to figure 10.1 (where μ is the sample average and σ the standard deviation of the current account-to-gross domestic product [GDP] ratio), over the past half-century, U.S. current accounts have centered around a small deficit over the postwar period (1.12 percent of GDP). But the last decade has borne witness to a remarkable extension of the left tail of this distribution. During the 1980s, an emergence of large U.S. external deficits—also against the backdrop of budgetary deficits and dollar appreciation—were reminiscent of the current episode. However, unlike the past when the counterparts to U.S. deficits were largely confined to other G7 industrial countries, the current global constellation of external imbalances has expanded the roster of players considerably.[3]

The current episode thus clearly suggests that matters are best viewed from a wider, multilateral perspective, including in terms of the uneven global pattern of growth and demand. A sanguine view of these develop-

1. The literature on current account reversals and their nexus with growth and other variables is extensive; see, for example, Milesi-Ferretti and Razin (2000), Edwards (2004), and Freund (2000). See also Freund and Warnock (chap. 4 in this volume) and Adalet and Eichengreen (chap. 6 in this volume).

2. Dollar dominance is likely to continue for the foreseeable future, though not a guarantee; see Chinn and Frankel (chap. 8 in this volume).

3. China's reserves increased by $117 billion in 2003, after subtracting $45 billion in reserves transferred in the recent bank recapitalization. These funds apparently remain in U.S. dollar assets. South Korea, Taiwan, and Singapore increased reserves by $34 billion, $44 billion, and $14 billion, respectively.

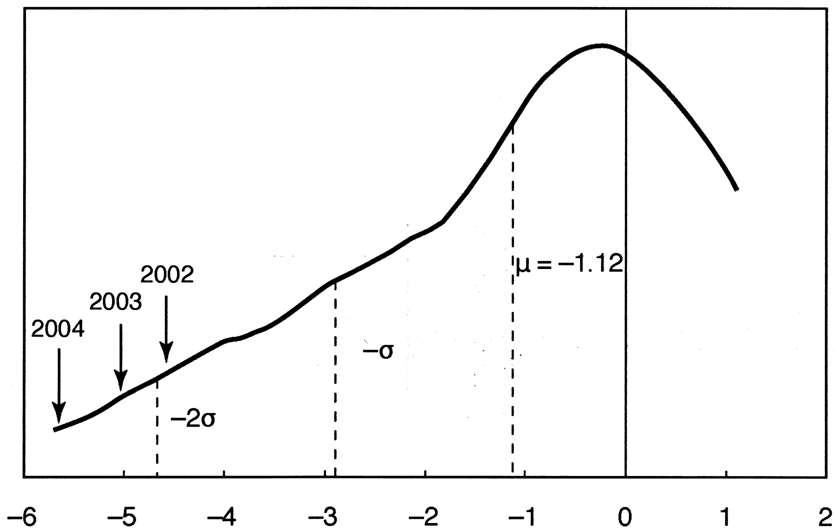

Fig. 10.1 Distribution of U.S. current accounts, 1960–2004 (percent of GDP)

ments (and their ultimate resolution) typically revolves around three related but distinct considerations: the Lawson doctrine, the new Bretton Woods system, and globalization.

Under a generalized interpretation of the Lawson doctrine,[4] external imbalances are inconsequential as they merely reflect the market's (optimal) decisions regarding saving and investment.[5] But two qualifications should be noted. First, this presumes that the public sector's balances remain in good standing. And second, private-sector decisions are not distorted by any major market imperfections or failures. Prima facie, the emergence of large budgetary deficits in the United States (at least since 2000) and the role of emerging market economies in prevailing global imbalances raise important caveats to the doctrine's application in the current circumstance. Nevertheless, the view that the current account deficit per se is not a problem, but remains the natural outgrowth of a strong domestic economy relative to persistent weakness in major partners—mainly Japan and Europe—has not receded.

Focusing on the important role of emerging markets in understanding global imbalances, the new Bretton Woods hypothesis—advanced by Dooley, Folkerts-Landau, and Garber (2003)—posits that the constella-

4. In the late 1980s, Nigel Lawson, then British Chancellor of the exchequer, argued that the large U.K. current account deficit was a matter of no consequence, given that the public-sector balance was in surplus. He also argued that this principle applied only to developed countries, where it was more reasonable to assume that private agents behaved optimally.

5. See Corden (1994).

tion of external imbalances partly reflects the deliberate actions (e.g., de facto pegs) of periphery countries seeking export-led growth as a strategy for economic development. In practical terms, this involves pegging the currency to the U.S. dollar to help domestic exporters safeguard their U.S. market shares and accumulate dollar reserves resulting from any payment imbalances. So long as the periphery, with new entrants waiting in the wings (e.g., India), willingly acquires dollar claims, this arrangement of external imbalances can endure indefinitely.[6] For its part at the center, the United States (a) resurrects its passive exchange rate role as the *n*th currency, and (b) provides liquidity and intermediation to the rest of the world—benefiting by borrowing short (e.g., foreign sales of U.S. treasuries) at favorable terms while lending long profitably (i.e., U.S. foreign direct investment [FDI]).[7]

The third major aspect of the sanguine side of the debate is globalization. A quarter century after Feldstein and Horioka (1980), saving and investment no longer appear quite so constrained to move in tandem, and the universe of current account imbalances has clearly expanded.[8] In other words, the mere fact that external imbalances, in many cases, have grown to unprecedented levels can be viewed as a testament to the better functioning and increasing integration of global capital markets. Indeed, the vast amounts of foreign saving mobilized to finance the ample shortfall of U.S. saving relative to investment have broken new ground. With a newfound ability to borrow (and lend), countries belonging to an increasingly integrated global economy can further engage in intertemporal trade to buffer against local shocks, smooth consumption, and raise welfare. A byproduct of globalization is that valuation effects—operating on larger gross levels of foreign assets or liabilities—can augment the traditional expenditure-switching effects of exchange rate adjustment and thereby facilitate a rebalancing scenario.[9]

So have we entered into a brave new world when thinking about global imbalances? The mainstream view, as lucidly argued by Obstfeld and Rogoff (2000a), would firmly reply not yet. Countervailing arguments note that while the underlying trends toward a more integrated global economy are undeniable, the limitations are also equally clear. Segmented goods

6. Eichengreen (2004) criticizes this assessment, arguing that the periphery is not a cohesive, uniform group, and could quickly unravel when national interests come into conflict with collective ones. The possibility of two viable international currencies—that is, also the euro—further complicates the picture.

7. Dooley, Folkerts-Landau, and Garber (2004) elaborate on this maturity transformation under the present global alignment. Adalet and Eichengreen (chap. 6 in this volume) criticize this, too, arguing that being an international financial center and providing intermediation service does not necessitate a large (or any) deficit on the part of the United States.

8. See Faruqee and Lee (2005) as well as Lane and Milesi-Ferretti (chap. 2 in this volume).

9. See Lane and Milesi-Ferretti (2001, 2003, 2004), Tille (2003), IMF (2005). An extreme form of this argument where valuation effects supplant the requisite adjustment in the trade balance is exposited in Gourinchas and Rey (chap. 1 in this volume).

markets and pricing to market, incomplete pass-through and disconnected exchange rates, home bias in goods and in assets, and significant trade costs are all emblematic of an international economy still some ways off from an idealized single, global market.[10] These real-world features and frictions raise cautionary flags about a more complacent view of global imbalances and the large shocks—including uneven economic and fiscal expansions—that have accompanied them. The key question from the mainstream is not *if* but *when* (and *how*) the inevitable adjustment will occur. As discussed by Obstfeld and Rogoff (chap. 9 in this volume), the concern is that the exchange rate changes needed to generate enough expenditure switching may be very large.[11] The hope is that broader adjustment—diversified across countries and policy instruments—may be able to help achieve a more orderly rebalancing and avoid a protectionist backlash.[12]

In sum, as implied by the stylized facts and by the various interpretations of the present episode, the evolution (and resolution) of global imbalances needs to be understood within a coherent multilateral framework. This paper reexamines these multifaceted issues through the lens of a dynamic, multiregion model of the global economy. The model offers sufficient complexity and richness to furnish a rigorous macroeconomic framework to assess the economic implications, related risks, and policy recommendations associated with the prevailing constellation and the prospect of global rebalancing of current accounts.

Informed by the multilateral analysis, our baseline view is that steady global rebalancing with an orderly unwinding of financial positions and currency realignments—notably a gradual depreciation in the U.S. dollar—can be achieved, although it is not assured. In this instance, the burden of adjustment will largely fall on the United States and emerging Asia in terms of reversing their past (net) national saving trends, requiring committed U.S. fiscal consolidation and aided by greater exchange rate flexibility in Asia that also limited output and inflation variability. Although more uncertain, some normalization of private consumption rates (in opposing directions) in the two regions would further facilitate external adjustment.

Europe and Japan, for their part, could meaningfully contribute to the multilateral adjustment process through stronger pursuit of growth-enhancing structural reforms that align with their own national interests. Led by competition friendly reforms in product markets and with structural adjustment supported by monetary policy, credible measures tackling deep-

10. See, for example, Engel (1993), Engel and Rogers (1996), Rogoff (1996), Obstfeld and Rogoff (2000a,b), Devereux and Engel (2002), Corsetti and Dedola (2002), and Choudhri, Faruqee, and Hakura (2005).

11. See also Engel (2002), Obstfeld (2002), and Corsetti and Pesenti (2005a,b) for a modern view on expenditure switching effects.

12. See De Rato (2005).

seated structural impediments and distortions would boost their growth and investment prospects, thereby contributing to external rebalancing.

Far less benign adjustment scenarios are also quite conceivable. A more dangerous route, in the absence of underlying, broad-based adjustment in macroeconomic and structural policies, would rely more on the vagaries of global financial markets. If mounting concerns over imbalances triggered sizable international portfolio shifts, a sudden exit out of U.S. dollar assets could effect more dramatic changes to (interest and) exchange rates, including a significantly weaker U.S. dollar, with harmful knock-on effects for global growth.

A roadmap to the paper is as follows. Sections 10.2 and 10.3 outline the structure and calibration of our multiregion model. Section 10.4 describes the individual key elements needed to construct the central baseline scenario of global rebalancing. Section 10.5 considers key alternative scenarios and assesses the likely macroeconomic and policy implications. Section 10.6 concludes.

10.2 The Structure of the Model

The simulation model we construct in this paper is rather detailed and complex. To simplify the exposition, in this section we limit ourselves to a very synthetic and intuitive overview of the model, highlighting a few formal features of particular relevance for the calibration exercise. Technical details of the theoretical framework are extensively discussed in the appendix.

The overall structure of the model is illustrated in figure 10.2. The world

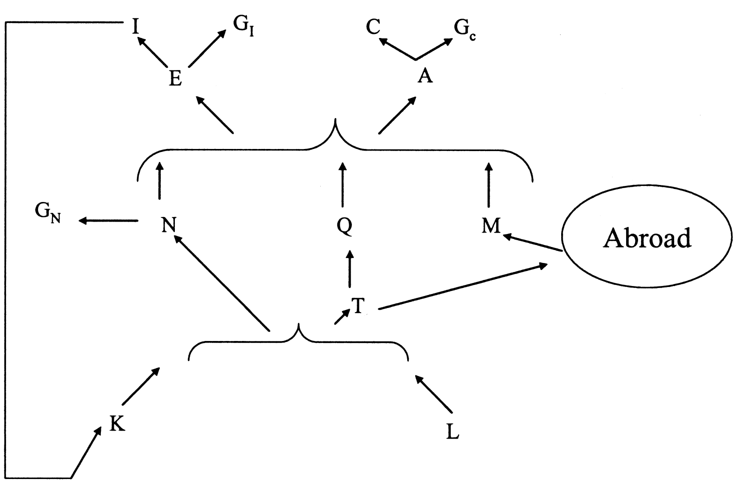

Fig. 10.2 The structure of the model

economy consists of four regional blocs (countries): US (United States),[13] JE (Japan and euro area), AS (emerging Asia), and RC (remaining countries).[14] There is a common stochastic trend for the world economy (the variable TREND), whose gross rate of growth between time t and time τ is denoted $g_{t,\tau}$. All quantity variables in the model are expressed in detrended terms, that is, as ratios relative to TREND. In each country, there are households, firms, and a government. Households consume a (nontradable) final good and supply differentiated labor inputs to firms. Firms produce final goods, intermediate goods, and provide intermediation services. The public sector consumes nontraded goods and services, financed through taxation or borrowing, and manages short-term interest rates through monetary policy. Each sector is described in turn in the following.

Infinitely lived households consume a nontradable final good (C), and each is the monopolistic supplier of a differentiated labor input (ℓ) to all domestic firms.[15] There are two types of households: forward-looking ones (with subscript FL) and liquidity-constrained ones (with subscript LC). Liquidity-constrained agents represent a fraction s_{LC} of national households. These households do not have access to capital markets and finance their consumption exclusively through disposable labor incomes. The specification of households' preferences adopts the Greenwood, Hercowitz, and Huffman (GHH; 1988) utility function, adjusted for habit formation and preference shocks. Denoting $W_t(j)$ as lifetime expected utility of household j, we have:

$$W_t(j) \equiv \mathrm{E}_t \sum_{\tau=t}^{\infty} \beta_{t,\tau} g_{t,\tau}^{1-\sigma} u_\tau[C_\tau(j), \ell_\tau(j)], \tag{1}$$

where the instantaneous felicity is proportional to:

$$u_t[C_t(j), \ell_t(j)] \propto \left[\frac{C_t(j) - b_c C_{j,t-1}/g_{t-1,t}}{1 - b_c/g_{t-1,t}} - \frac{Z_V}{1+\zeta} \left(\frac{\ell_t(j) - b_\ell \ell_{j,t-1}}{1 - b_\ell} \right)^{1+\zeta} \right]^{1-\sigma} \tag{2}$$

In the preceding expressions, $\beta_{t,\tau}$ is the discount rate, possibly different across countries, between time t and time τ. The term $g_{t,\tau}^{1-\sigma}$ in (1) implies that the disutility of labor effort moves with the common trend. As is customary, this feature can be interpreted as technological progress associated with home production activities, here related to the global trend. The pa-

13. To avoid confusion, in the text we refer to "US" as the region of the model and to the "U.S." as the real-world United States.

14. The choice of regional aggregation is discussed in section 10.3.1.

15. Interpreting TREND_t as labor-augmenting technical change at time t, ℓ_t in the model is time devoted to work, assumed to be bounded by endowment, while effective labor is $\mathrm{TREND}_t \ell_t$. It follows that the nominal wage (the monetary remuneration for one unit of labor services ℓ_t) can be trending both because of nominal inflation and because of real (labor-augmenting) growth.

rameter σ in equations (1) and (2) is the reciprocal of the elasticity of intertemporal substitution. The parameter ζ that affects the curvature of labor disutility is the reciprocal of the Frisch elasticity of labor supply. There is habit persistence in consumption with coefficient $0 < b_c < 1$. The term $C_{j,t-1}$ is past per-capita consumption of household j's peers (i.e., either forward-looking or liquidity-constrained agents). Similarly, there is habit persistence in leisure with coefficient $0 < b_t < 1$. The term Z_V is a constant.

Forward-looking households own domestic firms and the domestic capital stock (K), which they rent to domestic firms. The market for capital is competitive. Capital accumulation is subject to adjustment costs, as are wage contracts (i.e., nominal wage rigidities). Labor and capital are immobile internationally. Forward-looking households in each country also own two short-term nominal bonds, one denominated in domestic currency and issued by that country's government, and another denominated in US currency and issued in zero net supply worldwide. There are intermediation costs for national households transacting in the international bond market. No other asset is traded internationally.

On the production side, perfectly competitive firms produce two final goods—a consumption good (A) and an investment good (E). The consumption good is consumed either by domestic households or by the government (G_C). Similarly, demand for the investment good is split between private agents (I) and the public sector (G_I). Final goods are produced by using all available intermediate goods as inputs. Intermediate goods are either nontraded (N) or traded internationally (T). Domestic tradables used by domestic firms are denoted Q, imports are denoted M. For instance, a firm x produces the consumption good with the following nested constant elasticity of substitution (CES) technology:

$$(3) \quad A_t(x)^{1-(1/\varepsilon_A)} = (1-\gamma_{A,t})^{1/\varepsilon_A} N_{A,t}(x)^{1-(1/\varepsilon_A)} + \gamma_{A,t}^{1/\varepsilon_A}[\nu_A^{1/\mu_A} Q_{A,t}(x)^{1-(1/\mu_A)} + (1-\nu_A)^{1/\mu_A} M_{A,t}(x)^{1-(1/\mu_A)}]^{\{[\mu_A/(\mu_A-1)][(1-1/\varepsilon_A)]\}}$$

The three intermediate inputs used in the production of the consumption good A are a basket N_A of nontradable goods, a basket Q_A of domestic tradable goods, and a basket M_A of imported goods. The elasticity of substitution between tradables and nontradables is $\varepsilon_A > 0$, and the elasticity of substitution between domestic and imported tradables is $\mu_A > 0$. The weights of the three inputs in production are, respectively, $1-\gamma_A$, $\gamma_A \nu_A$ and $\gamma_A(1-\nu_A)$.

To handle the different goods produced in different countries, the variable M_A denotes a combination of different baskets of goods imported from the rest of the world. To model realistic dynamics of import volumes—such as delayed and sluggish adjustment to changes in relative prices—we assume that imports are subject to short-term adjustment costs (discussed in detail in the appendix). More precisely, referring to a generic country as CO, and to the importing country as H, firm x^H's imports $M_A^H(x^H)$ are a CES function of baskets of goods imported from the other countries, or

$$(4)\quad M_{A,t}^{H}(x^{H})^{1-(1/\rho_A^H)} = \sum_{\mathrm{CO}\neq H} (b_A^{H,\mathrm{CO}})^{1/\rho_A^H} \{M_{A,t}^{H,\mathrm{CO}}(x^H)\,[1 - \Gamma_{MA,t}^{H,\mathrm{CO}}(x^H)]\}^{1-(1/\rho_A^H)}.$$

In the preceding expression, ρ_A^H is the elasticity of import substitution across countries; a higher value for ρ_A^H implies that it is easier for firm x^H to substitute imports from one country with imports from another. The weights $b_A^{H,\mathrm{CO}}$ (summing up to one) determine the composition of the import basket across countries. $M_A^{H,\mathrm{CO}}(x^H)$ denotes imports from country CO by firm x^H located in country H, and $\Gamma_{MA}^{H,\mathrm{CO}}(x^H)$ denotes the associated adjustment costs.

Intermediate goods are available in different varieties, each produced by a single firm under conditions of monopolistic competition worldwide. The prices of intermediate goods are subject to adjustment costs (nominal price rigidities). These goods are produced with domestic labor inputs and domestic capital. For instance, the nontradable variety n is produced with the following CES technology:

$$(5)\qquad N_t(n) = Z_{N,t}[(1-\alpha_N)^{1/\xi_N}\ell_t(n)^{1-(1/\xi_N)} + \alpha_N^{1/\xi_N}K_t(n)^{1-(1/\xi_N)}]^{\xi_N/(\xi_N-1)}$$

Firm n uses labor $\ell(n)$ and capital $K(n)$ to produce $N(n)$ units of its variety. $\xi_N > 0$ is the elasticity of input substitution, and Z_N is a sectoral productivity shock common to all producers of nontradables.[16]

Finally, the government purchases the two national final goods as well as nontradable services G_N. As treasury, the government finances the excess of its expenditures over net taxes by borrowing from the domestic private sector. As central bank, the government manages the national short-term nominal interest rate. Monetary policy is specified in terms of a credible commitment to an interest rate rule that either targets inflation or the exchange rate.

10.3 Model Calibration

10.3.1 Initial Considerations

In what follows, we suggest a plausible calibration of the many parameters introduced in the model and discuss in some detail the reasons underlying our choices. In general, we rely on previous work done with the International Monetary Fund's (IMF) Global Economy Model (GEM) as well as estimates from the literature and our own empirical work.

Given the importance of a multicountry setting, some thought has been given to the composition of the regional blocs. As mentioned in section 10.2, to conserve on complexity we choose a four-region model—US (the United States), JE (Japan and the euro area countries), AS (emerging Asia:

16. Recall that a productivity shock is defined as a deviation from the common world trend. Variants of the model allow for the possibility of shocks to labor productivity or capital productivity instead of total factor productivity.

China, India, Hong Kong, Malaysia, the Philippines, Singapore, South Korea, Taiwan province of China, and Thailand) and RC (the remaining countries not considered elsewhere).

The decision to combine Japan and the euro area into one region reflects, from the vantage point of our project, their overlap in key structural characteristics—low productivity growth, very low inflation (or deflation), and structural rigidities, particularly in the labor market. Needless to say, Japan and the euro area have exhibited very different behaviors in the past regarding the accumulation of U.S. assets, foreign exchange intervention policy, and so on. However, our prior is that their role in the global rebalancing process will become comparatively less relevant in the years ahead and compared to Emerging Asia.

This latter bloc groups Asian countries with strong growth and whose currencies exhibit limited flexibility against the U.S. dollar. Moreover, their labor markets tend to be rapidly growing and fairly flexible. In addition, the ongoing process of market liberalization is expected to reduce entry barriers and enhance competition, including in the major constituents such as India and China. The RC bloc is dominated by the other members of the European Union (particularly the United Kingdom) and the other major Organization for Economic Cooperation and Development (OECD) countries such as Canada, Australia, New Zealand, and Mexico.

Keeping the composition of the four regions in mind, in what follows we discuss the calibration of the domestic economies. We then focus on the international elements of the model and pursue a realistic description of the macroeconomic interdependencies between regions, particularly their trade linkages and fiscal spillovers.

10.3.2 Parameterization of the Regional Blocs

Tables 10.1 through 10.5 document the parameterization adopted for the four regional blocs. Unless otherwise stated, similar behavioral parameter values apply to all regions.

Table 10.1 presents the parameters that are key for the consumers' optimization problem. Although consumers may differ with respect to their access to financing, the preferences of the liquidity-constrained and forward-looking households are taken to be the same. We assume that in US, JE, and RC the share of liquidity-constrained consumers (s_{LC}) is 25 percent. The share is much higher in emerging Asia at 50 percent, reflecting the nascent or underdeveloped financial markets for domestic consumers—particularly, in the cases of China, India, Indonesia, and the Philippines.

The rate of time preference (the annualized inverse of β in equation [1]) in combination with trend growth (g in equation [1]) of 2 percent per year is consistent with an annualized quarterly real world interest rate of 3 percent. The US, the most impatient region, has the highest rate of time preference at 3.2 percent; AS, the most patient, has a rate of 2.6 percent. For

Table 10.1 **Baseline parameterization of the regional blocs**

Parameter	US	AS	JE	RC
Rate of time preference $(1/\beta^4 - 1) \cdot 100$	3.2	2.6	2.7	2.7
Depreciation rate δ	0.020	0.020	0.020	0.020
Intertemporal elasticity of substitution $1/\sigma$	5.00	5.00	5.00	5.00
Habit persistence in consumption b_c	0.91	0.91	0.91	0.91
Inverse of the Frisch elasticity of labor ξ	2.50	2.50	2.50	2.50
Habit persistence in labor b_ℓ	0.75	0.75	0.75	0.75
Tradable intermediate goods				
Substitution between factors of production ξ_T	0.75	0.75	0.75	0.75
Bias towards capital α_T	0.67	0.72	0.76	0.67
Nontradable intermediate goods				
Substitution between factors of production ξ_N	0.75	0.75	0.75	0.75
Bias toward capital α_N	0.62	0.66	0.71	0.62
Final consumption goods				
Substitution between domestic and imported goods μ_A	2.5	2.5	2.5	2.5
Bias towards domestic goods ν_A	0.96	0.07	0.39	0.15
Substitution between domestic tradables and nontradables ε_A	0.5	0.5	0.5	0.5
Bias towards tradable goods γ_A	0.35	0.37	0.37	0.32
Final investment goods				
Substitution between domestic and imported goods μ_E	2.5	2.5	2.5	2.5
Bias towards domestic goods ν_E	0.98	0.05	0.78	0.17
Substitution between domestic tradables and nontradables ε_E	0.5	0.5	0.5	0.5
Bias towards tradable goods γ_E	0.77	0.82	0.80	0.76

Notes: US = United States; AS = Emerging Asia; JE = Japan/Euro area; RC = remaining countries.

all regions, we assume a high degree of intertemporal substitution in consumption ($1/\sigma$) of 5. This combined with a high value for habit persistence ($b_c = 0.91$) generates sluggish consumption behavior in the short run and hump-shaped dynamics in response to changes in the real interest rate. Conversely for labor, we assume a low Frisch elasticity ($1/\zeta$) in the long run of 0.40, coupled with lower habit persistence (b_ℓ) of 0.75. These choices are similar to the assumptions found in Bayoumi, Laxton, and Pesenti (2004), adjusted for our use of the GHH utility function.

For the firms' optimization problem, we also refer the reader to table 10.1. The elasticity of substitution between labor and capital (ξ_N and ξ_T in 5) is set at 0.75 in both the tradable and nontradable sectors. This is slightly lower than the conventional (Cobb-Douglas) unitary assumption in order to help reduce the sensitivity of capital to changes in its relative price. The bias toward the use of capital (α_T and α_N) is calibrated to achieve a relatively high investment share of GDP in AS, and a low share in US, in line with their respective historical averages (see table 10.2). In all regions, the nontradable sector (e.g., services) is assumed to be less capital intensive than the tradable sector (e.g., manufacturing). The depreciation rate is assumed to be 2 percent per quarter across all regions (8 percent per year).

The dynamics of the model are governed by the nominal rigidities and real adjustment costs described in table 10.3. The standard parameter choice of 400 for quadratic adjustment costs in prices is roughly equivalent to a four-quarter contract length under Calvo-style pricing. Real rigidities

Table 10.2 Steady-state national accounts decomposition in the baseline scenario

Ratio of GDP	US	AS	JE	RC
Total consumption	79.6	69.7	76.8	77.5
Private C	67.1	58.7	56.5	63.5
Liquidity-constrained consumers C_{LC}	5.1	9.9	3.0	4.4
Forward-looking consumers C_{FL}	62.1	48.8	53.5	59.1
Public $G_C + P_N G_N$	12.5	11.0	20.5	14.3
Total investment $P_E E$	19.7	29.6	23.3	22.9
Private $P_E I$	17.2	27.6	20.2	20.4
Public $P_E G_I$	2.5	2.0	3.0	2.5
Trade balance TBAL	0.7	–0.3	–0.2	–0.3
Imports IM	12.1	26.2	15.8	24.3
Consumption goods $P_{MA} MA$	7.9	12.7	13.1	13.1
Investment goods $P_{ME} ME$	4.2	13.5	2.7	11.2
Government debt B	61.5	24.0	67.0	30.0
Net foreign assets B^*	–54.2	31.3	17.4	23.5
Share of world GDP (%)	27.9	15.5	32.2	24.4

Note: See table 10.1 notes.

Table 10.3 Real adjustment costs and nominal rigidities

Parameter	US	AS	JE	RC
Real adjustment costs				
Capital accumulation ϕ_{I1}	1.00	1.00	1.00	1.00
Investment changes ϕ_{I2}	78	78	78	78
Imports of consumption goods ϕ_{MA}	0.95	0.95	0.95	0.95
Imports of investment goods ϕ_{ME}	0.95	0.95	0.95	0.95
Nominal rigidities				
Wages for liquidity-constrained consumers ϕ_{WLC}	400	400	400	400
Wages for forward-looking consumers ϕ_{WFL}	400	400	400	400
Price of domestically-produced tradables ϕ_{PQ}	400	400	400	400
Price of nontradables ϕ_{PN}	400	400	400	400
Price of imported intermediate goods ϕ_{PM}	400	400	400	400

Note: See table 10.1 notes.

Table 10.4 **Price and wage markups**

Parameter	US	AS	JE	RC
Tradables				
Markup $\theta_T/(\theta_T - 1)$	1.15	1.14	1.21	1.17
θ_T	7.67	8.00	5.70	6.73
Nontradables				
Markup $\theta_N/(\theta_N - 1)$	1.28	1.27	1.40	1.33
θ_N	4.58	4.75	3.50	4.04
Wages				
Markup $\psi/(\psi - 1)$	1.16	1.16	1.30	1.20
ψ	7.30	7.30	4.30	6.00

Note: See table 10.1 notes.

in investment align with the parameterization in Juillard et al. (2005) for a Bayesian-estimated, closed economy dynamic stochastic general-equilibrium (DSGE) model of the United States. For real rigidities in imports, a value of 0.95 approximates the typical sluggish reaction by volumes to movements in the real exchange rate.

There are separate markups on tradable and nontradable goods (table 10.4) as firms have some pricing power under monopolistic competition. We use estimates for the price markups from Martins, Scarpetta, and Pilat (1996) in the case of US, JE, and RC. The US bloc has the lowest price markups, indicating the greatest degree of competition, while Japan and the euro area have the highest. For AS, the markups are indicative of some (very) preliminary estimates done in the research department of the IMF for certain member countries of the AS bloc.

Similarly, in the labor market agents have some pricing power, resulting in the wage markups of table 10.4. For US and JE the markups (16 percent and 30 percent, respectively) correspond to Bayoumi, Laxton, and Pesenti (2004).[17] We further assume that RC is somewhere in between US and JE, with a 20 percent wage markup, while we assume AS has a labor market as competitive as US.

Finally, to provide a nominal anchor for the domestic economy, monetary policy is parameterized as follows (table 10.5). The US, JE, and RC are all committed to price stability, and we assume they follow an inflation-forecast-based (IFB) rule.[18] A representative calibration of IFB rules is

17. Their determination of the wage markups is based, in turn, on Jean and Nicoletti (2002), who consider the wage differentials for a variety of industries in the United States and six member states of the euro area.

18. Inflation-forecast-based rules have been used extensively in central bank models with inflation-targeting regimes in both advanced and emerging-market economies—see, for example, Laxton, Rose, and Tetlow (1993), Batini and Haldane (1999), Hunt, Rose, and Scott (2000), and Coats, Laxton, and Rose (2003). They have also been used in empirical work to characterize monetary policy in other countries that do not have explicit inflation-targeting

Table 10.5 **Monetary Policy**

Parameter	IFB rule	Fixed exchange rate regime
Lagged interest rate at $t-1\omega_i$	0.75	1.00
Inflation gap at $t+3\omega_1$	2.00	0.00
Change in the nominal exchange rate at $t\omega_2$	0.00	1,000,000 (proxy for ∞)

used, with a weight of 0.75 on the lagged short-term interest in order to impart a high degree of smoothing in the setting of policy rates, and a weight of 2.00 on the three-quarter ahead gap between inflation and its target. The year-on-year CPI inflation target is assumed to be fixed at 2 percent for JE and RC, and somewhat higher at 2.5 percent for US. Emerging Asia is assumed to pursue a fixed exchange rate regime against the U.S. dollar.[19] In the following alternative scenario, AS switches to an inflation-based rule but starts with a high value for its implicit inflation objective and adopts a lower 2.5 percent target two years after the regime switch.

10.3.3 The International Dimensions

The main results of the model rely heavily upon the calibration of each region's external sector in table 10.6. For given steady-state net foreign asset positions for each region, it is straightforward to calculate the current account and trade balances consistent with long-term stock-flow equilibrium. Using the IMF's Direction of Trade Statistics on merchandise trade, the national accounts data on the imports of goods and services, and the United Nations' Commodity Trade Statistics (COMTRADE) data on each region's imports of consumer and capital goods, we derive a disaggregated steady-state matrix delineating the pattern and composition of trade for all regions' exports and imports. A more aggregated form is found in figure 10.3. On the basis of this trade matrix, we derive all the weight coefficients in the demand function for imports (ν_A and ν_E in equation [3]) and the regional composition of imports (b_A and b_E in equation [4]).

For the corresponding trade elasticities, we assume that the elasticity of substitution between domestically produced and imported tradable consumption goods (μ_A in equation [3]) and investment goods (μ_E) is 2.5 as in

regimes, but have flexible exchange rates—see Orphanides (2003) and Juillard and others (2004). It is important to note that IFB rules are ad hoc. Svensson (1999) and Svensson and Woodford (2005) have proposed inflation-forecast-targeting (IFT) rules based on optimizing loss functions, and it is only a question of time before IFT rules are used extensively on linearized versions of models whose type and size are similar to ours.

19. This should be interpreted as a sensible approximation rather than in literal terms, given that China is the largest member of AS, and the limited flexibility of its currency against the U.S. dollar is at the center of the current policy debate. Similarly, other members such as Hong Kong, Malaysia, South Korea, Singapore, Thailand, the Philippines, and Indonesia attempt to manage the volatility of their currencies vis-à-vis the U.S. dollar.

Table 10.6 Calibrating the international linkages

Parameter	US	AS	JE	RC
Substitution between imports from different regions ρ_A	1.5	1.5	1.5	1.5
Bias towards imported consumption goods b_A from:				
United States		0.33	0.22	0.52
Emerging Asia	0.15		0.16	0.06
Japan/Euro area	0.32	0.42		0.42
Remaining countries	0.53	0.25	0.62	
Substitution between imports from different regions ρ_E	1.5	1.5	1.5	1.5
Bias towards imported investment goods b_E from:				
United States		0.45	0.78	0.51
Emerging Asia	0.25		0.17	0.11
Japan/Euro area	0.30	0.27		0.38
Remaining countries	0.45	0.28	0.05	
Net foreign liabilities				
Short-run dynamics ϕ_{B1}	0.05	0.05	0.05	0.05
Short-run dynamics ϕ_{B2}	0.10	0.10	0.10	0.10
% related to domestic government debt ϕ_{F1}	0.50	0.050	0.50	0.50
% related to U.S. government debt ϕ_{F2}		0.24	0.38	0.38

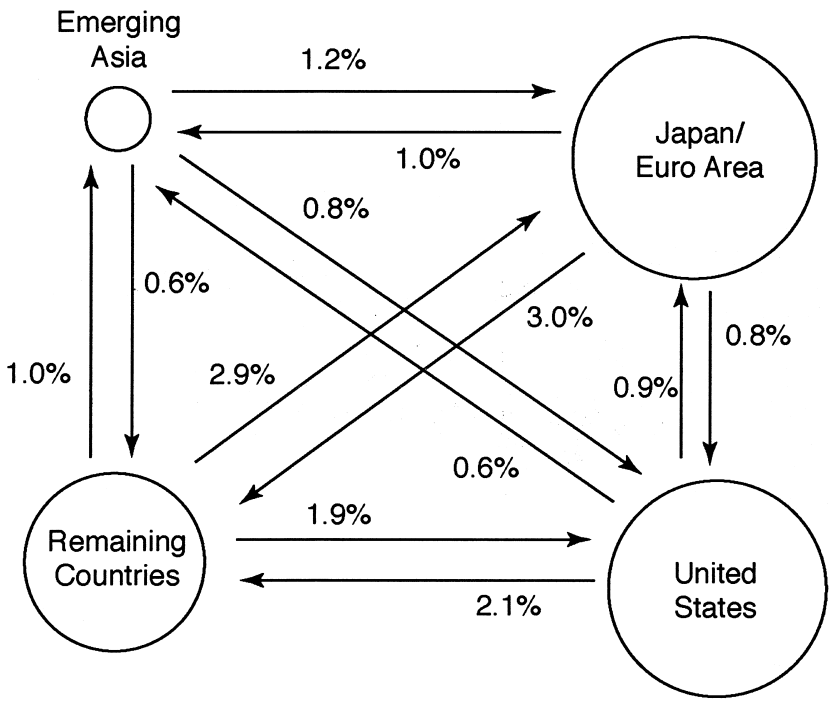

Fig. 10.3 International trade linkages (steady-state calibration; percent of world GDP)

Bayoumi, Laxton, and Pesenti (2004). The elasticity of substitution between goods from different regions for imported consumption goods (ρ_A in equation [4]) and imported investment goods (ρ_E) is set at 1.5, consistent with existing estimates of import elasticities.

Last, we need to calibrate the behavior of net foreign assets, also in table 10.6.[20] For the long-run behavior of net foreign assets, our prior is that a permanent increase in government debt by 1 percentage point of GDP is roughly associated with an increase in the net foreign liability position of the region by 0.5 percentage points of GDP.[21] As we discuss in the following, overlapping generations models (particularly those that follow the Blanchard-Weil-Yaari formulation) provide theoretical underpinnings to evaluate this non-Ricardian behavior. Quantitative simulations using models with such characteristics—specifically, the IMF's Global Fiscal Model (GFM) described in Botman et al. (2006) and Multimod (Faruqee et al. 1998)—are consistent with a value between roughly 0.40 and 0.80. Moreover, when the US expands its net foreign liabilities as a result of a permanent change in its public debt, the absorption of new issuance by each region is calibrated (on the basis of net foreign asset holdings in recent years) by assigning 24 percent of new issuance by US to AS, and 38 percent to each of JE and RC. This calibration implies that for a 1 percent net foreign liability (NFL)-to-GDP shock in US, the AS net foreign asset-to-GDP rises the most—around 0.8 percent of GDP—while JE and RC see their ratios only rise by around 0.3 and 0.5 percent of GDP, respectively.

10.4 A Baseline Scenario

10.4.1 The Six Component Shocks

We now construct a baseline scenario for the global rebalancing of current accounts. This is of interest not only per se—as a model-based quantitative assessment of macroeconomic adjustment paths in the global economy—but also as a benchmark, against which one can analyze and discuss alternative scenarios. The baseline is an attempt to identify the sources of the current global disequilibrium, accounting for both the shocks emanating from the United States and the respective role played by other regions. The purpose of the baseline is to coherently guide our thinking on the central questions surrounding external developments: What are the key macroeconomic factors underlying the recent dynamics of current account imbalances and real exchange rates in the world economy? What assump-

20. With reference to the notation of the appendix, the short-run speed of adjustment is governed by ϕ_{V1} and ϕ_{B2}, set at 0.05 and 0.10, respectively. This is consistent with most previous work based on GEM—see Laxton and Pesenti (2003), Hunt and Rebucci (2005), and Bayoumi, Laxton, and Pesenti (2004).

21. In terms of the notation adopted in the appendix, this implies that ϕ_{F1} is equal to 1/2.

tions about the size and persistence of the key underlying shocks are needed to fit the facts? What is the range of possible future trajectories for the relevant macroeconomic variables?

We are less interested in explaining and rationalizing current account dynamics over the past decade than in providing elements for an analysis of the present global outlook. Correspondingly, the baseline scenario is formulated on the general premise that the prevailing imbalances have mainly reflected savings behavior as of late, by both private and public agents, rather than the investment dynamics fueled by the market exuberance observed in the second half of the 1990s.[22]

Specifically, our working hypotheses are that the central tendencies underlying the global macroeconomic imbalances in the early 2000s can be attributed to a combination of six related but distinct shocks. The first three shocks center around the U.S. economy:

1. Higher U.S. government debt (with initial tax cuts followed by future tax hikes) centered around the announced plans of the U.S. federal government
2. A permanent decline in the private savings rate in the United States
3. An increase in the demand for U.S. assets abroad, particularly in emerging Asia

The next two shocks reflect relative productivity trends in the rest of the world. In the model, worldwide convergence of productivity growth rates is taken as the anchoring feature of the economy in the long term. However, prolonged deviations from balanced growth can play a key role in the unfolding of medium-term rebalancing scenarios, in line with the asymmetric tendencies observed across regions in the past decade. The following are the shocks:

4. Very persistent and rapid productivity growth in emerging Asia with a central tendency starting at 5.5 percent per year
5. Very persistent and lagging productivity growth in Japan and the euro area with a central tendency of 0.75 percent per year

The final shock attempts to capture policy choices in emerging Asia, including strategies of export promotion in China. The specific way these competitiveness-friendly strategies are introduced is through the following:

6. A short-run and temporary positive shock to AS fiscal policy to subsidize exports in order to increase rest of the world demand for AS exports by 5 percentage points of their imports

We now consider each of these shocks in turn, by outlining their central

22. See Hunt and Rebucci (2005) for a model-based analysis of current account imbalances over the 1990s.

tendencies and discussing their effects on the regional economies. The dynamics are reported for the first 80 quarters (i.e., a twenty-year horizon) after each shock begins.[23] Afterward, we will discuss the baseline scenario, which is simply an integrated presentation of these shocks.

It should be understood, however, that the behavior of the national economies in the baseline scenario is not a simple add-up of the six shocks. Each shock in fact can enhance, amplify, or dampen the outcomes of the other shocks. For example, a very persistent productivity shock in emerging Asia results in AS increasing its share in the world economy from 9.4 percent to 12.2 percent in the long run. In the case of the public debt shock in the United States, there is a considerable reaction of the Asian current account to the increased availability in the portfolio of US assets. The change in the current account-to-GDP ratio is smaller in the baseline scenario for the US public debt shock than in the presentation of the US public debt shock in isolation. This is simply because AS is much larger in the baseline (over 12.2 percent of the world instead of 9.4 percent) due to the productivity shock and has to devote fewer resources (as a share of GDP) in order to absorb its share of new US government debt. To put it simply, the sum is greater (or, in this case, lesser) than its parts. Where appropriate, in the remainder of this section we will try to highlight the most important cross-effects that occur in the baseline scenario.

Public Debt in the United States

For the public savings shock in the US, we couple a sustained increase in the government deficit for the next five years with a steady-state government debt shock of 11.5 percent of GDP (figures 10.4 and 10.5).[24] The steady-state government deficit of the US rises from 2.2 to 2.7 percent.[25] We observe lower taxes today, but higher taxes in the future to meet the interest payment obligations on the debt. The increased borrowing by the fiscal authority crowds out the trade balance, thereby worsening the current account deficit relative to the initial steady state. We also observe a real exchange rate appreciation in the short run, but a depreciation in the long run.

In the long run the increase in government debt increases US net foreign

23. It is worth emphasizing that in several cases the variables reported in the charts keep increasing (or falling) after the twenty-year horizon to approach their steady-state levels.

24. We implement the government debt shock as follows. We increase the steady-state government debt-to-GDP ratio in the United States by 11.5 percentage points. We implement the shock in the short run by letting the deficit-to-GDP ratio for the US peak at 5 percent after two years and then decline to the steady-state value of 2.7 percent of GDP. This demonstrates the effect of the US government deficit shock alone. In a framework with an endogenous link between government debt, NFAs, and the world real interest rate (as found in overlapping generations models of the Blanchard-Weil-Yaari type such as the aforementioned GFM) there would also be a permanent increase in the US interest rate to account for the crowding out effects on investment.

25. Figures 10.4 through 10.15 report variables as deviations from the initial steady state. For instance, for the US government deficit in figure 10.4, the starting point corresponds to a deficit of 2.2 percent and the endpoint to a deficit 0.5 percentage points above the initial level.

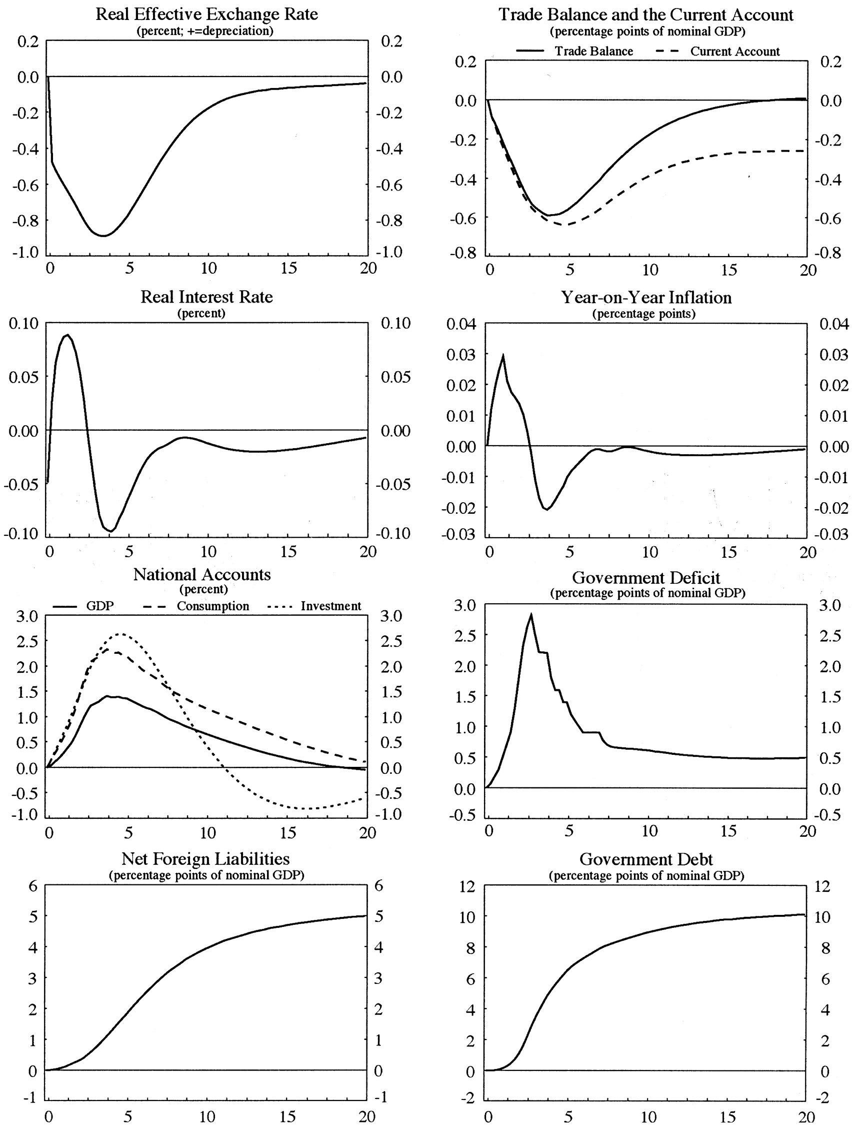

Fig. 10.4 United States—Government debt shock in the United States

liabilities by 5.75 percent of GDP, which is financed by the rest of the world. Relative to each region's GDP, AS sees the largest effect, as its net foreign asset (NFA) position increases by 4.40 percent of GDP in the long run, which means it must be financed by an increase in the current account surplus of 0.5 percent of GDP in the medium term and 0.2 percent of GDP in the long run. There are similar effects in JE and RC, but they are smaller.

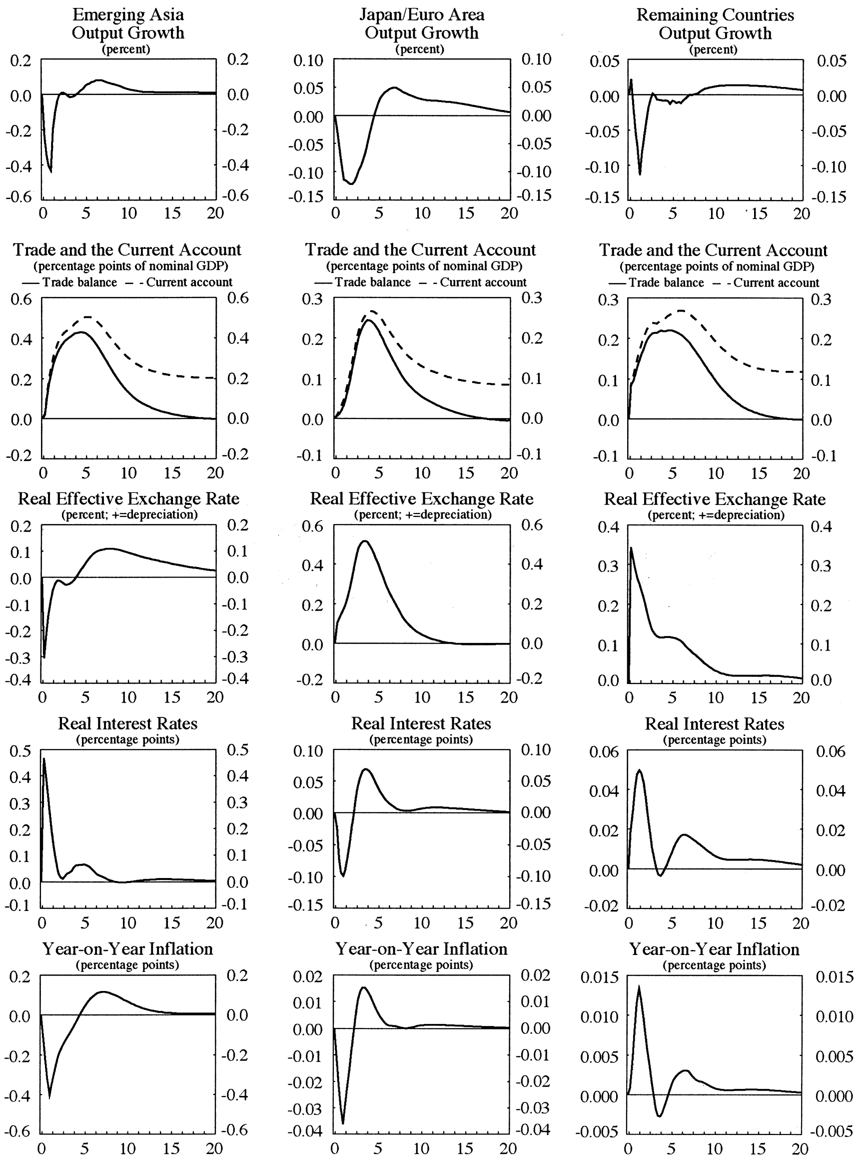

Fig. 10.5 Rest of the world—Government debt shock in the United States

Private Savings in the United States

The reduction in US consumers' desire to save is represented by an increase in the rate of time preference in the US relative to the rest of the world of 50 basis points, as well as a risk premium shock of 30 basis points for twenty-five years (figures 10.6 and 10.7).[26] At the same time, we assume AS is more patient than JE or RC—they have a lower rate of time preference at 2.6 percent. So a negative private savings shock in the US eventually results in an increase in the real interest rate, and a reduction in domestic demand.

In the short run, there is a deterioration of the current account balance of 0.5 percent of GDP in US. However, there is a long-run depreciation, which means there is an improvement in the steady-state trade balance. The spillover effects are relatively minor, their magnitudes depending entirely upon the extent of US trade linkages with AS, JE, and RC.

Foreign Demand for U.S. Assets

The third major component of the baseline scenario is an increase in the demand for US assets in the rest of the world (figures 10.8 and 10.9).[27] The major foreign investor in US dollar assets in this shock is AS (and, to a lesser extent, JE as Japan behaves much like the rest of Asia in its demand for US assets). We see that AS saves more and increases its net foreign asset holdings by 20.5 percentage points of GDP permanently, with lesser increases in JE and RC (5.2 and 9.0 percentage points of GDP, respectively). This results in an increase in the US NFL-to-GDP ratio by 20 percentage points.

As a counterpart to its asset accumulation, AS runs a current account surplus that shows up as a US current account deficit of 3.7 percent in the short run and 1 percent in the long run. In the short run, households in US consume more but in AS consume less. The converse is true in the long run. Output growth in AS is also positive, once the sharp negative effects of the sudden real appreciation wears off. The short-run appreciation of the AS real effective exchange rate is the result of adjusted uncovered interest parity as higher real interest rate differentials are necessary in the future to maintain its nominal exchange rate peg vis-à-vis the US.

26. The private savings shock has both a temporary and permanent component. The permanent component is the rate of time preference shock. Relative to the initial world rate of time preference ($1/\beta^4 - 1$) of 2.7 percent, AS is more patient at 2.6 percent (a negative 10 basis point shock), while US is much more impatient at 3.2 percent (a positive 50 basis point shock). For the temporary component, we increase the risk premium Z_B (see eq. [A42] in the appendix) for all regional blocs by 1 percent for twenty-five years.

27. For the technical implementation, we rely on the autonomous holdings (b^{*}_{FNEUT}) in the desired net foreign asset position equation (equation [A43] in the appendix). In order to finance the increase in US net foreign liabilities by 20 percentage points of GDP, AS increases its steady-state holdings of NFAs by 20.5 percentage points of GDP; JE increases its steady-state holdings of NFAs by 5.2 percentage points of GDP; and RC increases its steady-state holdings of NFAs by 9 percentage points of GDP.

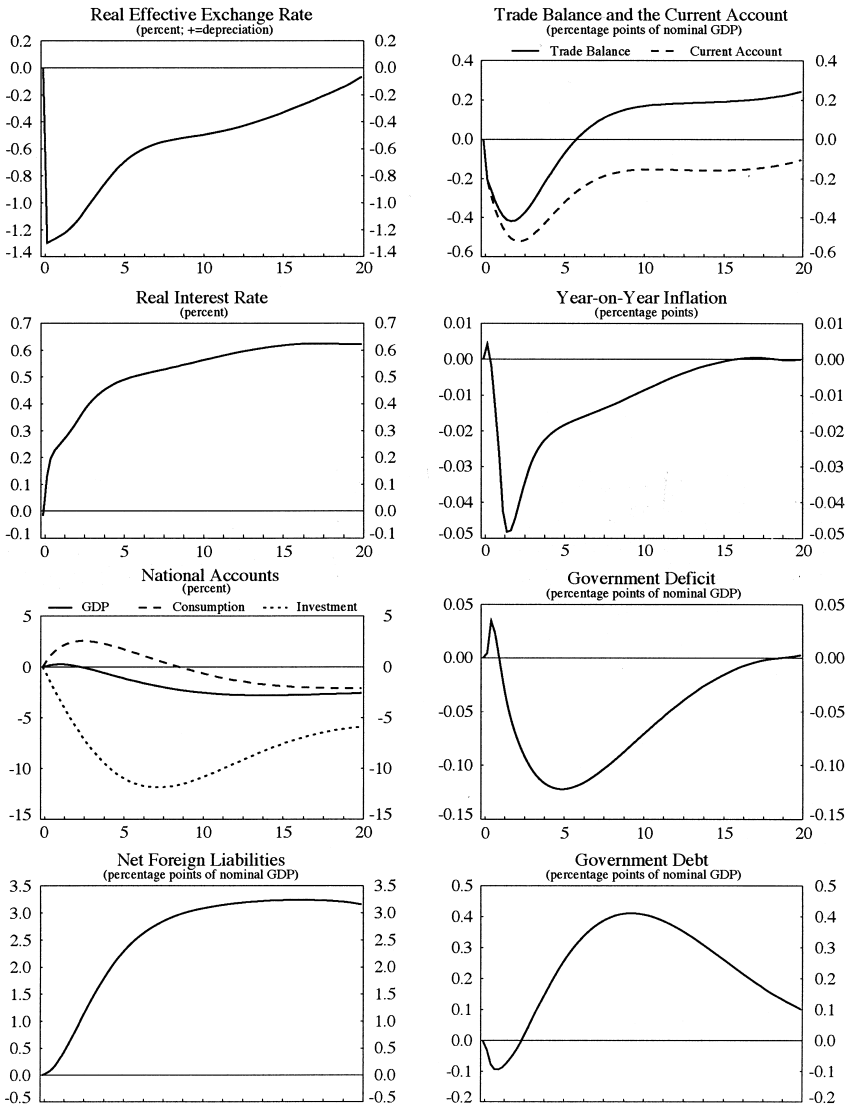

Fig. 10.6 United States—Private savings shock in the United States

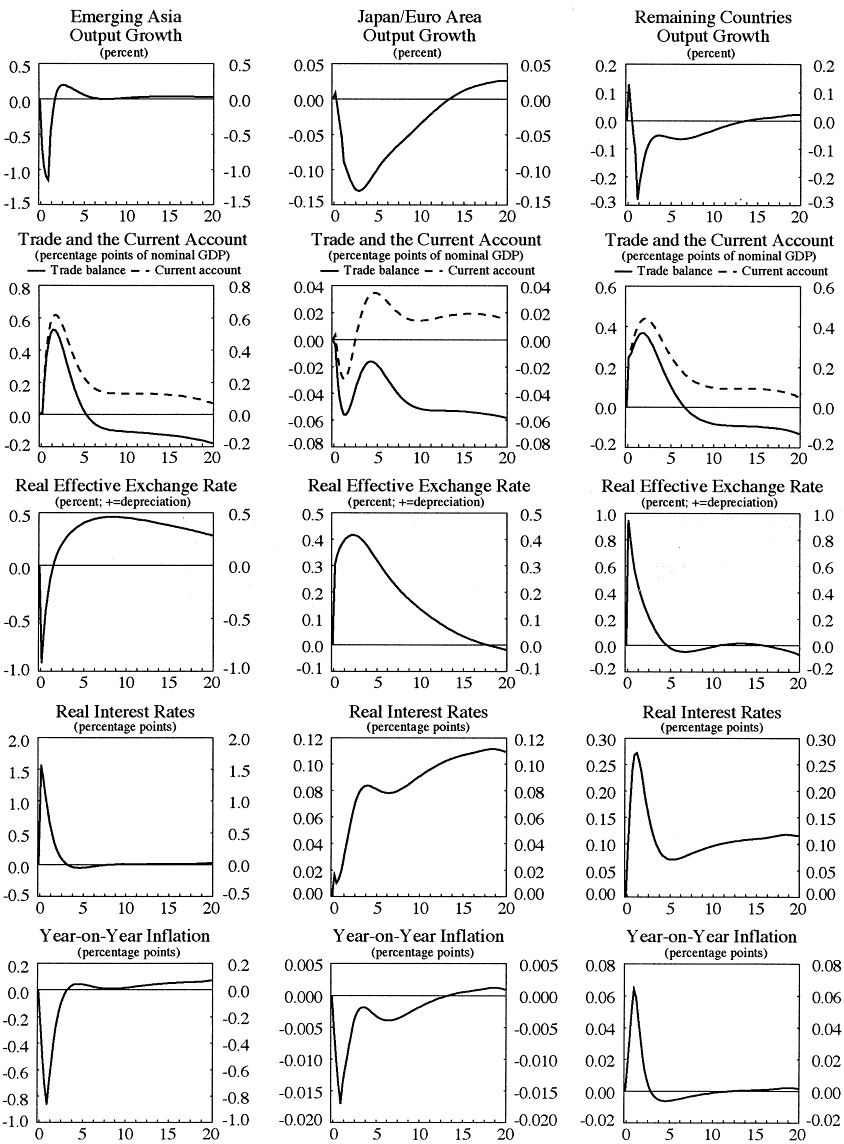

Fig. 10.7 Rest of the world—Private savings shock in the United States

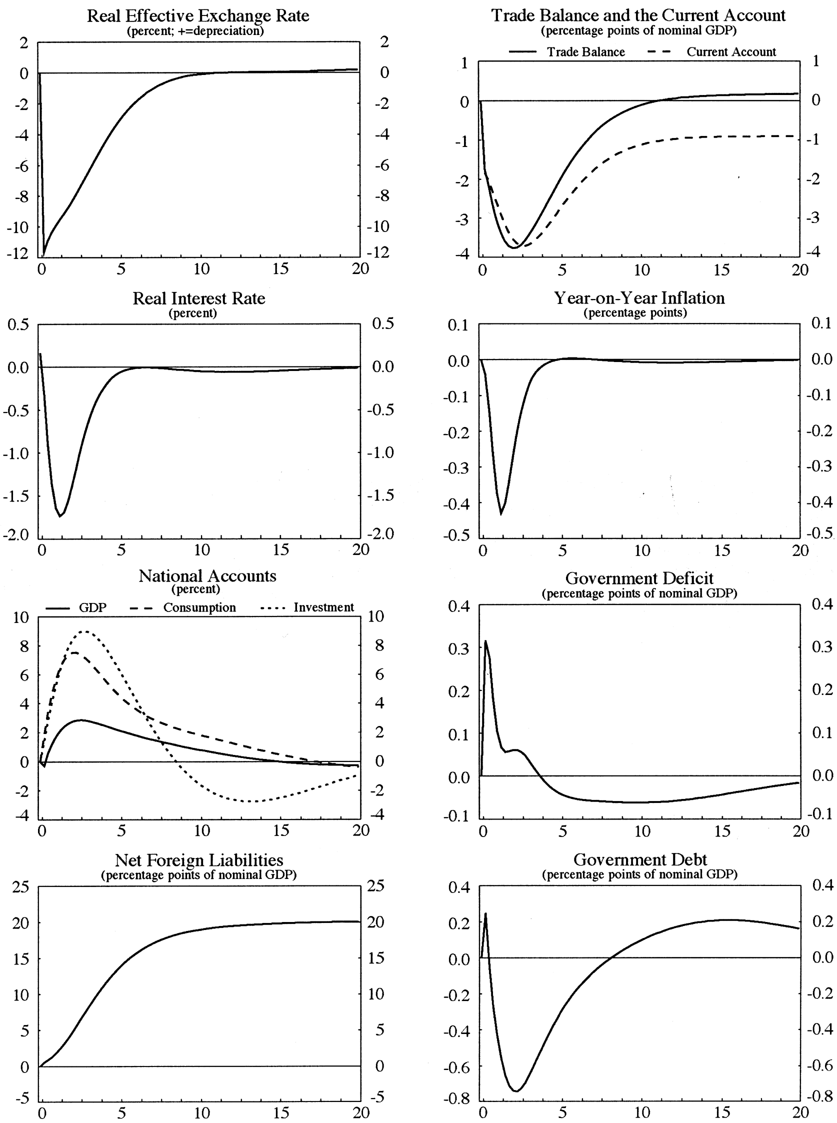

Fig. 10.8 United States—Preference for US assets shock in the rest of the world

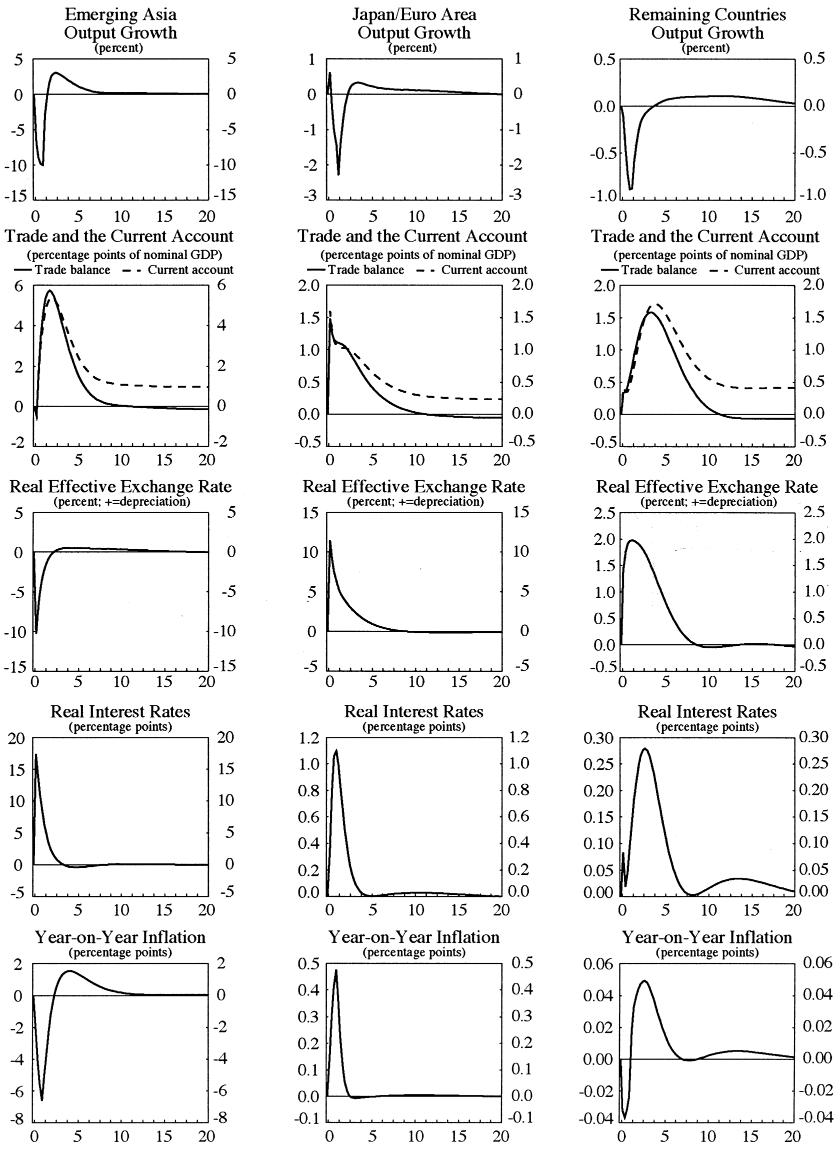

Fig. 10.9 Rest of the world—Preference for US assets shock in the rest of the world

Productivity Growth in JE (Japan and the Euro Area)

Japan and the euro area face a persistent negative shock of 0.75 percentage points to its productivity growth rate that lasts for thirteen years (figures 10.10 and 10.11).[28] Relative to the initial steady state, we see a notable decrease in output. Paired with a decrease in the marginal product of capital, there is a sustained decrease in investment to achieve a new lower capital-output ratio. Because the productivity shock is generalized across the entire economy, we see a long-term real appreciation. The spillover effects in the rest of the world are mostly confined to RC and AS (which have strong links to Japan), but less in US, reflecting their trading patterns with the rest of the world.

In the baseline scenario, this productivity shock serves to reduce the economic size of JE relative to the other regions, reducing the international effects of other shocks. One exception is that the current account balance effects of the US public debt shock is higher as a share of GDP as JE still has the same portion of US debt to finance through accumulation of NFA as in the isolated presentation of the US public debt shock.

Productivity Growth in AS (Emerging Asia)

This shock basically has the same effects as the shock in JE, but with all the signs of the responses reverted (figures 10.12 and 10.13). The AS has, on average, a higher growth rate of productivity, starting around 5.5 percent per year before returning close to the world trend growth rate of 2 percent after roughly thirty years.[29] Relative to the initial steady state, we see a large increase in output. Because of the increase in the marginal product of capital, there is also a sustained increase in investment to achieve a new higher capital-output ratio. Because the productivity shock is generalized across the entire economy, we see a long-term real depreciation of around 4.5 percent.

In the first two years there is a small increase in inflation by about 0.2 percent, followed by a sustained 0.8 percent disinflation as the expansion of productive capacity continues. The disinflation continues almost until twelve years after the shock begins. Given the higher degree of flexibility in price setting for the labor and goods markets in AS and the fact that monetary policy is conducted to defend an exchange rate peg rather than pur-

28. To be more precise, we assume that productivity grows at 1.25 percent per year for thirteen years in JE for both the tradable and nontradable sectors, instead of at the world trend growth rate of 2 percent.

29. Technically, the productivity growth rate shocks differ between the tradable and nontradable sectors. For the nontradable sector, productivity grows in AS at 3 percent per year for eight years. The shock in the tradable sector is much larger and much longer. Overall, the productivity growth rate in AS is close to 5.5 percent a year at the beginning of the shock, declining steadily to around 2.25 percent after thirty years and returning to the trend 2 percent growth rate two years later.

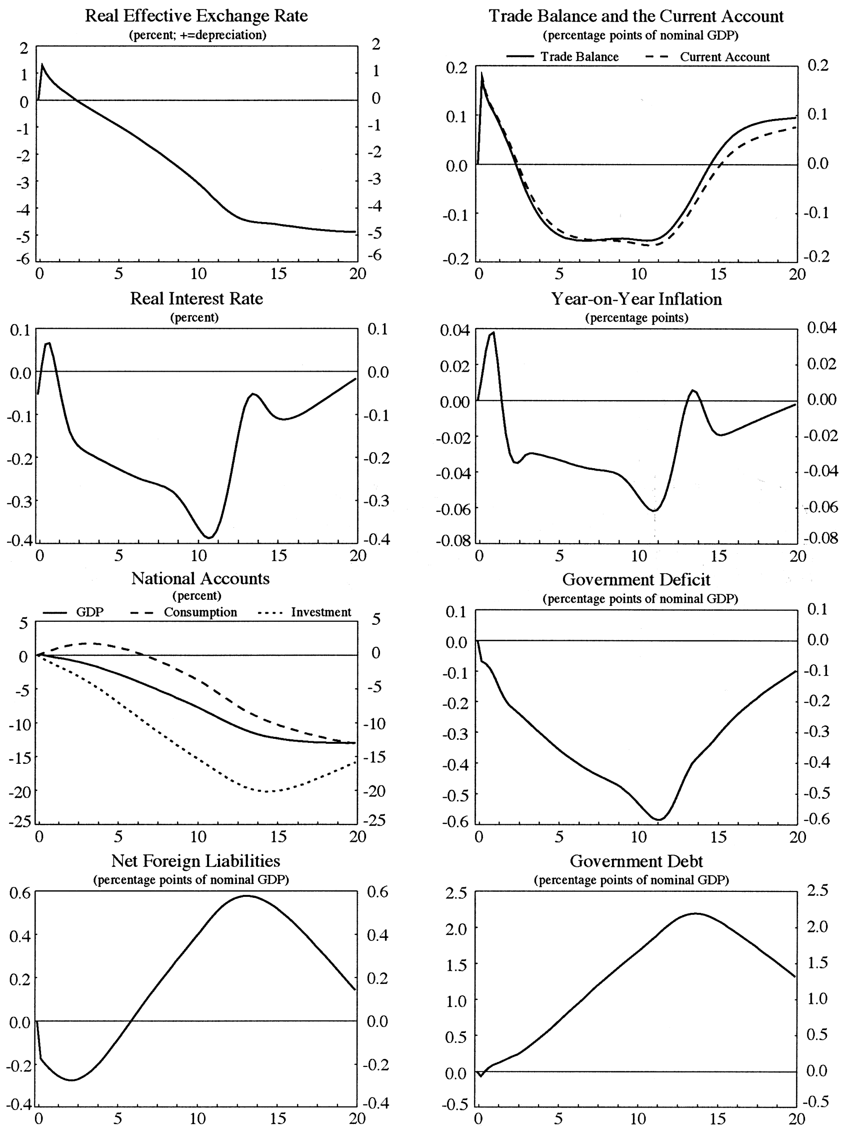

Fig. 10.10 Japan and the euro area—Negative productivity shock in Japan and the euro area

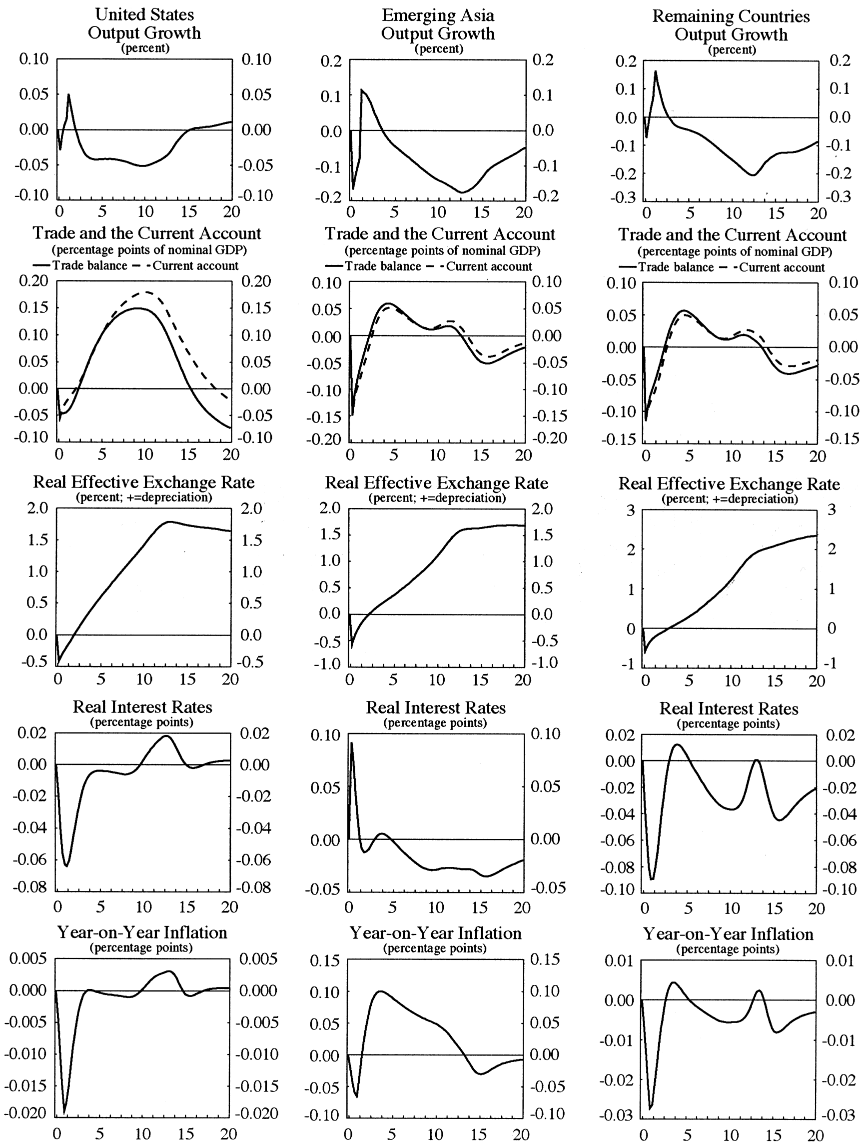

Fig. 10.11 Rest of the world—Negative productivity shock in Japan and the euro area

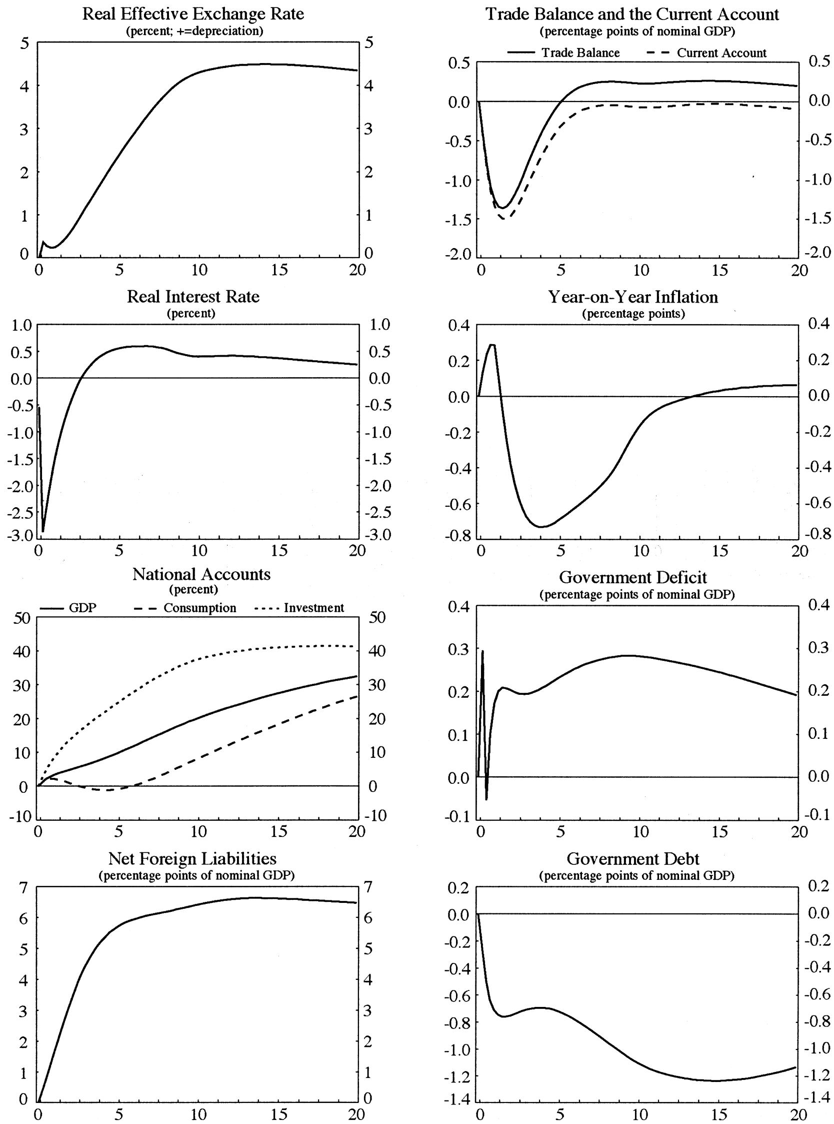

Fig. 10.12 Emerging Asia—Positive productivity shock in emerging Asia

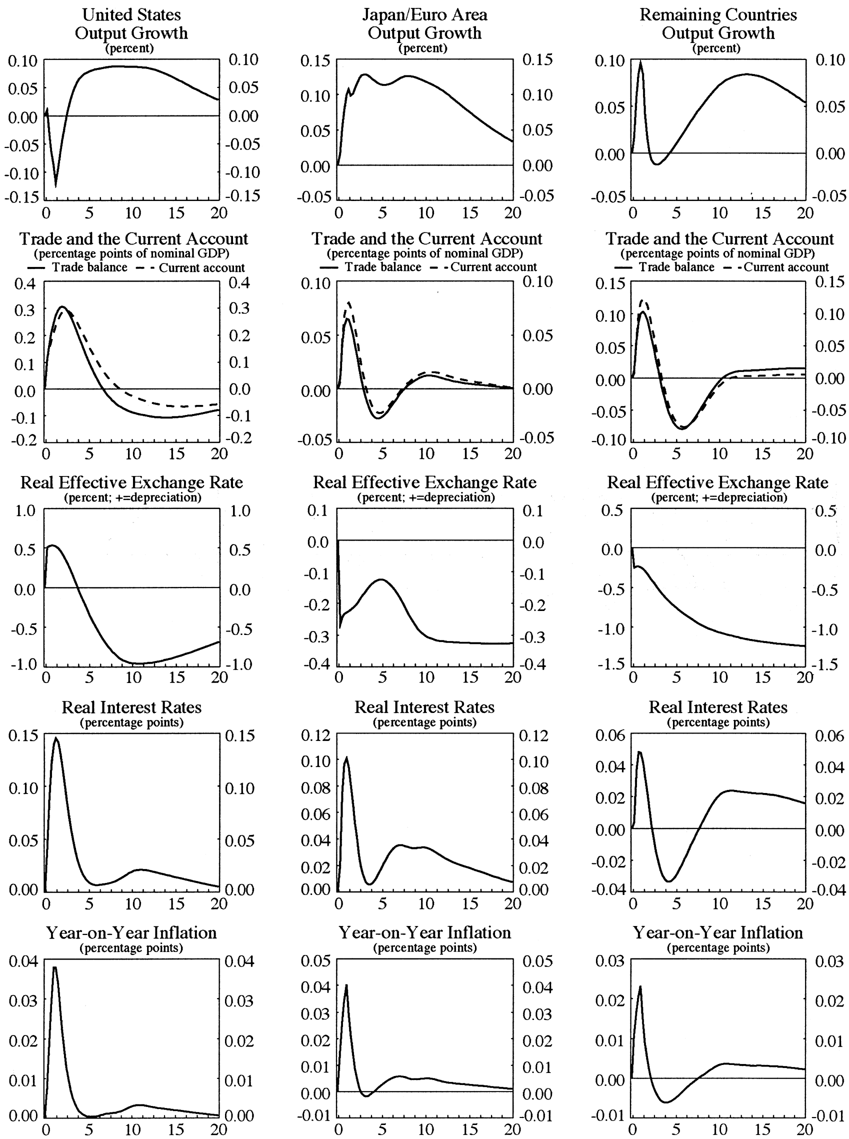

Fig. 10.13 Rest of the world—Positive productivity shock in emerging Asia

sue an inflation target, the dynamics of the shock are less extreme than would occur in a regional bloc such as JE.

The spillover effects from the shock in AS are not much larger than those spillovers from the JE productivity shock, despite its much more sustained and larger extent. This results from the fact that AS is merely 9.4 percent of world GDP in the initial equilibrium (whereas JE is 34.6 percent) and the fact that AS has stronger linkages with US than JE does (relatively speaking). Therefore, the productivity shock in AS also contributes to our formulation of the baseline scenario in US, where we see a current account deficit opening up in the medium to long term.

Fiscal Policy in AS

The role of AS in the baseline scenario is enhanced by a positive fiscal policy shock in AS that is used to finance exports to the rest of the world (figures 10.14 and 10.15).[30] By running a higher deficit than the initial steady state conditions imply, the government is able to subsidize the export of its goods and services abroad. In turn, this short-run subsidization is associated with a permanent shift in the rest of the world's preferences for AS goods.[31]

In the long run, demand for AS's goods is permanently higher by five percent of imports in the three other regional blocs (JE, US, and RC). However, because the increase in the government deficit is only temporary, there is no long-run shift in the level of net foreign liabilities in AS. Therefore, the long-run trade balance is unchanged in AS and the higher demand of AS goods abroad is offset by a permanent real appreciation of the exchange rate of 23 percent, leading to a higher level of AS imports from abroad.

This has implications for the other regions of the world. In the medium term, the increase in exports in the rest of the world roughly offsets the increase in demand for imports from AS, meaning the US sees almost no change in its current account position, while JE and RC see slight improvements. There are some significant short-run increases in the current account-to-GDP ratios in JE (0.3 percent of GDP) and RC (0.7 percent of GDP). The main effect of this shock is a long-run realignment of real effective exchange

30. Export subsidies are not modeled as direct subsidies because they usually take the form of tax rebates, accelerated depreciation allowances, and tax holidays.

31. This shock is implemented as a positive increase in the AS fiscal deficit above 4 percent of GDP in the first year, which declines to 1.0 percent of GDP by the end of the ninth year. Afterwards, it reverts to the deficit consistent with the original long-run debt target of 24 percent of GDP. At the same time, world preferences for Asian imports shift up by 5 percentage points of their total imports by moving the bias parameters for imported consumption goods (b_A in eq. 4) and investment goods (b_E) over roughly three years. For example, the bias of American consumers for imported goods from AS ($b_A^{US,AS}$) increases from 0.11 to 0.16, with a corresponding decrease in demand for imported goods from RC ($b_A^{US,RC}$) from 0.58 to 0.53. This implies that in the long run, for every additional 100 units of imports in JE, RW or US, five of those units now come from AS rather than from the other trading partners.

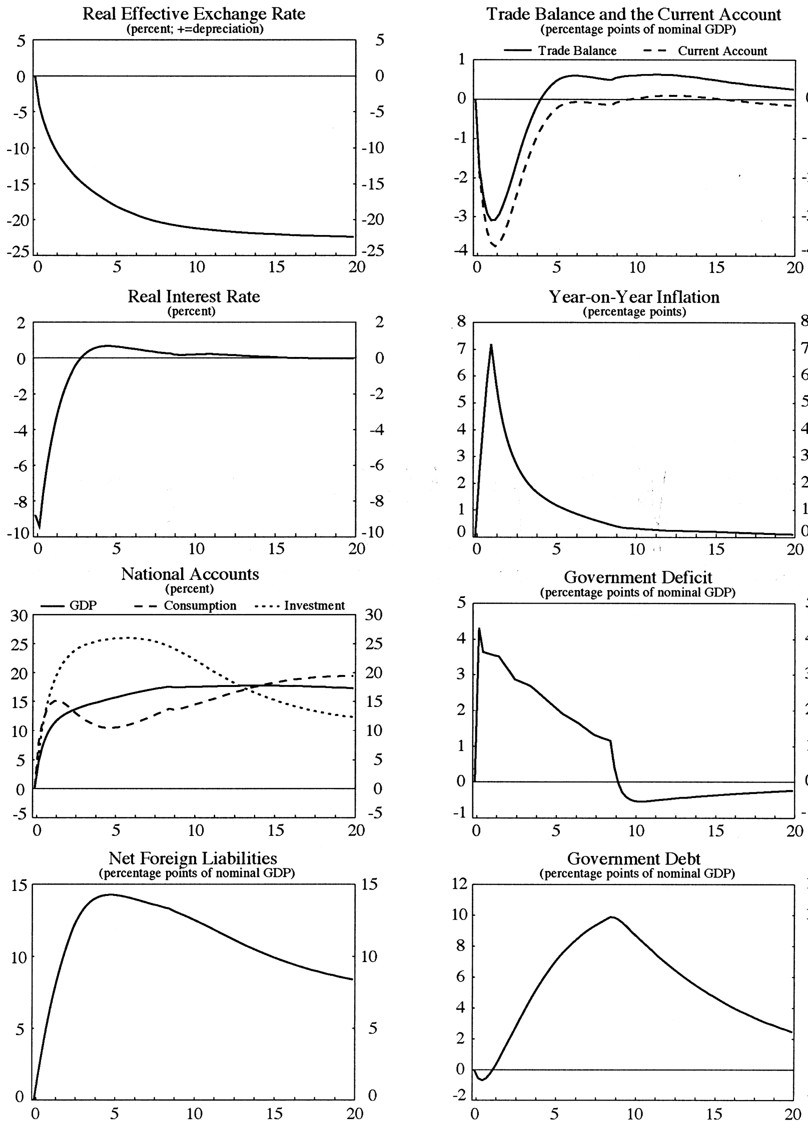

Fig. 10.14 Emerging Asia—Positive fiscal policy shock in emerging Asia, including export subsidies

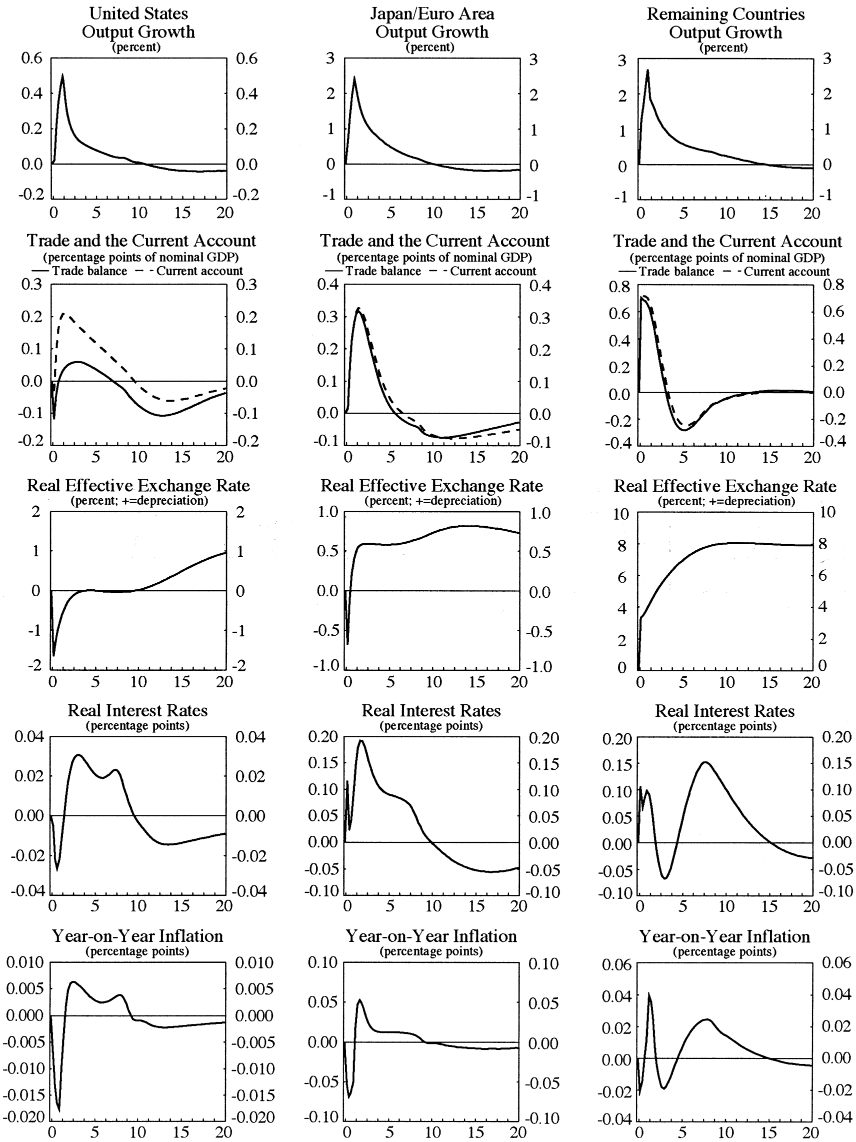

Fig. 10.15 Rest of the world—Positive fiscal policy shock in emerging Asia, including export subsidies

rates worldwide. Also, the shift in world preferences toward AS imports means there is now a higher degree of openness between AS and the rest of the world. So when all six shocks are combined to form the baseline scenario, responses of trade movements to the various shocks are higher vis-à-vis AS (and they are, to varying degrees, less among the other regional blocs).

10.4.2 The Integrated Scenario

The six aforementioned shocks form the components for our integrated baseline scenario. As alluded to, the shocks should be viewed as the central tendencies of the scenario, while the latter is presented more broadly as a range of potential outcomes. Indeed, over time there has been considerable uncertainty about the evolution and correction of the U.S. current account imbalance, and there is no basis to assume that this will not be the case in the future. Figure 10.16 demonstrates this point by showing the evolution

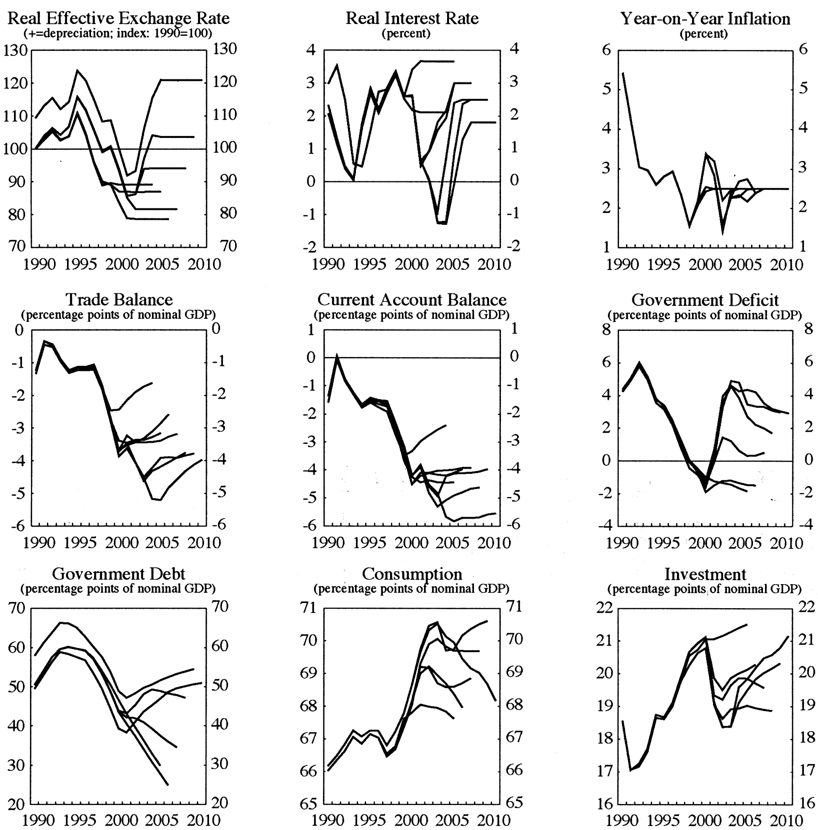

Fig. 10.16 Forecasts from the IMF's *World Economic Outlook, 1999 to 2005*—United States

of the IMF's forecasts in its *World Economic Outlook,* from 1999 to the present. In later forecasts we see the same basic story as the one we are proposing. Earlier forecasts put more weight on beliefs that the U.S. current account deficit was caused by high investment rates, rather than low private savings and large public dissaving. We can also observe that consumption continues to trend upward over time, but in later forecasts there is a need for a notable correction toward the end of the forecast horizon.

In presenting the baseline scenario, we therefore consider a range of possibilities that accounts for the degree of uncertainty around the central tendency of the six component shocks already outlined. A high degree of uncertainty, in particular, surrounds the outcome of shocks related to private savings in the United States, rest of world preferences for holdings of US assets, and the positive productivity shock in AS. For the outcome of shocks related to the US fiscal policy and lagging productivity in JE, the uncertainty bounds are more narrow.

The baseline scenario begins in the first quarter of 2005. In order to achieve the state of disequilibrium we believe exists in that period, we do not start reporting from the initial steady state of the model, but rather from period 13 (i.e., the start of the fourth year) after the occurrence of each of the shocks presented previously. We believe that using this time frame for the combination of the six shocks (with minor modifications to smooth demand and monetary policy) is the best strategy to represent our baseline view of the world economy at the beginning of 2005.

Figure 10.17 presents the baseline scenario in the United States. The key features are a gradual build up in government debt and decline in net foreign assets for US. The exchange rate depreciates gradually to allow the net asset position to stabilize. This generates the trade surplus required to finance the interest obligations resulting from the increase in net foreign liabilities. Consumption as a share of GDP is higher in the short run but is eventually crowded out as US becomes more heavily indebted. In addition, investment is crowded out by persistent budgetary deficits. Overall, the dynamics in the United States are driven by the current account deficit moderating from more than 5 percent of GDP to a sustainable level in ten years' time.

Emerging Asia's most important role in the baseline is through its absorption of the increased supply of US assets (figure 10.18). Initially AS runs a large and growing current account surplus. Eventually, the trade balance turns negative to support the large increase in the net foreign asset position. To absorb the inflows from the interest payments on its net foreign asset position, the AS real effective exchange rate roughly appreciates between 10 and 20 percent over the next five years, achieved through higher inflation. Because of limited exchange rate flexibility, there is an increase in the real interest rate necessary to defend the stability of the currency. Overall, the economy cools in the short run as higher interest rates dampen in-

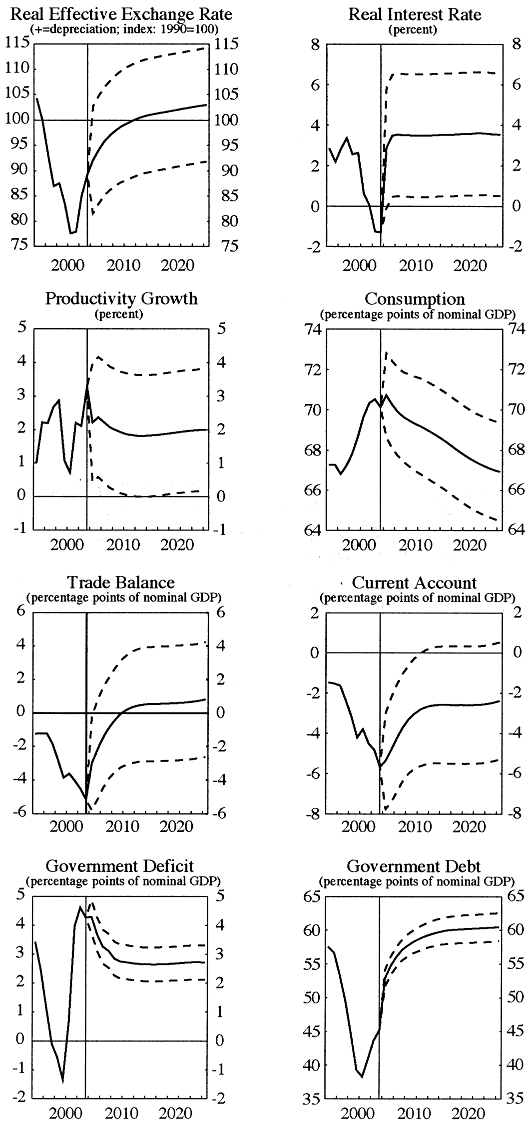

Fig. 10.17 The baseline scenario—United States

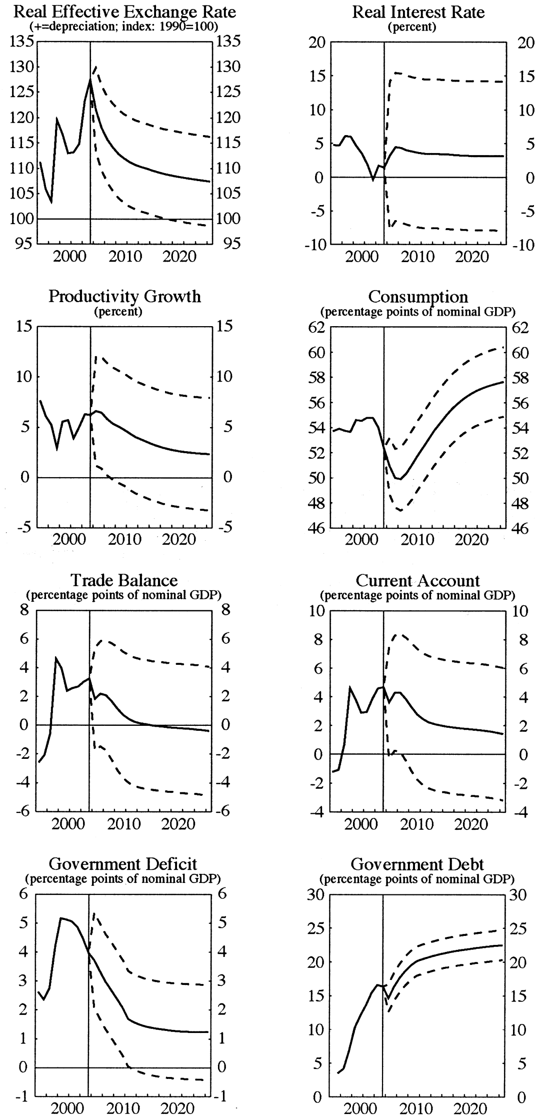

Fig. 10.18 The baseline scenario—Emerging Asia

vestment and real appreciation affects net exports. However, consumption increases as a share of GDP in the medium term in anticipation of higher wealth (and lower saving) in the long run.

Japan and the euro area are relatively stable in terms of adjustment, experiencing few effects as AS absorbs most of the increased US demand for goods and the increased supply of US assets (figure 10.19). The JE external account is broadly stable going forward, with only a temporary and

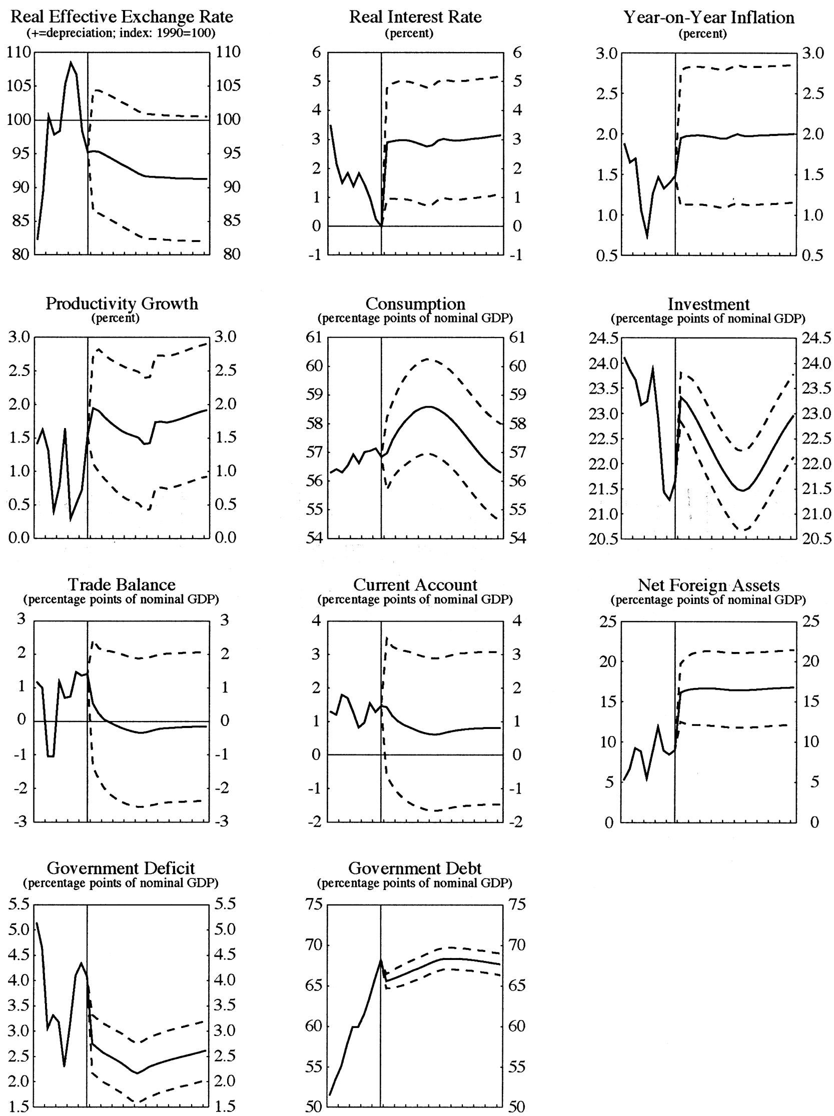

Fig. 10.19 The baseline scenario—Japan and the euro area

small current account improvement until it stabilizes around 0.5 percent of GDP in about ten years' time.

The RC bloc is not a key part of either the baseline scenario or the alternative scenarios presented in the following. It behaves much like AS because it has strong links with the United States (mainly Canada and Mexico). But RC absorbs less US debt as there is no large underlying positive shock to its preference for US assets. Furthermore, it experiences relatively little inflation and has a smaller movement in its real effective exchange rate than AS because it conducts its monetary policy by targeting inflation rather than a nominal exchange rate peg.

10.5 Elements for Alternative Scenarios

This section has two objectives. First, we consider some scenarios that are designed to highlight the potential risks of large current account imbalances. Second, we discuss some possible solutions that may mitigate these risks. In summary, we argue that the short-run output costs for the U.S. economy associated with financial market turbulence and a sudden loss in appetite for U.S. assets are likely to be the same order of magnitude as a large, credible fiscal consolidation that would make a significant contribution to reducing these imbalances steadily over time and make both the U.S. and world economy less susceptible to shocks. We also consider the effects of competition friendly structural policies aimed at reducing long-standing structural rigidities and distortions in the product markets in Europe and Japan. Our analysis suggests that such policies could play a meaningful role in reducing current account imbalances on a sustainable basis.

10.5.1 Sudden Loss in Appetite for U.S. Assets

Among the major risks surrounding the large buildup of U.S. external liabilities, there has been considerable discussion that a sudden loss in appetite for these assets by the rest of the world could precipitate a large and abrupt depreciation in the U.S. dollar, adversely impact interest rates, and cause significant second-round negative effects on other countries. We attempt to evaluate these predictions.

Initially, we consider the effects of a sudden portfolio reshuffling in the rest of the world (AS, JE, and RC blocs) under the assumption that AS maintains a peg relative to the US currency. The effects of this first scenario are reported as solid lines in figure 10.20. Next, we consider the same scenario, but in this case central banks in AS gradually adopt a flexible exchange rate regime (and inflation targeting).[32] The effects of this second scenario are reported as dashed lines in figure 10.20 and serve to illustrate

32. Technically, this is made operational by shifting the parameters in the reaction function for AS gradually over time to be consistent with the parameters in the other country blocs of the model.

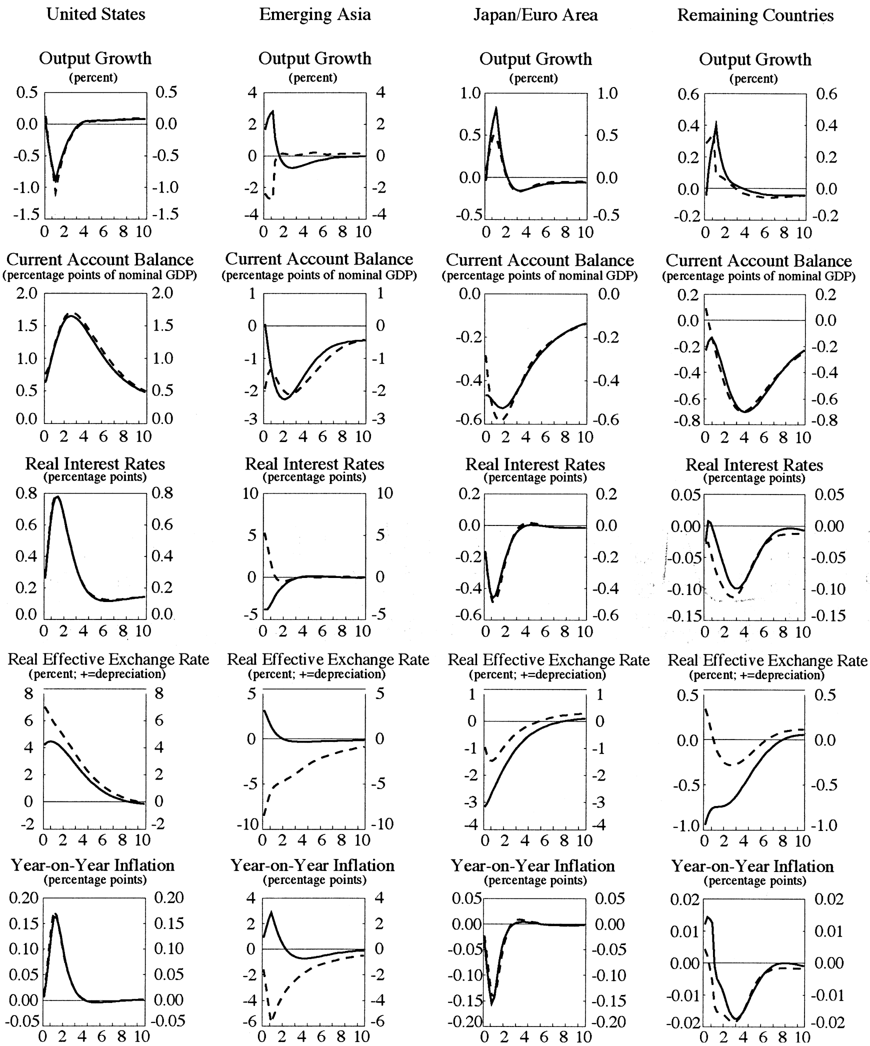

Fig. 10.20 Loss of appetite for US assets—Benign scenario where the U.S. current account deficit declines by 1.5 percentage points: Exchange peg in emerging Asia (solid lines) and move to flexible exchange rates in emerging Asia (dashed lines; deviation from baseline)

how flexibility in the exchange rate can help reduce variability in both output and inflation in AS.

If market sentiment soured on dollar assets, higher real interest rates in the United States and a significant depreciation in the US dollar in effective terms would result. Dollar depreciation would improve the US trade balance but have a contractionary effect on US GDP growth as higher real interest rates have a larger depressing effect on domestic demand than the effect of the real exchange rate depreciation. Interestingly, this analysis suggests a fairly benign scenario in partner countries where growth rises temporarily in response to lower real interest rates.

These scenarios seem consistent with a view that adjustment in relative prices and real interest rates may not have enormous implications for the world economy as a whole, insofar as the adjustment process was orderly and did not yield persistently higher real interest rates in the rest of the world. It is important to note that these simulations assume relatively high elasticities of substitution between domestically produced tradables and importables. Reducing these elasticities to one approximately doubles the real depreciation in the U.S. dollar, but has much smaller effects on the other results reported in figure 10.20 as the exchange rate simply has to do more work to reequilibrate the economies to move U.S. dollar asset holdings toward their new desired levels.[33]

Benefits of Exchange Rate Flexibility in Emerging Asia

While the effects appear somewhat benign for the world economy generally, they would be anything but benign for the regional economies in AS that exhibit symptoms of overheating. In this scenario one can see the potential benefits of allowing greater exchange rate flexibility in AS as a way to reduce variability in both output and inflation. Indeed, a comparison of the solid lines and the dashed lines in figure 10.20 shows intensifying pressure on domestic inflation and output, associated with a reduction in demand for US assets by AS central banks, if they (perhaps, paradoxically) kept trying to peg their exchange rates to the US dollar.[34]

In the first case, attempting to maintain the peg would generate significant overheating pressures and higher inflation, as accelerating prices would be the only method to appreciate their real exchange rates toward values in line with underlying fundamentals. In the second case, we allow the weight on the exchange rate in the AS monetary policy reaction function to fall gradually over time and at the same time the weight on (ex-

33. Our baseline elasticities are in line with the parameters used in standard open-economy models, but they are significantly higher than the midpoint of the range of macroeconometric estimates, which falls closer to one. For example, Bergin (2004) finds evidence for a unitary elasticity. See Corsetti and Pesenti (2001) for a stylized model with a unit elasticity of substitution between home and foreign goods, complete pass-through, and home bias in government spending. More complex simulation models such as Erceg, Guerrieri, and Gust (2005) and Bayoumi, Laxton, and Pesenti (2004) employ estimates of 2.5 and 3.0, respectively, closer to estimates of long-run elasticities based on disaggregated data. It is important to note that estimates around 2.5 combined with adjustment costs on imports results in dynamic responses for imports that are consistent with typical impulse response functions over one- to two-year horizons.

34. Dooley, Folkerts-Landau, and Garber (2004) argue that diversification of foreign reserves by Asian central banks, amounting to sterilized intervention to weaken the dollar, would be incompatible unless these central banks changed their (fixed) exchange rate policies.

pected) inflation to rise. Consequently, the real exchange rate depreciates by less in AS, and this results in less variability in output and inflation.[35]

Are These Scenarios Too Benign?

Possibly. The conundrum of historically low interest rates, against the backdrop of historically strong global growth and U.S. monetary tightening, is far from being well understood. And uncertainty lingers about the sustainability and vulnerability of prevailing relaxed financial conditions. Correspondingly, there is a clear and present risk that real rates may rise universally if a sharp U.S. dollar depreciation were to precipitate a reassessment of global risks, including for inflation. This could also trigger adjustments in the prices of other assets (such as housing and equities) and bring into play confidence effects with further reverberations throughout the economy.

To elaborate on these risks, we consider a scenario (see figure 10.21) where additional ramifications of a sharp decline in market sentiment toward abundant US dollar assets are considered. In this case, global inflation fears and pressures emerge and interest rates tend to rise significantly across markets. Emerging Asia attempts to contain the overheating pressures from past low real exchange rates through revaluation and sharply higher interest rates. For other countries, inflationary pressures are exacerbated as the competitive forces from cheap AS exports recede. In this case, note that the adverse effects on global growth are significant.

10.5.2 Reducing Budget Deficits in the United States

In a recent model-based analysis of current account imbalances, Erceg, Guerrieri, and Gust (2005) suggest that fiscal deficits do not have very significant effects on current account deficits.[36] The implication is that a large reduction in the U.S. government deficits would not play a major role in correcting current account imbalances. But this analysis relies on a single, narrow mechanism (i.e., liquidity constraints) through which fiscal variables might operate (beyond tax distortions), while other theoretical frameworks—and other models—reach rather different conclusions. This is the case, for instance, with simulation results based on the aforemen-

35. We acknowledge that the difference between the scenarios is not large. It would be much larger if we assumed there was an immediate move to a flexible exchange rate regime. We show some results below for a US fiscal experiment that better contrasts the differences between a pure exchange rate peg and a pure flexible exchange rate regime in the AS bloc.

36. Erceg, Guerrieri, and Gust (2005) add rule-of-thumb consumers to a model based on the representative agent paradigm and then use the model to study the effects of recent U.S. fiscal deficits on the current account deficit. The effects they find are much smaller than in models allowing for the possibility that permanent increases in government debt can have permanent consequences on the stock of NFLs. Faruqee and Laxton (2000) show that liquidity-constrained consumers by themselves do not result in significant long-term crowding-out effects associated with permanent increases in government debt.

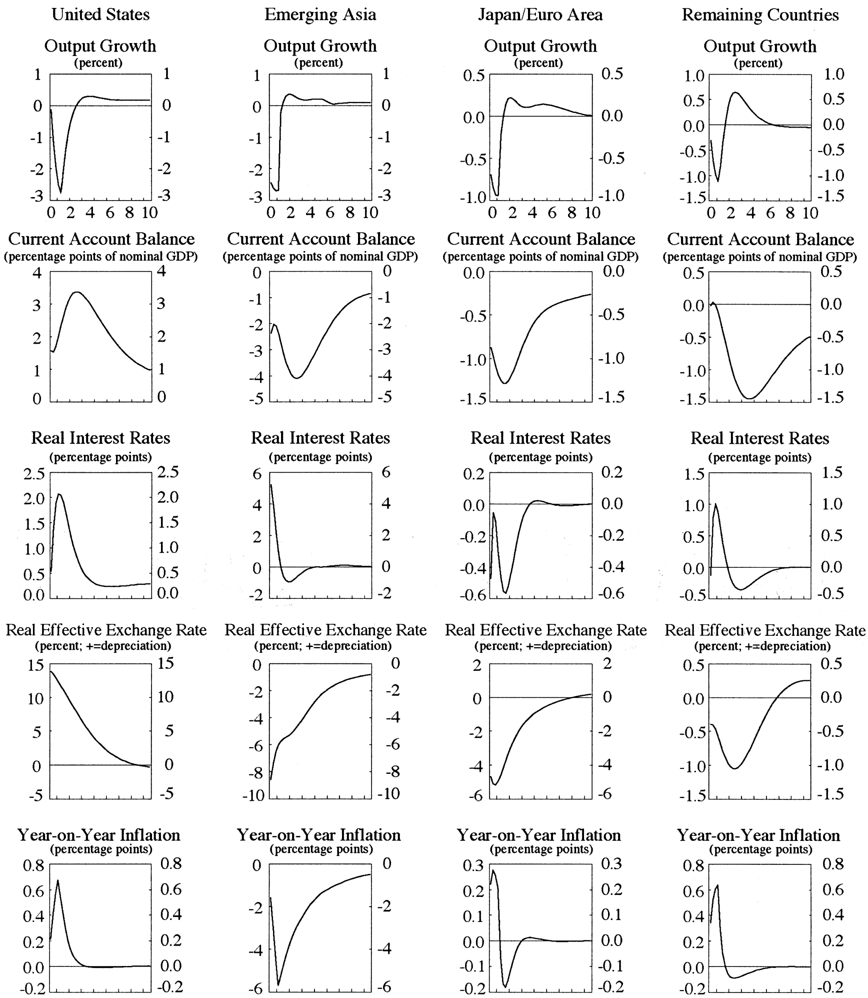

Fig. 10.21 More painful current account reversal (deviation from baseline)

tioned GFM, a multicountry choice-theoretic model—in the life cycle, overlapping generations tradition—that has been developed specifically to study the medium- and long-term consequences of alternative fiscal policies that involve permanent changes in government debt.[37]

The theoretical framework adopted in this paper provides a synthesis between these disparate modeling strategies by considering the link be-

37. For an introduction to the structure and properties of the IMF's GFM, see Botman and others (2006) and Kumhof, Laxton, and Muir (2005). The model assumes that prices and wages are perfectly flexible but has a well-defined steady state where private- and public-sector preferences determine if countries are net creditors or debtors.

tween government debt and net asset positions in relation to the technology of financial intermediation.[38] When this link is switched off, and no allowance is made for the possibility that permanent changes in government debt can result in a permanent shift in the desired level of NFLs, our simulation results show that the effects of fiscal deficits on current account deficits can be very small. However, when the link is explicitly and realistically taken into account, our results predict a rather different path for current account rebalancing.

Effects of a Permanent Reduction in Government Debt through Tax Hikes

Figure 10.22 reports the results for a US fiscal consolidation scenario where the government debt-to-GDP ratio is reduced by 60 percentage points in the long run by increasing taxes by 3 percent of GDP over fifteen years. The tax hike is assumed to fall entirely on labor income, but after the fifteenth year of the simulation, the tax rate is allowed to fall in order to stabilize the government debt ratio at a value that is 60 percentage points below baseline.

The solid line in figure 10.22 reports the results when the AS currencies are assumed to be pegged to the dollar, while the dashed lines refer to the case in which they have a flexible exchange rate regime. In both cases output growth falls in the United States and the current account balance improves significantly. The contractionary effects on real GDP are moderated by a real depreciation in the US dollar. These simulations show clearly that US fiscal consolidation would not be achieved without some short-run costs for output growth, but unlike the results by Erceg, Guerrieri, and Gust (2005), they suggest that a large and credible fiscal consolidation could have large and durable benefits by reducing current account imbalances.

The dashed lines report the results when the AS countries no longer import an inappropriate monetary stance by pegging their exchange rates to the US dollar. In the case of a peg, their real exchange rate depreciates with the US dollar, and real interest rates decline. This results in a significant expansion in demand in the short run and higher inflation. In the case where they are assumed to follow a flexible exchange rate regime, there is substantially less variability in output and inflation as the real exchange rate is allowed to appreciate in line with fundamentals. Note that the rest of the world (Japan, Europe, and RC) benefits from fiscal consolidation in the United States as the rise in world savings results in lower real interest rates and higher investment.

The fiscal scenarios reported above allow the desired level of net foreign liabilities to fall by one half of the decline in government debt while in

38. The section on the budget constraint for the Ricardian households in the Appendix explains more fully the implementation of these linkages.

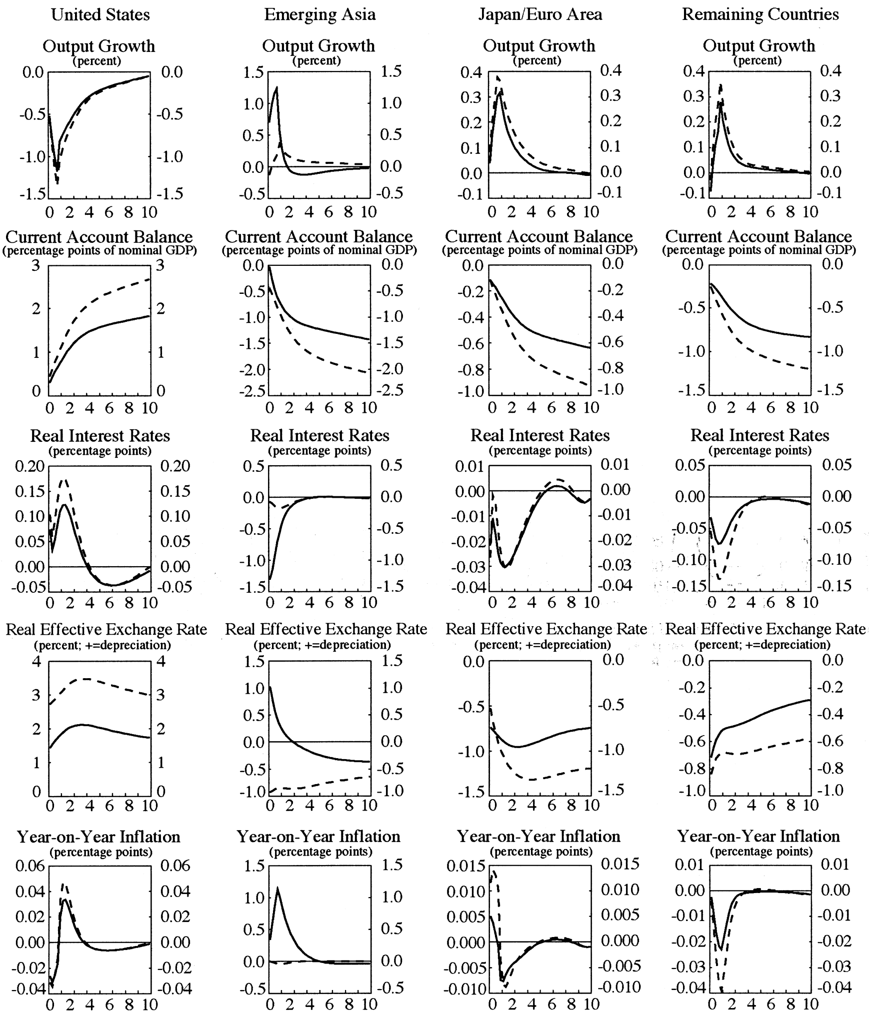

Fig. 10.22 Effects of a permanent reduction in government debt through tax hikes: Exchange rate peg in emerging Asia (solid lines) and move to flexible exchange rates in emerging Asia (dashed lines; deviation from baseline)

Erceg, Guerrieri, and Gust (2005) this mechanism does not exist. To see the importance of this assumption for our results we have constructed two alternative scenarios, one that employs a lower estimate of one-fourth and another that employs an estimate of three-fourths—see figure 10.23. Not surprisingly, this parameter has a significant effect on the path of the current account balance. In the limiting case when it is assumed to be zero, the effects on the current account balance over the medium term become in-

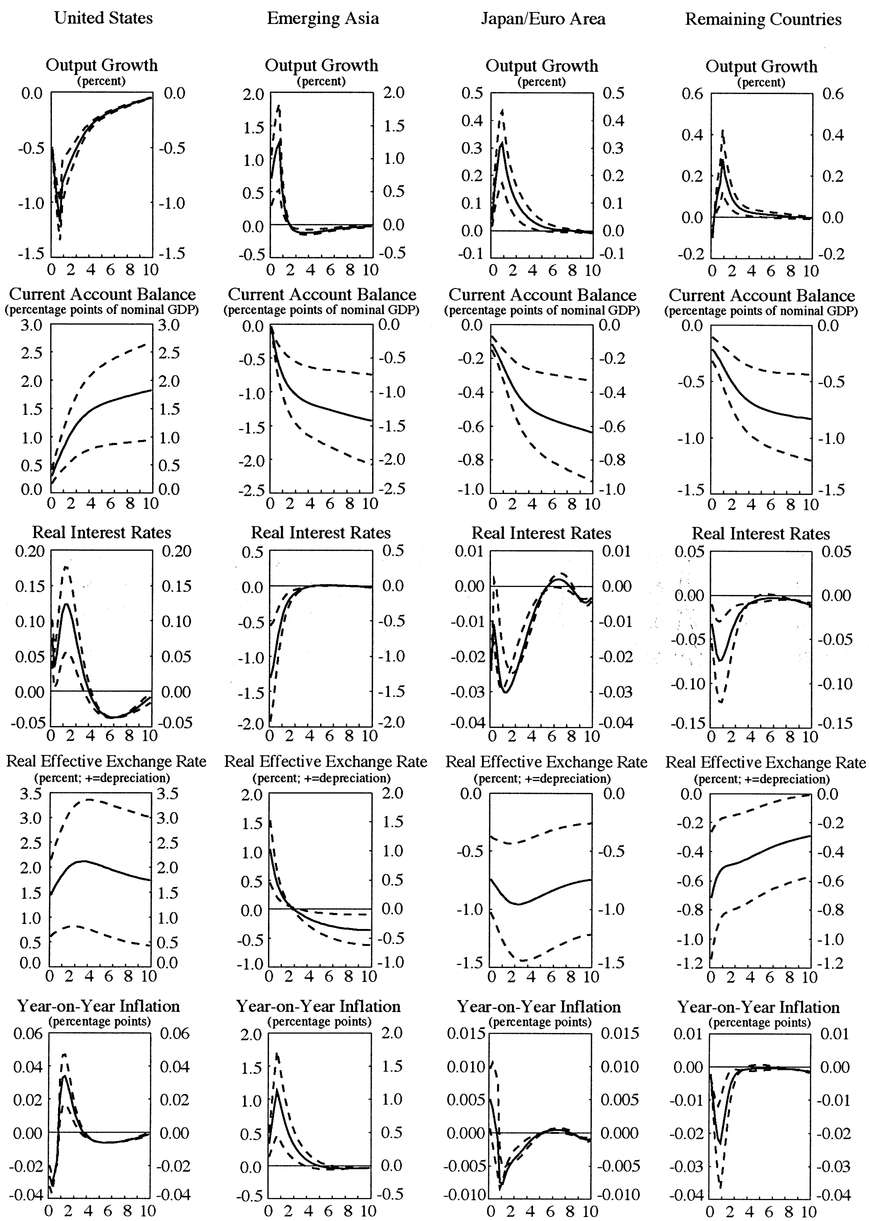

Fig. 10.23 Effects of a permanent reduction in government debt through tax hikes: Sensitivity analysis with alternative assumptions on the link between government debt and net foreign liabilities (deviations from baseline)

significant. Indeed, in the long run the effects would be absolutely zero as the relationship between current account deficit and fiscal deficit, measured as ratios of nominal GDP, will be exactly the same as the relationship between the stocks of net foreign liabilities and government debt.

Alternative Views about the Link between Government Debt and Net Foreign Liabilities

As a check of the reliability of our simulations, it is worthwhile to investigate what assumptions may point to larger or smaller estimates in models where the relationship between government debt and NFLs is modeled endogenously and falls directly out of assumptions about behavior. The aforementioned GFM is based on an overlapping generations framework with finite lives and potential myopia in consumer spending decisions because the planning horizon can be set to be shorter than the expected lifetime of an average consumer. An important consequence of these assumptions is that there will be a strong link in the long run between government debt and the stock of NFLs.

Figure 10.24 presents results for the same fiscal consolidation experiment considered in the preceding. We consider two cases. The first assumes a planning horizon of ten years (solid lines) while the second assumes a planning horizon of twenty years (dashed lines). Note that in both cases there are significant effects on the current account balance from permanently reducing government debt. In the first case, the current account balance improves by about 2.0 percentage points, while in the second case when the planning horizon is twenty years it improves by about 1.5 percentage points.

It is important to emphasize that the improvements in the current account balance are durable to the extent that there is a permanent reduction in net foreign liabilities of 40 and 30 percentage points, respectively. Kumhof, Laxton, and Muir (2005) show that the long-run elasticity between the stock of government debt and NFLs in GFM ranges from a low of 0.50 to a high of 0.75 for plausible assumptions about structural parameters such as the planning horizon of agents, the type of fiscal consolidation (labor taxes, corporate income taxes, or government absorption), and key elasticities (especially intertemporal substitution).

Does the Effect on the Current Account Depend on the Type of Fiscal Consolidation?

Yes. The effects on the current account balance will generally be larger if the fiscal consolidation is a result of a cut in government absorption rather than an increase in taxes. Figure 10.25 compares the same tax-induced fiscal consolidation reported earlier (solid lines) with an alternative fiscal consolidation where government absorption is cut by 3 percentage points of GDP for fifteen years (dashed lines). In the short run, expenditure cuts

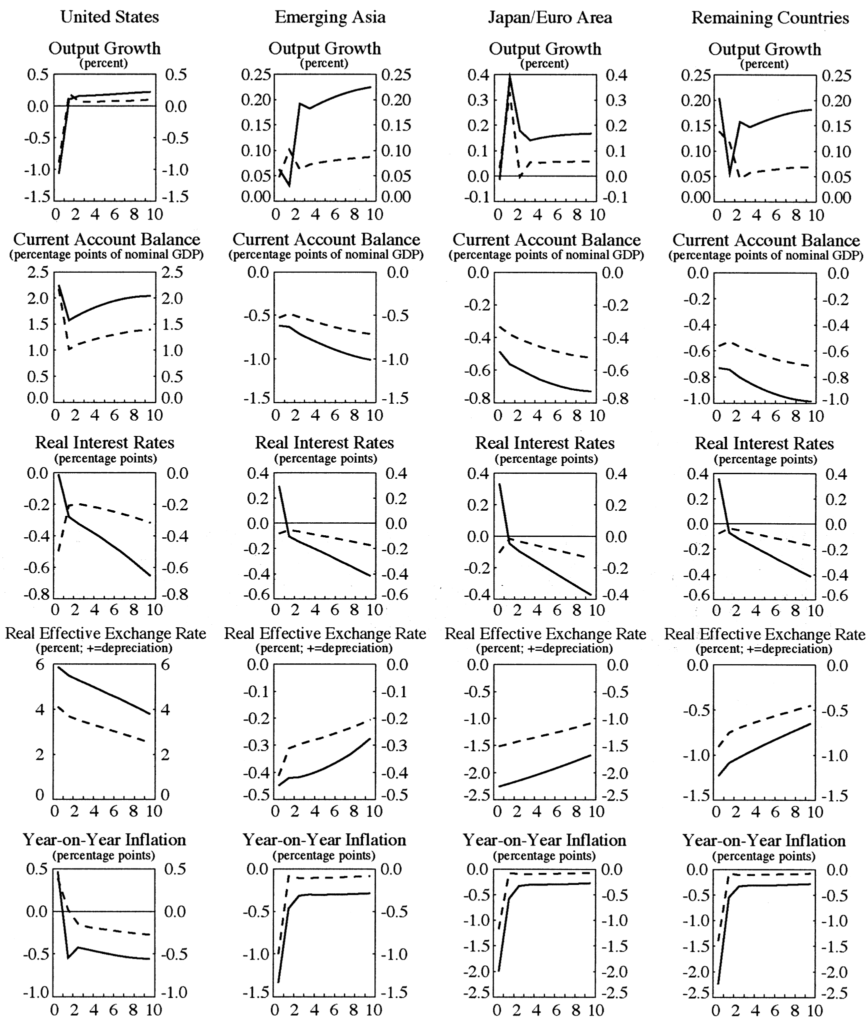

Fig. 10.24 Effects of a permanent reduction in government debt through tax hikes: Sensitivity analysis using GFM comparing a planning horizon of ten years (solid lines) with a planning horizon of twenty years (dashed lines; deviations from baseline)

are associated with much stronger contractionary effects on real GDP as well as larger effects on the current account balance.

10.5.3 How Much Would Structural Reforms in Japan and the Euro Area Contribute?

Given the uneven pattern of global growth and demand and the sluggish economic performance in JE, it has been suggested that one component

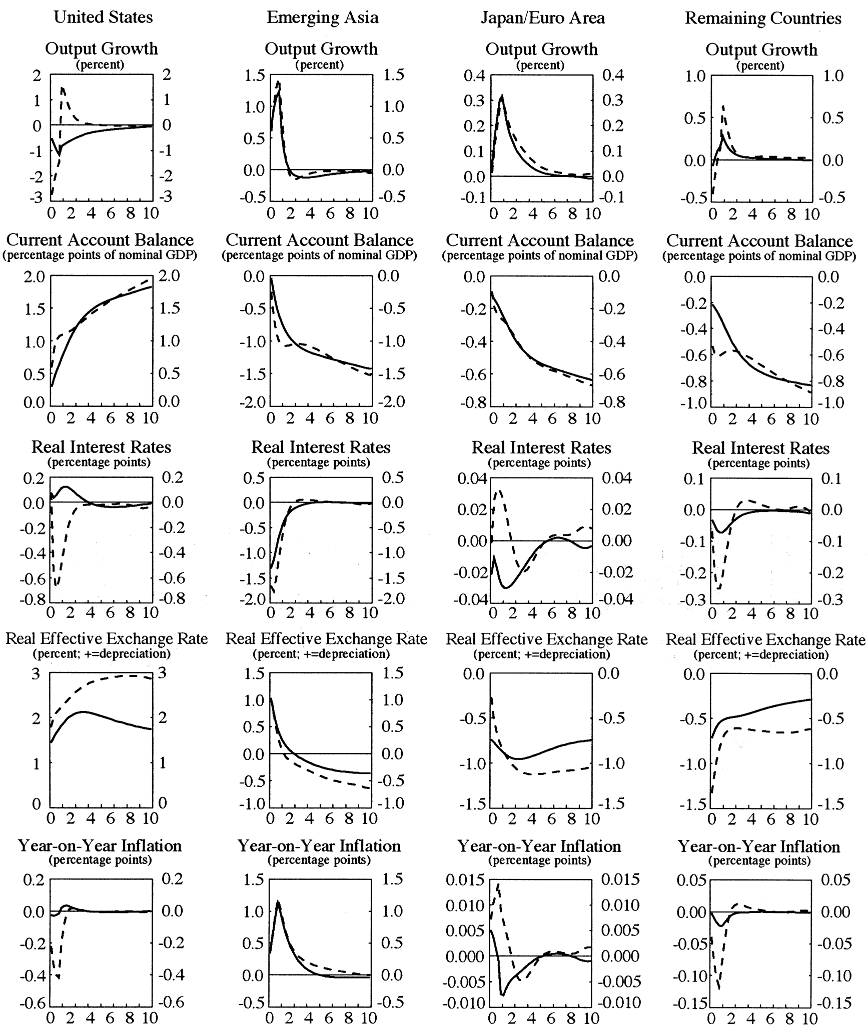

Fig. 10.25 Effects of a permanent reduction in government debt through tax hikes (solid lines) and expenditure cuts (dashed lines; deviations from baseline)

solution to help reduce global imbalances would be to raise the growth potential—hampered by deep-seated structural rigidities—in these regions through further structural reforms. Namely, policies aimed at lowering barriers to competition, enhancing flexibility in employment and production practices, raising labor utilization, and reducing distortions in labor and product markets could substantially improve growth prospects, boost domestic demand, and attract foreign investors. Some have challenged the notion that structural reforms would do much at all and may even exacerbate global imbalances, given that they may weigh on consumer confidence (and spending) over drawn-out transitions typical of structural change episodes.

To evaluate these viewpoints, we study scenarios of reducing labor and product market distortions (i.e., markups) in JE following Bayoumi, Laxton, and Pesenti (2004). Labor market reforms alone (not shown) can have minimal effects on reducing high domestic net saving, particularly if uncertainty over reforms further weighed on households. However, credible product market reforms can offer strong complementary effects enhancing the impact of labor market reforms on growth and employment (and thereby confidence).[39] Moreover, the direct output effects from comparable product market reforms tend to be larger. Considering these reforms, figure 10.26 shows the effects of reducing price markups in both the tradables and nontradables sectors in JE gradually to US levels over a ten-year period. Growth rises significantly in JE with some small spillovers to the rest of the world. Note that accommodative monetary policy in JE lends further support to domestic demand during the structural adjustment toward higher economic activity.

The simulations presented in figure 10.26 include a permanent 6 percentage point reduction in the desired NFA to GDP ratios—akin to the implications of higher productivity—in JE as well as an increase in desired NFA positions in other countries. The solid lines are based on the shifts in the long-run desired NFA positions that obtain under the same simulation experiment in GFM, while the dashed lines assumes that the United States alone would finance the increase in investment in JE through an increase in its desired NFA holdings. Obviously, if the effects on growth were more sustained and trend productivity growth were to increase, there could be even larger changes in the desired NFA positions.

10.6 Conclusion

Global imbalances are a complex, multifaceted issue, with potentially far-reaching implications for the global economy that should not be ignored. Concern about potential scenarios where the adjustment process could be costly to both the United States and the world economy has motivated several policymakers and analysts to demand credible and swift action to help mitigate the risks by reducing the magnitude of these imbalances. While predicting their future evolution cannot be done with any certitude, a better understanding of the likely conditions, causes, and consequences surrounding these external developments can guide key policies needed to help navigate economies toward a desirable resolution. Examining the implications, risks, and attendant policies attached to global rebal-

39. See, for example, IMF (2005) for evidence based on OECD countries.

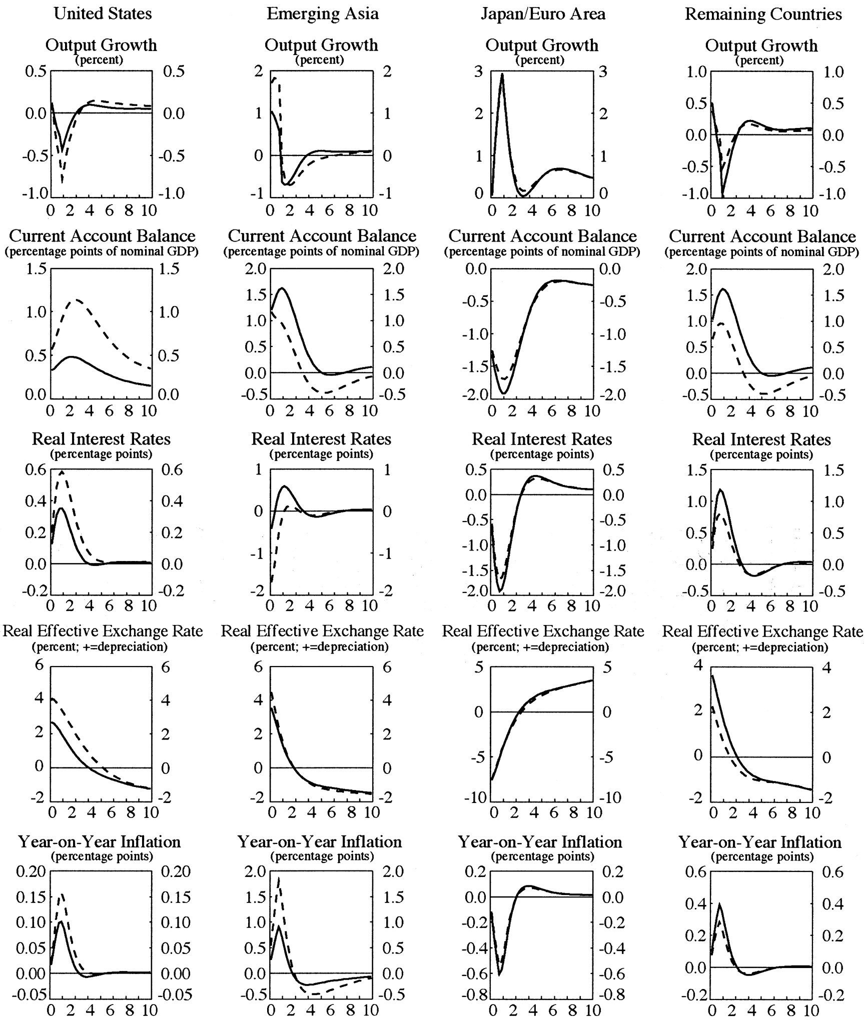

Fig. 10.26 Estimated effects of more competition friendly policies in Japan and the euro area: Financed by all other regional blocs (solid lines) and financed only by the United States (dashed lines; deviations from baseline)

ancing through the lens of a dynamic, multiregion model of the global economy, this analysis has yielded some useful insights in this regard.

Our baseline view is that steady global rebalancing with an orderly unwinding of financial positions and currency realignments—notably a gradual depreciation in the U.S. dollar—can be achieved. The challenge for policymakers at the national level is to help ensure this outcome that is in the collective interest. In this instance, the burden of adjustment will largely fall on the United States and AS in terms of reversing their past (net) national saving trends. This may require a committed U.S. fiscal consolidation through a combination of higher taxes and reining in government absorption. Supportive fiscal policies in AS, aimed at easing export competitiveness strains, could facilitate adjustment, aided by greater exchange rate flexibility that limited output and inflation variability. Although more uncertain, some normalization of private consumption rates (in opposing directions) in the two regions would further facilitate external adjustment.

Europe and Japan, for their part, could meaningfully contribute to the multilateral adjustment process through stronger pursuit of growth-enhancing structural reforms that align with their own national interests. Namely, policies aimed at addressing long-standing structural rigidities and distortions could substantially improve growth prospects, strengthen consumption and investment spending, and increase the attractiveness to foreign investors. Labor market reforms alone might not significantly contribute to rebalancing, especially if uncertainty about policy direction and resolve weighed on confidence. However, committed product market initiatives could complement these reforms to enhance confidence and further raise growth and domestic demand. Led by these competition friendly reforms and with structural adjustment supported by monetary policy, credible growth-enhancing measures tackling deep-seated structural impediments and distortions would boost domestic consumption and investment prospects, attract foreign capital, and thereby contribute to external rebalancing.

Far less benign adjustment scenarios are also quite conceivable. A more dangerous route, in the absence of underlying, broad-based adjustment in macroeconomic and structural policies, would rely on global financial markets to take a lead role. If mounting concerns over imbalances triggered sizable international portfolio shifts, a sudden loss of appetite for U.S. dollar assets could effect more drastic changes in interest and exchange rates, including a significantly weaker U.S. dollar. This is particularly the case if relaxed financial conditions were to give way, with harmful knock-on effects for global growth.

Appendix

Theoretical Framework

Introduction

The structure of the model has been introduced in section 10.2 and illustrated in figure 10.2. Needless to say, the model is fairly complex even though it abstracts from a number of issues (such as trade in oil, commodities and other upstream intermediate inputs, distribution costs,[40] as well as balance-sheet and revaluation effects stemming from asymmetries in the currency denomination of assets and liabilities across countries) of obvious relevance for the analysis of the international transmission mechanism. In what follows we provide a brief but comprehensive overview of the model. In some sections we focus on country-specific equations that are independent of foreign variables, thus qualitatively similar across countries. We therefore drop country indexes for notational simplicity, with the understanding that all four countries are analogously characterized. In the sections involving international transactions, instead, we explicitly incorporate country indexes in our notation. As a general convention throughout the model, when we state that variable X follows an autoregressive process, we mean that

$$X_t = (1 - \lambda_X)X + \lambda_X X_{t-1} + e_{X,t}, \tag{A1}$$

where $0 < \lambda_X < 1$, X is the steady-state value of X_t, and $e_{X,t}$ is a shock.

Final Goods

In each country there is a continuum of symmetric firms producing the two final goods, A (the consumption good) and E (the investment good) under perfect competition.

Consider first the consumption sector. Each firm is indexed by $x \in [0, s]$, where $0 < s < 1$ is the country size. Firm x's output at time (quarter) t is denoted $A_t(x)$. The consumption good is produced with the following nested constant elasticity of substitution (CES) technology:

$$\begin{aligned} A_t(x)^{1-(1/\varepsilon_A)} = {} & (1 - \gamma_{A,t})^{1/\varepsilon_A} N_{A,t}(x)^{1-(1/\varepsilon_A)} + \gamma_{A,t}^{1/\varepsilon_A}[\nu_A^{1/\mu_A} Q_{A,t}(x)^{1-(1/\mu_A)} \\ & + (1 - \nu_A)^{1/\mu_A} M_{A,t}(x)^{1-(1/\mu_A)}]^{\{[\mu_A/(\mu_A-1)][1-(1/\varepsilon_A)]\}} \end{aligned} \tag{A2}$$

Three intermediate inputs are used in the production of the consumption good A: a basket N_A of nontradable goods, a basket Q_A of domestic tradable goods, and a basket M_A of imported goods. The elasticity of substitution between tradables and nontradables is $\varepsilon_A > 0$, and the elasticity of substitution between domestic and imported tradables is $\mu_A > 0$, and the elasticity of substitution between domestic and imported tradables is $\mu_A > 0$. The weights of the three inputs are, respectively, $1 - \gamma_A$, $\gamma_A \nu_A$ and $\gamma_A(1 - \nu_A)$ with $0 < \gamma_A, \nu_A < 1$.

Firm x takes as given the prices of the three inputs and minimizes its costs subject to the technological constraint (A2). As a convention throughout the model, A is the *numeraire* of the economy, and all national prices are expressed in terms of domestic consumption units, that is, rela-

40. The reader interested in these two features is referred to the variant of the model considered in Laxton and Pesenti (2003).

tive to the Consumer Price Index (CPI).[41] Cost minimization implies that firm x's demands for intermediate inputs are

$$N_{A,t}(x) = (1 - \gamma_{A,t})p_{N,t}^{-\varepsilon_A}A_t(x) \tag{A3}$$

$$Q_{A,t}(x) = \gamma_{A,t}\nu_A p_{Q,t}^{-\mu_A}p_{XA,t}^{\mu_A-\varepsilon_A}A_t(x) \tag{A4}$$

$$M_{A,t}(x) = \gamma_{A,t}(1 - \nu_A)p_{MA,t}^{-\mu_A}p_{XA,t}^{\mu_A-\varepsilon_A}A_t(x), \tag{A5}$$

where p_N, p_Q and p_{MA} are the relative prices of the inputs in terms of consumption baskets and p_{XA} is the price of the composite basket of domestic and foreign tradables, or

$$p_{XA,t} \equiv [\nu_A p_{Q,t}^{1-\mu_A} + (1 - \nu_A)p_{MA,t}^{1-\mu_A}]^{1/(1-\mu_A)}. \tag{A6}$$

The technologies of production of consumption and investment goods can be quantitatively different but their formal characterizations are similar, with self-explanatory changes in notation. For instance, a firm $e \in [0, s]$, that produces the investment good, demands nontradable goods according to

$$N_{E,t}(e) = (1 - \gamma_{E,t})\frac{p_{N,t}}{p_{E,t}^{-\varepsilon_E}}E_t. \tag{A7}$$

Note that p_{MA} and p_{ME} are sector specific as they reflect the different composition of imports in the two sectors, while p_N and p_Q are identical across sectors.

Demand for Domestic Intermediate Goods

Consider now the composition of the baskets of intermediate goods. Intermediate inputs come in different varieties (brands) and are produced under conditions of monopolistic competition. In each country there are two kinds of intermediate goods, tradables and nontradables. Each kind is defined over a continuum of mass s. Without loss of generality, we assume that each nontradable good is produced by a single domestic firm indexed by $n \in [0, s]$, and each tradable good is produced by a firm $h \in [0, s]$.

Focusing first on the basket N_A, this is a CES index of all domestic varieties of nontradables. Denoting as $N_A(n, x)$ the demand by firm x of an intermediate good produced by firm n, the basket $N_A(x)$ is

$$N_{A,t}(x) = \left[\left(\frac{1}{s}\right)^{1/\theta_{N,t}} \int_0^s N_{A,t}(n, x)^{1-(1/\theta_{N,t})}dn\right]^{\theta_{N,t}/(\theta_{N,t}-1)}, \tag{A8}$$

where $\theta_{N,t} > 1$ denotes the elasticity of substitution among intermediate nontradables.

41. The transformation of all prices in relative terms and all quantities in detrended terms is motivated by the desire to avoid dealing with unit roots, either nominal or real, in quantitative simulations of the model over very long time horizons.

Firm x takes as given the prices of the nontradable goods $p(n)$. Cost minimization implies

(A9)
$$N_{A,t}(n, x) = \frac{1}{s}\left[\frac{p_t(n)}{p_{N,t}}\right]^{-\theta_{N,t}} N_{A,t}(x),$$

where p_N is the price of one unit of the nontradable basket, or

(A10)
$$p_{N,t} = \left[\left(\frac{1}{s}\right)\int_0^s p_t(n)^{1-\theta_{N,t}} dn\right]^{1/(1-\theta_{N,t})}.$$

The basket N_E is similarly characterized. Aggregating across firms,[42] and accounting for public demand of nontradables—here assumed to have the same composition as private demand—we obtain the total demand for good n as

(A11)
$$\int_0^s N_{A,t}(n, x)dx + \int_0^s N_{E,t}(n, e)de + G_{N,t}(n)$$
$$= \left[\frac{p_t(n)}{p_{N,t}}\right]^{-\theta_{N,t}} (N_{A,t} + N_{E,t} + G_{N,t}).$$

Following the same steps, we can derive the domestic demand schedules for the intermediate goods h:

(A12)
$$\int_0^s Q_{A,t}(h, x)dx + \int_0^s Q_{E,t}(h, e)de = \left[\frac{p_t(h)}{p_{Q,t}}\right]^{-\theta_{T,t}} (Q_{A,t} + Q_{E,t}).$$

Demand for Imports

The derivation of the foreign demand schedule for good h is analytically more complex but, as we show in (A21) at the end of this section, it shares the same functional form as (A11) and (A12) and can be written as a function of the relative price of good h (with elasticity $\theta_{T,t}$) and total foreign demand for imports.

Let's focus first on import demand in the consumption-good sector. Because we deal with goods produced in different countries, we need to introduce explicit country indexes in our notation. Thus, in this section we will refer to a specific country as H, to the other countries as $\text{CO} \neq H$, and to the representative firm in the consumption sector as $x^H \in [0, s^H]$. Its imports $M_A^H(x^H)$ are a CES function of baskets of goods imported from the other countries, or

(A13)
$$M_{A,t}^H(x^H)^{1-(1/\rho_A^H)} = \sum_{\text{CO}\neq H} (b_A^{H,\text{CO}})^{1/\rho_A^H}\{M_{A,t}^{H,\text{CO}}(x^H)[1 - \Gamma_{MA,t}^{H,\text{CO}}(x^H)]\}^{1-(1/\rho_A^H)},$$

where

42. The convention throughout the model is that variables that are not explicitly indexed (to firms or households) are expressed in per capita (average) terms. For instance, $A_t \equiv (1/s) \int_0^s A_t(x)dx$.

$$\text{(A14)} \qquad 0 \leq b^{H,\mathrm{CO}} \leq 1, \sum_{\mathrm{CO} \neq H} b^{H,\mathrm{CO}} = 1.$$

In (A13), ρ_A^H is the elasticity of import substitution across countries: the higher is ρ_A^H, the easier it is for firm x^H to substitute imports from one country with imports from another. The parameters $b_A^{H,CO}$ determine the composition of the import basket across countries. $M_A^{H,\mathrm{CO}}(x^H)$ denotes imports of country H's firm x^H from country CO.

The response of imports to changes in fundamentals and their price elasticities are typically observed to be smaller in the short term than in the long run. To model realistic dynamics of imports volumes (such as delayed and sluggish adjustment to changes in relative prices), we assume that imports are subject to adjustment costs $\Gamma_{MA}^{H,\mathrm{CO}}$. These costs are specified in terms of import shares relative to firm x^H's output and can be different across exporters. They are zero in steady state. Specifically, we adopt the parameterization:

$$\text{(A15)} \qquad \Gamma_{MA,t}^{H,\mathrm{CO}} \frac{M_{A,t}^{H,\mathrm{CO}}(x^H)/A_t^H(x^H)}{M_{A,t-1}^{H,\mathrm{CO}}/A_{t-1}^H}$$

$$= \frac{\phi_{MA}^{H,\mathrm{CO}}}{2} \frac{\{[M_{A,t}^{H,\mathrm{CO}}(x^H)/A_t^H(x^H)]/[M_{A,t-1}^{H,\mathrm{CO}}/A_{t-1}^H] - 1\}^2}{(1 + \{[M_{A,t}^{H,\mathrm{CO}}(x^H)/A_t^H(x^H)]/(M_{A,t-1}^{H,\mathrm{CO}}/A_{t-1}^H) - 1\}^2)},$$

such that $\Gamma_{MA}^{H,\mathrm{CO}}(1) = 0$, $\Gamma_{MA}^{H,\mathrm{CO}}(\infty) = \phi_{MA}^{H,\mathrm{CO}}/2$ and $\Gamma_{MA}^{H,\mathrm{CO}}(0) = \Gamma_{MA}^{H,\mathrm{CO}}(2) = \phi_{MA}^{H,\mathrm{CO}}/4$.[43]

Denoting $p_M^{H,\mathrm{CO}}$ the price in country H of a basket of intermediate inputs imported from CO, cost minimization implies

$$\text{(A16)} \qquad \frac{M_{A,t}^{H,\mathrm{CO}}(x^H)[1 - \Gamma_{MA,t}^{H,\mathrm{CO}}(x^H)]}{[1 - \Gamma_{MA,t}^{H,\mathrm{CO}}(x^H) - M_{A,t}^{H,\mathrm{CO}}(x^H)\Gamma'^{H,\mathrm{CO}}_{MA,t}(x^H)]^{\rho_A^H}}$$

$$= b_A^{H,\mathrm{CO}} \left[\frac{p_{M,t}^{H,\mathrm{CO}}}{p_{MA,t}^H(x^H)} \right]^{-\rho_A^H} M_{A,t}^H(x^H),$$

where $\Gamma'^{H,\mathrm{CO}}_{MA}(x^H)$ is the first derivative of $\Gamma_{MA}^{H,\mathrm{CO}}(x^H)$ with respect to $M_A^{H,\mathrm{CO}}(x^H)$. The import price in the consumption sector, p_{MA}^H, is defined as

$$\text{(A17)} \qquad p_{MA,t}^H(x^H)$$

$$= \left\{ \sum_{\mathrm{CO} \neq H} b^{H,\mathrm{CO}} \left[\frac{p_{M,t}^{H,\mathrm{CO}}}{1 - \Gamma_{MA,t}^{H,\mathrm{CO}}(x^H) - M_{A,t}^{H,\mathrm{CO}}(x^H)\Gamma'^{H,\mathrm{CO}}_{MA,t}(x^H)} \right]^{1-\rho_A^H} \right\}^{1/(1-\rho_A^H)}.$$

In principle, the cost-minimizing import price $p_{MA}^H(x^H)$ is firm specific, as it depends on firm x^H's import share. To the extent that all firms x^H are sym-

43. Relative to the quadratic specification adopted, for example, in Laxton and Pesenti (2003), this parameterization of import adjustment costs allows the nonlinear model to deal with potentially large shocks.

metric within the consumption sector, however, there will be a unique import price p^H_{MA}.[44]

Let's now consider the basket $M^{H,\text{CO}}_A(x^H)$ in some detail. In analogy with (A8), it is a CES index of all varieties of tradable intermediate goods produced by firms h^{CO} operating in country CO and exported to country H. Denoting as $M^{H,\text{CO}}_A(h^{\text{CO}}, x^H)$ the demand by firm x^H of an intermediate good produced by firm h^{CO}, the basket $M^{H,\text{CO}}_A(x^H)$ is

$$\text{(A18)}\quad M^{H,\text{CO}}_{A,t}(x^H) = \left[\left(\frac{1}{s^{\text{CO}}}\right)^{1/\theta^{\text{CO}}_{T,t}} \int_0^{s^{\text{CO}}} M^{H,\text{CO}}_{A,t}(h^{\text{CO}}, x^H)^{1-(1/\theta^{\text{CO}}_{T,t})} dh^{\text{CO}}\right]^{\theta^{\text{CO}}_{T,t}/(\theta^{\text{CO}}_{T,t}-1)},$$

where $\theta^{\text{CO}}_T > 1$ is the elasticity of substitution among intermediate tradables, the same elasticity entering (A12) in country CO.

The cost-minimizing firm x^H takes as given the prices of the imported goods $p^H(h^{\text{CO}})$ and determines its demand of good h^{CO} according to

$$\text{(A19)}\qquad M^{H,\text{CO}}_{A,t}(h^{\text{CO}}, x^H) = \frac{1}{s^{\text{CO}}}\left[\frac{p^H_t(h^{\text{CO}})}{p^{H,\text{CO}}_{M,t}}\right]^{-\theta^{\text{CO}}_{T,t}} M^{H,\text{CO}}_{A,t}(x^H),$$

where $M^{H,\text{CO}}_{A,t}(x^H)$ has been defined in (A16) and $p^{H,\text{CO}}_M$ is

$$\text{(A20)}\qquad p^{H,\text{CO}}_{M,t} = \left[\left(\frac{1}{s^{\text{CO}}}\right)\int_0^{s^{\text{CO}}} p^H_t(h^{\text{CO}})^{1-\theta^{\text{CO}}_{T,t}} dh^{\text{CO}}\right]^{1/(1-\theta^{\text{CO}}_{T,t})}.$$

The import demand schedules in the investment-good sector can be derived in perfect analogy with the preceding analysis. As a last step, we can derive country CO's demand schedule for country H's intermediate good h^H, that is, the analog of (A12). Aggregating across firms (and paying attention to the order of the country indexes) we obtain the following:

$$\text{(A21)}\qquad \int_0^{s^{\text{CO}}} \mathrm{M}^{\text{CO},H}_{A,t}(h^H, x^{\text{CO}})dx^{\text{CO}} + \int_0^{s^{\text{CO}}} M^{\text{CO},H}_{E,t}(h^H, e^{\text{CO}})de^{\text{CO}}$$
$$= \frac{s^{\text{CO}}}{s^H}\left(\frac{p^{\text{CO}}_t(h^H)}{p^{\text{CO},H}_{M,t}}\right)^{-\theta^H_{T,t}}(M^{\text{CO},H}_{A,t} + M^{\text{CO},H}_{E,t})$$

Supply of Intermediate Goods

The nontradable n is produced with the following CES technology:

$$\text{(A22)}\quad N_t(n) = Z_{N,t}[(1-\alpha_N)^{1/\xi_N}\ell_t(n)^{1-(1/\xi_N)} + \alpha_N^{1/\xi_N}K_t(n)^{1-(1/\xi_N)}]^{\xi_N/(\xi_N-1)}$$

Firm n uses labor $\ell(n)$ and capital $K(n)$ to produce $N(n)$ units of its variety. $\xi_N > 0$ is the elasticity of input substitution, and Z_N is a productivity shock common to all producers of nontradables.[45]

44. It follows that $p^H_{MA}M^H_A = \Sigma_{\text{CO}\neq H}\, p^{H,\text{CO}}_M M^{H,\text{CO}}_A(1-\Gamma^{H,\text{CO}}_{MA})/(1-\Gamma^{H,\text{CO}}_{MA} - M^{H,\text{CO}}_{MA}\Gamma'^{H,\text{CO}}_{MA})$

45. Recall that a *productivity shock* is defined as a deviation from the common world trend. Variants of the model allow for the possibility of shocks to labor productivity or capital productivity instead of total factor productivity.

Defining as w_t and r_t the prices of labor and capital, the marginal cost in nontradables production is[46]

$$mc_t(n) = \frac{[(1-\alpha_N)w_t^{1-\xi_N} + \alpha_N r_t^{1-\xi_N}]^{1/(1-\xi_N)}}{Z_{N,t}}, \tag{A23}$$

and the capital-labor ratio is

$$\frac{K_t(n)}{\ell_t(n)} = \frac{\alpha_N}{1-\alpha_N}\left(\frac{r_t}{w_t}\right)^{-\xi_N}. \tag{A24}$$

Labor inputs are differentiated and come in different varieties (skills). They are defined over a continuum of mass equal to the country size and indexed by $j \in [0, s]$. Each firm n uses a CES combination of labor inputs

$$\ell_t(n) = \left[\left(\frac{1}{s}\right)^{1/\psi_t}\int_0^s \ell(n,j)^{1-(1/\psi_t)}dj\right]^{\psi_t/(\psi_t-1)}, \tag{A25}$$

where $\ell(n,j)$ is the demand of labor input of type j by the producer of good n, and $\psi > 1$ is the elasticity of substitution among labor inputs. Cost minimization implies that $\ell(n,j)$ is a function of the relative wage

$$\ell_t(n,j) = \left(\frac{1}{s}\right)\left[\frac{w_t(j)}{w_t}\right]^{-\psi_t}\ell_t(n), \tag{A26}$$

where $w(j)$ is the wage paid to labor input j, and the wage index w is defined as

$$w_t = \left[\left(\frac{1}{s}\right)\int_0^s w_t(j)^{1-\psi_t}dj\right]^{1/(1-\psi_t)}. \tag{A27}$$

Similar considerations hold for the production of tradables. We denote by $T(h)$ the supply of each intermediate tradable h. Using self-explanatory notation, we have

$$T_t(h) = Z_{T,t}[(1-\alpha_T)^{1/\xi_T}\ell_t(h)^{1-(1/\xi_T)} + \alpha_T^{1/\xi_T}K_t(h)^{1-(1/\xi_T)}]^{\xi_T/(\xi_T-1)}, \tag{A28}$$

where Z_T is an autoregressive process (in logarithm). Aggregating across firms, we obtain the total demand for labor input j as

$$\int_0^s \ell_t(n,j)dn + \int_0^s \ell_t(h,j)dh \tag{A29}$$

$$= \left[\frac{w_t(j)}{w_t}\right]^{-\psi_t}\left(\frac{1}{s}\right)\left[\int_0^s \ell_t(n)dn + \int_0^s \ell_t(h)dh\right] \equiv \left[\frac{w_t(j)}{w_t}\right]^{-\psi_t}\ell_t,$$

where ℓ is per capita total labor in the economy.

46. Following the notational convention regarding prices, mc_t, w_t, and r_t denote marginal costs, wages, and rental rates in consumption units.

Price Setting in the Nontradables Sector

Consider now profit maximization in the intermediate nontradables sector. Each firm n takes into account the demand (A11) for its product and sets its nominal price by maximizing the present discounted value of real profits. There are costs of nominal price adjustment measured in terms of total profits forgone. The adjustment cost is denoted $\Gamma_{PN,t}[p_t(n), p_{t-1}(n)]$.[47]

The price-setting problem is then characterized as

$$\text{(A30)}\quad \max_{p_t(n)} \mathrm{E}_t \sum_{\tau=t}^{\infty} D_{t,\tau}\pi_{t,\tau}g_{t,\tau}[p_\tau(n) - mc_\tau(n)] \cdot \left[\frac{p_\tau(n)}{p_{N,\tau}}\right]^{-\theta_{N,\tau}}(N_{A,\tau} + N_{E,\tau} + G_{N,\tau})[1 - \Gamma_{PN,\tau}(n)],$$

where $D_{t,\tau}$(with $D_{t,t} = 1$) is the appropriate discount rate, to be defined in equation (A48). As real variables are detrended and prices are deflated by the CPI, equation (A30) includes $\pi_{t,\tau}$, the CPI inflation rate between time t and time τ, and $g_{t,\tau}$, the rate of growth of the global trend between t and τ.

As firms n are symmetric and charge the same equilibrium price $p(n) = p_N$, the first-order condition can be written as

$$\text{(A31)}\quad 0 = [1 - \Gamma_{PN,t}(n)][p_t(n)(1 - \theta_{N,t}) + \theta_{N,t}mc_t(n)] - [p_t(n) - mc_t(n)] \cdot \frac{\partial\Gamma_{PN,t}}{\partial p_t(n)}p_t(n) - \mathrm{E}_t D_{t,t+1}\pi_{t,t+1}g_{t,t+1}[p_{t+1}(n) - mc_{t+1}(n)] \cdot \frac{N_{A,t+1} + N_{E,t+1} + G_{N,t+1}}{N_{A,t} + N_{E,t} + G_{N,t}}\frac{\partial\Gamma_{PN,t+1}}{\partial p_t(n)}p_t(n).$$

Interpreting the previous equation, when prices are fully flexible ($\Gamma_{PN} = 0$), the optimization problem collapses to the standard markup rule:

$$\text{(A32)}\quad p_t(n) = \frac{\theta_{N,t}}{\theta_{N,t} - 1}mc_t(n),$$

where the gross markup is a negative function of the elasticity of input substitution. Deviations from markup pricing occur if firms are penalized for modifying their prices in the short term. The speed of adjustment in response to shocks depends on the trade-off between current and future expected costs, making the price-setting process forward-looking.

47. It is worth emphasizing that the adjustment costs are related to changes in nominal prices. However, the maximization problem can be carried out in terms of relative prices. In fact, denote with $G_{PN,t}[P_t(n), P_{t-1}(n)]$ the adjustment cost as a function of nominal (i.e., non-deflated by the CPI) prices $P_t(n)$ and $P_{t-1}(n)$, with $G_{PN,t}[P_t(n), P_{t-1}(n)] = \Gamma_{PN,t}[p_t(n), p_{t-1}(n)]$, and express the price-setting problem in nominal terms. It is easy to verify that the first-order condition of the new problem coincides with (A31) as $P_t(n)\partial G_{PN,t}/\partial P_t(n) = p_t(n)\partial\Gamma_{PN,t}/\partial p_t(n)$ and $P_t(n)\partial G_{PN,t+1}(\partial P_t(n) = p_t(n)\partial\Gamma_{PN,t+1}/\partial p_t(n)$.

The specific parameterization we adopt allows the model to reproduce realistic nominal dynamics:

$$\text{(A33)} \qquad \Gamma_{PN,t}(n) \equiv \frac{\phi_{PN}}{2}\left[\pi_{t-1,t}\frac{p_t(n)/p_{t-1}(n)}{\Pi_{t-4,t}^{0.25}} - 1\right]^2$$

The adjustment cost is related to changes of the nominal price of nontradable n relative to the inflation target for the CPI, $\Pi_{t-4,t}$. The inflation target is specified in annualized terms (hence indexed by $t-4$, t), while changes in $p(n)$ occur at a quarterly frequency.[48] Underlying this specification is the notion that firms should not be penalized when their price hikes are indexed to some (publicly observable) benchmark, such as the inflation target for the economy as a whole.

Price Setting in the Tradables Sector and Exchange Rate Pass-Through

Consider now the price-setting problem in the tradables sector. To the extent that the four country blocs represent segmented markets in the global economy, each firm h has to set four prices, one in the domestic market and the other three in the export markets. Exports are invoiced (and prices are set) in the currency of the destination market. As we reintroduce export markets, once again our notation needs to make explicit the country indexes. In what follows we use the index CO for a generic country and denote as H the country where the exporting firm h^H is located.

Accounting for (A21), the four price-setting problems of firm h in country H can then be characterized as follows:

$$\text{(A34)} \quad \max_{p_t^{\mathrm{CO}}(h^H)} \sum_{\mathrm{CO}} \mathrm{E}_t \sum_{\tau=t}^{\infty} D_{t,\tau}^H \pi_{t,\tau}^H g_{t,\tau}[\varepsilon_\tau^{H,\mathrm{CO}} p_\tau^{\mathrm{CO}}(h^H) - mc_\tau^H(h^H)]$$
$$\cdot \frac{s^{\mathrm{CO}}}{s^H}\left[\frac{p_\tau^{\mathrm{CO}}(h^H)}{p_{M,\tau}^{\mathrm{CO},H}}\right]^{-\theta_{T,\tau}^H}(M_{A,\tau}^{\mathrm{CO},H} + M_{E,\tau}^{\mathrm{CO},H})[1 - \Gamma_{PM,\tau}^{\mathrm{CO},H}(h)]$$

When $H \neq \mathrm{CO}$, recall that $p^{\mathrm{CO}}(h^H)$ is the price of good h^H in country CO, $p_M^{\mathrm{CO},H}$ is the price of country CO's imports from country H, and $M_A^{\mathrm{CO},H} + M_E^{\mathrm{CO},H}$ are country CO's imports from country H. The term ε^H,CO is the bilateral real exchange rate between country H and country CO (an increase in ε^H,CO represents a depreciation of country H's currency against country CO),[49] and $\Gamma_{PM}^{H,\mathrm{CO}}(h^H)$ are adjustment costs related to changes of the price of good h^H in country CO. These costs are the analogs of (A33):

48. This specification implies that the inflation target is known at any point in time. More generally, the adjustment cost could be specified relative to any variable that converges asymptotically to the steady-state inflation rate.

49. All exchange rates are quoted in real terms, that is, in relative consumption units. Of course, $\varepsilon^{H,\mathrm{CO}} = 1/\varepsilon^{\mathrm{CO},H}$ and $\varepsilon^{H,H} = 1$.

$$\text{(A35)} \qquad \Gamma^{CO,H}_{PM,t}(h^H) \equiv \frac{\phi^{CO,H}_{PM}}{2}\left[\pi^{CO}_{t-1,t}\frac{p^{CO}_t(h^H)/p^{CO}_{t-1}(h^H)}{(\Pi^{CO}_{t-4,t})^{0.25}} - 1\right]^2$$

For the domestic prices of tradables $p^H(h^H)$ we still use (A34) with CO = H, adopting the notational conventions $p^{H,H}_M = p^H_Q$, $M^{H,H}_A = Q^H_A$ and $M^{H,H}_E = Q^H_E$ as described in (A12), and $\Gamma^{H,H}_{PM} = \Gamma^H_{PQ}$.

Despite its fastidiousness, the notation above is straightforward and the equations are self-explanatory. Profit maximization yields:

$$\begin{aligned}\text{(A36)} \quad 0 = {} & [1 - \Gamma^{CO,H}_{PM,t}(h^H)][\varepsilon^{H,CO}_t p^{CO}_t(h^H)(1 - \theta^H_{T,t}) + \theta^H_{T,t} mc^H_t(h^H)] \\ & - [\varepsilon^{H,CO}_t p^{CO}_t(h^H) - mc^H_t(h^H)]\frac{\partial \Gamma^{CO,H}_{PM,t}}{\partial p^{CO}_t(h^H)} p^{CO}_t(h^H) - \mathrm{E}_t\Bigg\{D^H_{t,t+1}\pi^H_{t,t+1}g_{t,t+1} \\ & \cdot [\varepsilon^{H,CO}_{t+1} p^{CO}_{t+1}(h^H) - mc^H_{t+1}(h^H)]\left(\frac{M^{CO,H}_{A,t+1} + M^{CO,H}_{E,t+1}}{M^{CO,H}_{A,t} + M^{CO,H}_{E,t}}\right)\frac{\partial \Gamma^{CO,H}_{PM,t+1}}{\partial p^{CO}_t(h^H)} p^{CO}_t(h^H)\Bigg\}\end{aligned}$$

If adjustment costs in the export market are highly relevant (that is, if the $\phi^{CO,H}_{PM}$ coefficient is relatively large), the prices of country H's goods in the foreign markets are characterized by significant stickiness in local currency. In this case, the degree to which exchange rate movements (and other shocks to marginal costs in country H) through import prices in country CO is rather small. If instead the $\phi^{CO,H}_{PM}$ coefficients are zero worldwide, expression (A36) collapses to a markup rule under the law of one price, and exchange rate pass-through is full:

$$\text{(A37)} \quad p^{H,H}_t(h^H) = p^H_{Q,t} = \varepsilon^{H,CO}_t p^{CO}_t(h^H) = \varepsilon^{H,CO}_t p^{CO,H}_{M,t} = \frac{\theta^H_{T,t}}{\theta^H_{T,t} - 1} mc_t$$

Consumer Preferences

In each country there is a continuum of households indexed by $j \in [0, s]$, the same index of labor inputs. Some households have access to capital markets; some do not. The latter finance their consumption by relying exclusively on their labor incomes. We refer to the first type as *Ricardian* or *forward-looking;* they represent a share $(1 - s_{LC})$ of domestic households and are indexed by $j \in [0, s\,(1 - s_{LC})]$. We refer to the second type as *non-Ricardian* or *liquidity-constrained;* they represent a share s_{LC} of domestic households and are indexed by $j \in [s(1 - s_{LC}), s]$.

The specification of households' preferences adopts the GHH (1988) utility function, adjusted for habit formation. Denoting with $W_t(j)$ the lifetime expected utility of household j, we have:

$$\text{(A38)} \qquad W_t(j) \equiv \mathrm{E}_t \sum_{\tau=t}^{\infty} \beta_{t,\tau} g^{1-\sigma}_{t,\tau} u_\tau[C_\tau(j), \ell_\tau(j)],$$

where the instantaneous felicity is a function of detrended consumption C and labor effort ℓ:

$$u_t[C_t(j), \ell_t(j)] = Z_U\left(1 - \frac{b_c}{g_{t-1,t}}\right)\left(\frac{1-b_t}{1-\sigma}\right) \tag{A39}$$
$$\cdot \left\{\frac{C_t(j) - b_c C_{j,t-1}/g_{t-1,t}}{1 - b_c/g_{t-1,t}} - \frac{Z_V}{1+\zeta}\left[\frac{\ell_t(j) - b_\ell \ell_{j,t-1}}{1-b_\ell}\right]^{1+\zeta}\right\}^{1-\sigma}$$

In the preceding expressions, $\beta_{t,\tau}$ is the discount rate between time t and time τ, possibly different across countries. As mentioned in section 10.2, because of technological progress associated with home production activities (here related to the global trend), the term $g_{t,\tau}^{1-\sigma}$ in (A38) implies that the disutility of labor effort increases with the common trend.[50] The parameter σ in (A38) and (A39) is the reciprocal of the elasticity of intertemporal substitution. The parameter ζ, which affects the curvature of labor disutility, is the reciprocal of the Frisch elasticity.

There is habit persistence in consumption with coefficient $0 < b_c < 1$. The term $C_{j,t-1}$ in (A39) is past per capita consumption of household j's peers, (i.e., either forward-looking or liquidity-constrained agents). Similarly, there is habit persistence in leisure with coefficient $0 < b_\ell < 1$.[51] The terms Z_U and Z_V are constants. Households' preferences are therefore symmetric within their respective categories but, because of different reference groups in habit formation, they are not symmetric across categories.

Budget Constraint (Ricardian Households)

The individual flow budget constraint for Ricardian agent $j \in [0, (1 - s_{LC})s]$ is

$$B_t(j) + \varepsilon_t B_t^*(j) \leq (1 + i_{t-1})\frac{B_{t-1}(j)}{\pi_{t-1,t}g_{t-1,t}} \tag{A40}$$
$$+ (1 + i_{t-1}^*)[1 - \Gamma_{B,t-1}]\frac{\varepsilon_t B_{t-1}^*(j)}{\pi_{t-1,t}^{US}g_{t-1,t}}$$
$$+ (1 - \tau_{K,t})r_t K_t(j) + (1 - \tau_{L,t})w_t(j)\ell_t(j)[1 - \Gamma_{W,t}(j)]$$
$$- C_t(j) - p_{E,t}I_t(j) + \Phi_t(j) - TT_t(j).$$

Households hold two nominal bonds, denominated in domestic and US currency, respectively.[52] In terms of our notation, $B_t(j)$ is (detrended) hold-

50. The restriction $\beta_{t,\tau} g_{t,\tau}^{1-\sigma} < 1$ is imposed to ensure that utility is bounded.

51. The instantaneous felicity is normalized such that in a steady state U, U_C and U_ℓ can all be written as constant $\times f(C, \ell)$, where f is some function of steady-state consumption and labor effort, independent of the habit persistence coefficients.

52. The choice of currency denomination of the international bond is arbitrary. With a simple redefinition of the relevant variables, one could think of B^* in terms of any available currency or basket of currencies.

ings of domestic bond by household j, expressed in terms of domestic consumption units, $B_t^*(j)$ is (detrended) holdings of the international bond, expressed in terms of US consumption units, and ε_t is the CPI-based real exchange rate, expressed as the price of one US consumption basket in terms of domestic consumption.[53]

The short-term nominal rates i_t and i_t^* are paid at the beginning of period $t + 1$ and are known at time t. The two rates are directly controlled by their respective national governments. Only the US-currency bond is traded internationally: the US bond is in zero net supply worldwide, while the domestic bond is issued by the local government.[54] It follows that the net financial wealth of Ricardian household j at time t is

$$F_t(j) \equiv (1 + i_{t-1}^*)(1 - \Gamma_{B,t-1}) \frac{\varepsilon_t B_{t-1}^*(j)}{\pi_{t-1,t}^{\mathrm{US}} g_{t-1,t}}. \tag{A41}$$

A financial friction Γ_B is introduced to guarantee that international net asset positions follow a stationary process and the economies converge asymptotically to a well-defined steady state.[55] Agents who take a position in the international bond market must deal with financial intermediaries who charge a transaction fee Γ_B on sales or purchases of the international bond.[56] This transaction cost is a function of the average net asset position of the whole economy. Specifically, we adopt the following functional form:

$$1 - \Gamma_{B,t} = \left\{1 - \phi_{B1} \frac{\exp[\phi_{B2}(\varepsilon_t B_t^*/\mathrm{GDP}_t - b_{\mathrm{FDES},t}^*)] - 1}{\exp[\phi_{B2}(\varepsilon_t B_t^*/\mathrm{GDP}_t - b_{\mathrm{FDES},t}^*)] + 1} - Z_{B,t}\right\} \frac{\beta_t^{\mathrm{US}}}{\beta_t}, \tag{A42}$$

where $0 \leq \phi_{B1} \leq 1$, $\phi_{B2} > 0$, and $\varepsilon_t B^* \equiv (1/s)\varepsilon_t \int_0^{s(1-s_{\mathrm{LC}})} B^*(j)dj$ represents the per capita net asset position of the country in consumption units. The term b_{FDES}^* is the desired net asset position of the country expressed as a ratio of GDP.[57] This variable measures the degree of international exposure that financial intermediaries consider appropriate for the economy, based on their assessment of the economic outlook.

To understand the role played by Γ_B, suppose first that $b_{\mathrm{FDES}}^* = Z_B = 0$ and $\beta^{\mathrm{US}} = \beta$. In this case, when the net asset position of the country is equal

53. It is understood that ε is shorthand for $\varepsilon^{H,\mathrm{US}}$, where H denotes the country under consideration.

54. If the country under consideration is the US, $\varepsilon = 1$ and $i = i^*$.

55. See Ghironi, Talan, and Rebucci (2005) for an analysis of the steady-state distribution of NFAs with heterogeneous discounting.

56. In our model it is assumed that all intermediation firms are owned by the country's residents and that their revenue is rebated to domestic households in a lump-sum fashion. A simple variant of the model in which intermediation firms are owned by foreign residents leaves the basic results virtually unchanged. There are no intermediation costs for US residents entering the international bond market, that is, there is no difference between onshore and offshore US interest rates.

57. The concept of GDP in our model will be discussed in the following with reference to (A83).

to its desired level of zero, it must be the case that $\Gamma_B = 0$ and the return on the international bond is equal to $1 + i^*$. If the country is a net creditor worldwide Γ_B rises above zero, implying that the country's households lose an increasing fraction of their international bond returns to financial intermediaries. When holdings of the international bond go to infinity, the return on the international bond approaches $(1 + i^*)(1 - \phi_{B1})$. By the same token, if the country is a net debtor worldwide, Γ_B falls from zero to $-\phi_{B1}$, implying that households pay an increasing intermediation premium on their international debt. When net borrowing goes to infinity, the cost of borrowing approaches $(1 + i^*)(1 + \phi_{B1})$. The parameter ϕ_{B2} controls the flatness of the Γ_B function: if $\phi_{B2} = 0$, then $\Gamma_B = 0$ regardless of the net asset position; if ϕ_{B2} tends to infinity, then $1 - \Gamma_B = (1 - \phi_{B1})$ for any arbitrarily small net lending position, and $1 - \Gamma_B = (1 + \phi_{B1})$ for any arbitrarily small net borrowing position. An appropriate parameterization allows the model to generate realistic dynamics for net asset positions and current account.

Consider now the other components of (A42). The variable $Z_{B,t}$ is a shock.[58] In our framework uncertainty in international financial intermediation plays the same role that uncovered interest parity shocks or risk-premium fluctuations play in other open-economy models. Finally, when rates of time preference diverge across countries and $\beta^* \neq \beta$, the transaction cost is appropriately modified to account for asymmetries in real interest rates across countries.

The term b^*_{FDES} can be positive or negative. The preceding considerations are still valid after reinterpreting the concepts of net creditor or net borrower in terms of deviations from the desired levels. The desired net asset position in country H is characterized as follows:

$$\text{(A43)} \qquad b^{*H}_{\mathrm{FDES},t} = b^{*H}_{\mathrm{FNEUT}} - \phi^{H}_{F1}\frac{B^H_t}{\mathrm{GDP}^H_t} + \sum_{\mathrm{CO}\neq H} \phi^{\mathrm{CO},H}_{F2}\frac{B^{\mathrm{CO}}_T}{\mathrm{GDP}^{\mathrm{CO}}_t}$$

According to the previous expression, b^{*H}_{FDES} is a country-specific constant, b^{*H}_{FNEUT}, adjusted to account for changes in the debt-to-GDP ratios in either the domestic economy (B^H/GDP^H) or the rest of the world ($B^{\mathrm{CO}}/\mathrm{GDP}^{\mathrm{CO}}$).

This specification provides a plausible link between debt imbalances and net asset positions. When the national debt-to-GDP ratio increases, domestic agents reduce the share of foreign securities in their portfolios by selling the international bond to foreigners. By the same token, if the debt-to-GDP ratio increased in the US, investors in the rest of the world would require a higher return on US securities, leading to a higher share of US assets in their portfolios or a reduction of net borrowing from the US. Of course, our approach should be viewed only as a crude approximation to the actual determinants of cross-country spreads and interest rate premia

58. Fluctuations in Z_B cannot be large enough to push Γ_B above 1.

in response to macroeconomic imbalances, whose endogenization should be eventually incorporated in a self-contained model. It remains unclear, however, whether a framework that incorporates a large amount of complications from which we abstract here would add much to our qualitative conclusions. Quantitatively, one could take b^*_{FDES} as a free variable and estimate the ϕ_{F1} and ϕ_{F2} parameters on the basis of empirical evidence on the link between net asset positions and debt levels. Alternatively, one could rely on cross-fertilization with respect to alternative theoretical models able to shed light on the structural determinants of these parameters, as mentioned in the preceding.

Households accumulate physical capital which they rent to domestic firms at the after-tax rate $r\,(1 - \tau_K)$. The law of motion of capital is

$$\text{(A44)} \qquad K_{t+1}(j)g_{t,t+1} = (1 - \delta)K_t(j) + \Gamma_{I,t}K_t(j) \quad 0 < \delta \leq 1,$$

where δ is the country-specific depreciation rate of capital. To simulate realistic investment flows, capital accumulation is subject to adjustment costs. Capital accumulation is denoted $\Gamma_{I,t}K_t(j)$, where $\Gamma_I(.)$ is an increasing, concave, and twice continuously differentiable function of the investment or capital ratio $I_t(j)/K_t(j)$ with two properties entailing no adjustment costs in steady state: $\Gamma_I(\delta + g - 1) = \delta + g - 1$ and $\Gamma_I'(\delta + g - 1) = 1$. The specific functional form we adopt is quadratic and encompasses inertia in investment:

$$\Gamma_{I,t}(j) \equiv \frac{I_t(j)}{K_t(j)} - \frac{\phi_{I1}}{2}\left[\frac{I_t(j)}{K_t(j)} - (\delta + g - 1)\right]^2 - \frac{\phi_{I2}}{2}\left[\frac{I_t(j)}{K_t(j)} - \frac{I_{t-1}}{K_{t-1}}\right]^2,$$

where $\phi_{I1}, \phi_{I2} \geq 0$, and g is the steady-state growth rate.

Each household j is the monopolistic supplier of a specific labor input and sets the nominal wage for its labor variety j accounting for (A29). Labor incomes are taxed at the rate τ_L. There is sluggish wage adjustment due to resource costs that are measured in terms of the total wage bill. The adjustment cost is denoted $\Gamma_{\mathrm{WFL},t}$ (for wage forward-looking) and its specification is the analog of (A33), recalling that the real wage is expressed in detrended terms:

$$\text{(A45)} \qquad \Gamma_{\mathrm{WFL},t}(j) \equiv \frac{\phi_{\mathrm{WFL}}}{2}\left[\pi_{t-1,t}g_{t-1,t}\frac{w_t(j)/w_{t-1}(j)}{\Pi^{0.25}_{t-4,t}g_{t-1,t}} - 1\right]^2$$

Ricardian households own all domestic firms, and there is no international trade in claims on firms' profits. The variable Φ includes all dividends accruing to shareholders, plus all revenue from nominal and real adjustment rebated in a lump-sum way to all Ricardian households, plus revenue from financial intermediation which is assumed to be provided by domestic firms exclusively.

Finally, agents pay lump-sum (nondistortionary) net taxes $TT_t(j)$ denominated in consumption units.

Consumer Optimization (Ricardian Households)

The representative Ricardian household chooses bond holdings, capital and consumption paths, and sets wages to maximize its expected lifetime utility (A38) subject to (A40) and (A44), taking into account (A29).

For expositional convenience, it is worthwhile to write explicitly the maximization problem of agent $j \in [0, (1 - s_{LC})s]$ in terms of the following Lagrangian:

$$\text{(A46)} \quad \max_{C_t(j), I_t(j), B_t(j), B_t^*(j), K_{t+1}(j), w_t(j)} \mathrm{E}_t \sum_{\tau=t}^{\infty} \beta_{t,\tau} g_{t,\tau}^{1-\sigma} \Bigg[u[C_\tau(j), w_\tau^{-\psi_\tau}(j) w_\tau^{\psi_\tau} \ell_\tau] + \mu_\tau(j) \Bigg(-B_\tau(j) - \varepsilon_\tau B_\tau^*(j) + \frac{(1 + i_{\tau-1}) B_{\tau-1}(j)}{\pi_{\tau-1,\tau} g_{\tau-1,\tau}}$$

$$+ \frac{(1 + i_{\tau-1}^*)(1 - \Gamma_{B,\tau-1}) \varepsilon_\tau B_{\tau-1}^*(j)}{\pi_{\tau-1,\tau}^{\mathrm{US}} g_{\tau-1,\tau}} + (1 - \tau_{K,\tau}) r_\tau K_\tau(j)$$

$$+ (1 - \tau_{L,\tau}) w_\tau(j)^{1-\psi_\tau} w_\tau^{\psi_\tau} \ell_\tau \{1 - \Gamma_{W,\tau}[w_\tau(j), w_{\tau-1}(j)]\} - C_\tau(j) - p_{E,\tau} I_\tau(j)$$

$$+ \Phi_\tau(j) - TT_\tau(j) \Bigg) + \lambda_\tau(j) \left[-K_{\tau+1}(j) g_{\tau,\tau+1} + (1 - \delta) K_\tau(j) + \Gamma_{I,\tau} \frac{I_\tau(j)}{K_\tau(j)} K_\tau(j) \right] \Bigg],$$

where μ and λ are the multipliers associated with, respectively, the budget constraint and capital accumulation.

The first order conditions with respect to $C_t(j)$ and $I_t(j)$ yield

$$\text{(A47)} \quad \mu_t(j) = \frac{\partial u_t(j)}{\partial C_t(j)} = \frac{\lambda_t(j) \Gamma'_{I,t}(j)}{p_{E,t}}.$$

In a symmetric setup, $\partial u_t(j) / \partial C_t(j)$ is the same across Ricardian agents j. Their stochastic discount rate and pricing kernel is therefore the variable $D_{t,\tau}$, which is defined as

$$\text{(A48)} \quad D_{t,\tau} \equiv \beta_{t,\tau} g_{t,\tau}^{1-\sigma} \frac{\mu_\tau}{\mu_\tau} \frac{1}{\pi_{t,\tau}} \frac{1}{g_{t,\tau}}.$$

Accounting for the preceding expressions, the first-order conditions with respect to $B_t(j)$ and $B_t^*(j)$ are, respectively,

$$\text{(A49)} \quad 1 = (1 + i_t) \mathrm{E}_t D_{t,t+1}$$

$$\text{(A50)} \quad 1 = (1 + i_t^*)(1 - \Gamma_{B,t}) \mathrm{E}_t (D_{t,t+1} \Delta_{t,t+1})$$

where Δ denotes the rate of nominal exchange rate depreciation against the US, or

$$\text{(A51)} \qquad \Delta_{t,\tau} = \frac{\varepsilon_\tau}{\varepsilon_t}\frac{\pi_{t,\tau}}{\pi^*_{t,t}}.$$

In a nonstochastic steady state (A49) implies $(1 + i)/\pi = g^\sigma/\beta$, where π is the (gross steady-state quarterly) inflation rate, $(1 + i)/\pi$ is the real interest rate, g is the (gross steady-state quarterly) rate of growth of the world economy, $1/\beta$ is the rate of time preference, and g^σ/β is the natural rate of the economy.[59] Expressions (A49) and (A50) yield the risk-adjusted uncovered interest parity, recalling that the return on international bond holdings is modified to account for the costs of intermediation Γ_B. In a nonstochastic steady state, the interest differential $(1 + i)/[(1 + i^*)(1 - \Gamma_B)]$ is equal to the steady-state nominal depreciation rate of the currency vis-à-vis the US and relative purchasing power parity holds.

The first-order condition with respect to $K_{t+1}(j)$ is

$$\text{(A52)} \qquad \frac{p_{E,t}}{\Gamma'_{I,t}(j)}\mathrm{E}_t g_{t,t+1} = \mathrm{E}_t\Bigg(D_{t,t+1}\pi_{t,t+1}g_{t,t+1}\Bigg\{(1-\tau_{K,t+1})r_{t+1} + \frac{p_{E,t+1}}{\Gamma'_{I,t+1}(j)} \cdot \left[1 - \delta + \Gamma_{I,t+1}(j) - \Gamma'_{I,t+1}(j)\frac{I_{t+1}(j)}{K_{t+1}(j)}\right]\Bigg\}\Bigg).$$

Expression (A52) links capital accumulation to the behavior of the after-tax price of capital $(1 - \tau_K)r$. In a nonstochastic steady state, $1 + (1 - \tau_K)r/p_E$ is equal to the sum of the natural real rate g^σ_β and the rate of capital depreciation δ.[60]

Finally, the first-order condition with respect to $w(j)$ determines wage dynamics for the wages of the Ricardian households:

$$\text{(A53)} \qquad -\psi_t\frac{u_{\ell,t}(j)}{u_{C,t}(j)}\frac{1}{w_t(j)} = (\psi_t - 1)[1 - \Gamma_{\mathrm{WFL},t}(j)](1-\tau_{L,t}) + \frac{\partial\Gamma_{\mathrm{WFL},t}(j)}{\partial w_t(j)}w_t(j)(1-\tau_{L,t}) + \mathrm{E}_t D_{t,t+1}\pi_{t,t+1}g_{t,t+1}\frac{[w_{t+1}(j)/w_{t+1}]^{-\psi_{t+1}}}{[w_t(j)/w_t]^{-\psi_t}} \cdot \frac{w_{t+1}(j)}{w_t(j)}\frac{\ell_{t+1}}{\ell_t}\frac{\partial\Gamma_{\mathrm{WFL},t+1}(j)}{\partial w_t(j)}w_t(j)(1-\tau_{L,t+1})$$

59. International differences in natural rates can arise from asymmetric rates of time preference. They are accounted for in the definition of Γ_B in (A42).

60. The expectation operator on the left-hand side of (A52) is needed as shocks to the trend $g_{t,t+1}$ are not part of the information set at time t. This is because variables are expressed as deviations from the current trend. An alternative specification that expresses variables as deviations from the lagged trend would make little difference.

Note that in expression (A53) the wage rate of the Ricardian household $w(j)$ is not equal to the average wage rate in the economy w. In a nonstochastic steady state, the real wage $w(j)$ is equal to the marginal rate of substitution between consumption and leisure, $-u_\ell/u_c$, augmented by the markup $\psi/(\psi-1)$, which reflects monopoly power in the labor market.

Consumer Optimization (Liquidity-Constrained Households)

Liquidity-constrained households have no access to capital markets. Their optimal choices are confined to labor supply. Similar to Ricardian households, they can optimally set their wages to exploit their market power. The maximization problem of agent $j \in [(1-s_{\mathrm{LC}})s, s]$ can be written in terms of the following static Lagrangian:

$$\text{(A54)} \quad \max_{C_t(j), w_t(j)} u[C_t(j), \ell_t(j)] + \mu_t(j)(-C_t(j) - TT_t(j) + (1-\tau_{L,t})w_t(j)^{1-\psi_t}w_t^{\psi_t}\ell_t\{1-\Gamma_{\mathrm{WLC},t}[w_t(j), w_{t-1}(j)]\})$$

It is assumed that redistributive policies rebate to these households the income losses associated with wage adjustment so that their consumption level is

$$\text{(A55)} \quad C_t(j) = (1-\tau_{L,t})w_t(j)\ell_t(j).$$

The first-order conditions with respect to $C(j)$ and $w(j)$ determine partial adjustment of wages:

$$\text{(A56)} \quad -\psi_t \frac{u_{\ell,t}(j)}{u_{C,t}(j)} \frac{1}{w_t(j)} = (1-\tau_{L,t})\{(\psi_t - 1)[1-\Gamma_{\mathrm{WLC},t}(j)] + \frac{\partial \Gamma_{\mathrm{WLC},t}(j)}{\partial w_t(j)} w_t(j)\}$$

Denoting w_{FL} the wage rate $w(j)$ that solves (A53), and w_{LC} the wage rate $w(j)$ that solves (A56), equation (A27) determines the wage rate for the whole economy as

$$\text{(A57)} \quad w_t^{1-\psi_t} = s_{\mathrm{LC}} w_{\mathrm{LC},t}^{1-\psi_t} + (1-s_{\mathrm{LC}}) w_{\mathrm{FL},t}^{1-\psi_t}.$$

Government

Public spending falls on nontradable goods, both final and intermediate. In per capita terms, G_C is government consumption, G_I is government investment, and G_N denotes public purchases of intermediate nontradables. There are three sources of (net) tax revenue: taxes on capital income τ_K, taxes on labor income τ_L, and lump-sum taxes TT net of transfers to households. The government finances the excess of public expenditure over net taxes by issuing debt denominated in nominal currency, denoted B in per capita terms. All national debt is held exclusively by domestic (Ricardian) agents. The budget constraint of the government is

$$B_t \geq (1 + i_{t-1})\frac{B_{t-1}}{\pi_{t-1,t}g_{t-1,t}} + G_t - G_{\mathrm{REV},t}, \tag{A58}$$

where

$$G_t = G_{C,t} + p_{E,t}G_{I,t} + p_{N,t}G_{N,t} \tag{A59}$$

and

$$G_{\mathrm{REV},t} = \frac{1}{s}\left[\int_0^s TT_t(j)dj + \tau_{K,t}r_t\int_0^{s(1-s_{\mathrm{LC}})} K_t(j)dj + \tau_{L,t}\int_0^s w_t(j)\ell_t(j)dj\right]. \tag{A60}$$

Define now the average tax rate for the economy τ as

$$\tau_t \equiv \frac{G_{\mathrm{REV},t}}{\mathrm{GDP}_t}. \tag{A61}$$

Similarly, define the deficit-to-GDP ratio as

$$\frac{\mathrm{DEF}_t}{\mathrm{GDP}_t} = \left(B_t - \frac{B_{t-1}}{\pi_{t-1,t}g_{t-1,t}}\right)/\mathrm{GDP}_t. \tag{A62}$$

From (A58), in steady state we have:

$$\frac{B}{\mathrm{GDP}} = \frac{\pi g}{\pi g - (1+i)}\left(\frac{G}{\mathrm{GDP}} - \tau\right) = \frac{\pi g}{\pi g - 1}\frac{\mathrm{DEF}}{\mathrm{GDP}} \tag{A63}$$

The previous equations define the relations between debt-to-GDP, average tax rate, and deficit-to-GDP ratio that are sustainable in the long term. In what follows we treat the long-run debt-to-GDP ratio as a policy parameter set by the government, and let τ and DEF/GDP be determined by (A63).

The government is assumed to control lump-sum taxes, τ and τ_K directly, while τ_L is endogenously determined. The fiscal rule for τ is specified as

$$\begin{aligned}\tau_t = {} & \frac{\tau_{t-1} + \tau_t + E_t\tau_{t+1}}{3} \\ & + \phi_{\mathrm{TAX1}}\left[\frac{B_t}{\mathrm{GDP}_t} - \phi_{\mathrm{TAX2}}b_{\mathrm{TAR},t} - (1-\phi_{\mathrm{TAX2}})\frac{B_{t-1}}{\mathrm{GDP}_{t-1}}\right] \\ & + \phi_{\mathrm{TAX3}}\left(\frac{\mathrm{DEF}_t}{\mathrm{GDP}_t} - \frac{\mathrm{DEF}}{\mathrm{GDP}}\right) + \phi_{\mathrm{TAX4}}\left(\frac{G_t}{\mathrm{GDP}_t} - \frac{G}{\mathrm{GDP}}\right),\end{aligned} \tag{A64}$$

where b_{TAR} is an autoregressive process for the targeted debt-to-GDP ratio converging to $B \neq \mathrm{GDP}$. The tax rate is a smoothed function of past and expected future rates, adjusted upward when the current debt-to-GDP ratio is above the average of its current target and its past observed level, when the current deficit-to-GDP ratio is above its sustainable steady-state level, and when current government spending as a share of GDP is above its long-run level.

The government controls the short-term rate i_t. Monetary policy is specified in terms of annualized interest rate rules of the form

$$\text{(A65)} \qquad (1 + i_t)^4 = \omega_i(1 + i_{t-1})^4 + (1 - \omega_i)(1 + i_t^{\text{neut}})^4 + \omega_1 \mathrm{E}_t(\pi_{t-1,t+3} - \Pi_{t-1,t+3}).$$

The current interest rate i_t is an average of the lagged rate i_{t-1} and the current neutral rate i_t^{neut}, defined as[61]

$$\text{(A66)} \qquad 1 + i_t^{\text{neut}} \equiv \frac{\Pi_{t-4,t}^{0.25}(g_{t-1,t})^{\sigma}}{\beta_{t-1,t}}.$$

This average is adjusted to account for the expected inflation gap three-quarters in the future.[62] In a steady state when all constant targets are reached, it must be the case that

$$\text{(A67)} \qquad 1 + i = 1 + i^{\text{neut}} = \frac{\Pi^{0.25} g^{\sigma}}{\beta} = \frac{\pi g^{\sigma}}{\beta}.$$

Market Clearing

The model is closed by imposing the following resource constraints and market clearing conditions, adopting explicit country indexes.

For each country H, the domestic resource constraints for capital and labor are, respectively,

$$\text{(A68)} \qquad \int_0^{s^H(1-s_{LC}^H)} K_t^H(j^H)dj^H \geq \int_0^{s^H} K_t^H(n^H)dn^H + \int_0^{s^H} K_t^H(h^H)dh^H$$

and

$$\text{(A69)} \qquad \ell_t^H(j^H) \geq \int_0^{s^H} \ell_t^H(n^H, j^H)dn^H + \int_0^{s^H} \ell_t^H(h^H, j^H)dh^H.$$

The resource constraint for the nontradable good n^H is

$$\text{(A70)} \quad N_t^H(n^H) \geq \int_0^{s^H} N_{A,t}^H(n^H, x^H)dx^H + \int_0^{s^H} N_{E,t}^H(n^H, e^H)de^H + G_{N,t}^H(n^H),$$

while the tradable h^H can be used by domestic firms or imported by foreign firms:

$$\text{(A71)} \quad T_t(h^H) \geq \int_0^{s^H} Q_{A,t}(h^H, x^H)dx^H + \int_0^{s^H} Q_{E,t}(h^H, e^H)de^H + \sum_{CO \neq H}\left[\int_0^{s^{CO}} M_{A,t}^{CO,H}(h^H, x^{CO})dx^{CO} + \int_0^{s^{CO}} M_{E,t}^{CO,H}(h^H, e^{CO})de^{CO}\right]$$

61. Recall that $\Pi_{t-\tau,t-\tau+4}$ is the year-on-year gross CPI inflation target prevailing at time t for the four-quarter period between $t - \tau$ and $t - \tau + 4$.

62. In the case of AS, we model an exchange rate targeting regime by introducing the component $\omega_2^{AS}\Delta_t^{AS}$ in (A65), where Δ^{AS} is defined in (A51), and we choose a very high value of ω_2^{AS} to peg the nominal bilateral exchange rate against the US.

The final good A can be used for private (by both liquidity-constrained and forward-looking households) or public consumption,

$$\text{(A72)}\quad \int_0^{s^H} A_t^H(x^H)dx^H \geq \int_0^{s^H(1-s_{\mathrm{LC}}^H)} C_t^H(j^H)dj^H + \int_{s^H(1-s_{\mathrm{LC}}^H)}^{s^H} C_t^H(j^H)dj^H + s^H G_{C,t}^H,$$

and similarly for the investment good E,

$$\text{(A73)}\quad \int_0^{s^H} E_t^H(e^H)de^H \geq \int_0^{(1-s_{\mathrm{LC}}^H)s^H} I_t^H(j^H)dj^H + s^H G_{I,t}^H.$$

All profits and intermediation revenue (ignoring import adjustment costs) accrue to Ricardian households:

$$\text{(A74)}\quad \int_0^{s^H(1-s_{\mathrm{LC}}^H)} \Phi_t^H(j^H)dj^H = \int_0^{s^H(1-s_{\mathrm{LC}}^H)} (1+i_{t-1}^*)\Gamma_{B,t-1}^H \frac{\varepsilon_t^{H,\mathrm{US}} B_{t-1}^{*H}(j^H)}{\pi_{t-1,t}^{\mathrm{US}} g_{t-1,t}} dj^H$$

$$+ \int_0^{s^H(1-s_{\mathrm{LC}}^H)} \Gamma_{\mathrm{WFL},t}^H(j^H)(1-\tau_{L,t}^H)w_t^H(j^H)dj^H$$

$$+ \int_{s^H(1-s_{\mathrm{LC}}^H)}^{s^H} \Gamma_{\mathrm{WLC},t}^H(j^H)(1-\tau_{L,t}^H)w_t^H(j^H)dj^H + \int_0^{s^H} [p_t^H(n^H) - mc_t^H(n^H)]$$

$$\cdot \left[\int_0^{s^H} N_{A,t}^H(n^H, x^H)dx^H + \int_0^{s^H} N_{E,t}^H(n^H, e^H)de^H + G_{N,t}^H(n^H)\right]dn^H$$

$$+ \int_0^{s^H} [p_t^H(h^H) - mc_t^H(h^H)]\left[\int_0^{s^H} Q_{A,t}^H(h^H, x^H)dx^H\right.$$

$$\left. + \int_0^{s^H} Q_{E,t}^H(h^H, e^H)de^H\right]dh^H + \sum_{\mathrm{CO}\neq H}\int_0^{s^H} [\varepsilon_t^{H,\mathrm{CO}} p_t^{\mathrm{CO}}(h^H) - mc_t^H(h^H)]$$

$$\cdot \left[\int_0^{s^{\mathrm{CO}}} M_{A,t}^{\mathrm{CO},H}(h^H, x^{\mathrm{CO}})dx^{\mathrm{CO}} + \int_0^{s^{\mathrm{CO}}} M_{E,t}^{\mathrm{CO},H}(h^H, e^{\mathrm{CO}})de^{\mathrm{CO}}\right]dh^H$$

Market clearing in the asset market requires

$$\text{(A75)}\quad \int_0^{s^H(1-s_{\mathrm{LC}}^H)} B_t^H(j^H)dj^H = s^H B_t^H$$

for the four government bond markets, and

$$\text{(A76)}\quad \sum_{\mathrm{CO}} \int_0^{s^{\mathrm{CO}}(1-s_{\mathrm{LC}}^{\mathrm{CO}})} B_t^{*\mathrm{CO}}(j^{\mathrm{CO}})dj^{\mathrm{CO}} = 0$$

for the international bond market. Finally, aggregating the budget constraints across private and public agents after imposing the appropriate transversality conditions we obtain the law of motion for financial wealth:

$$\text{(A77)}\quad \mathrm{E}_t D_{t,t+1}^H \pi_{t,t+1}^H g_{t,t+1} F_{t+1}^H = F_t^H + \Gamma_{B,t-1}^H \frac{(1+i_{t-1}^*)\varepsilon_t^{H,\mathrm{US}} B_{t-1}^{*H}}{\pi_{t-1,t}^{\mathrm{US}} g_{t-1,t}} + p_{N,t}^H N_t^H$$

$$+ p_{T,t}^H T_t^H - C_t^H - p_{E,t}^H I_t^H - G_t^H,$$

where the total value of tradables is defined as

$$p^H_{T,t}T^H_t \equiv p^H_{Q,t}(Q^H_{A,t} + Q^H_{E,t}) + \sum_{CO \neq H} \frac{s^{CO}}{s^H} \varepsilon^{H,CO}_t p^{CO,H}_{M,t}(M^{CO,H}_{A,t} + M^{CO,H}_{E,t}). \tag{A78}$$

Measuring Output and Current Account

Expression (A78) can be written as

$$\mathrm{CURBAL}^H_t = \varepsilon^{H,US}_t \left(B^{*H}_t - \frac{B^{*H}_{t-1}}{\pi^{US}_{t-1,t} g_{t-1,t}} \right) = \frac{i^*_{t-1} \varepsilon^{H,US}_t B^{*H}_{t-1}}{\pi^{US}_{t-1,t} g_{t-1,t}} + \mathrm{TBAL}^H_t. \tag{A79}$$

The left-hand side of (A79) is country H's current account, the first term on the right-hand side are net factor payments from the rest of the world to country H, and TBAL is the trade balance. The latter can be thought of as

$$\mathrm{TBAL}^H_t = \mathrm{EX}^H_t - \mathrm{IM}^H_t, \tag{A80}$$

where total exports EX are

$$\mathrm{EX}^H_t = p^H_{T,t}T^H_t - p^H_{Q,t}(Q^H_{A,t} + Q^H_{E,t}), \tag{A81}$$

and total imports IM are

$$\mathrm{IM}^H_t = \sum_{CO \neq H} p^{H,CO}_{M,t}(M^{H,CO}_{A,t} + M^{H,CO}_{E,t}). \tag{A82}$$

Finally, we define the model-based GDP (in consumption units) as

$$\begin{aligned} \mathrm{GDP}^H_t &= A^H_t + p^H_{E,t}E^H_t + p^H_{N,t}G^H_{N,t} + \mathrm{EX}^H_t - \mathrm{IM}^H_t \\ &= p^H_{N,t}N^H_t + p^H_{T,t}T^H_t \end{aligned} \tag{A83}$$

so that

$$\begin{aligned} \mathrm{CURBAL}^H_t &= \mathrm{TBAL}^H_t + \frac{i^*_{t-1} \varepsilon^{H,US}_t B^{*H}_{t-1}}{\pi^{US}_{t-1,t} g_{t-1,t}} \\ &= \mathrm{GDP}^H_t - (C^H_t + p^H_{E,t}I^H_t + G^H_t) + \frac{i^*_{t-1} \varepsilon^{H,US}_t B^{*H}_{t-1}}{\pi^{US}_{t-1,t} g_{t-1,t}}. \end{aligned} \tag{A84}$$

While theoretically sound, this measure of output would bear little similarity with standard fixed-weight, constant-dollar measures of real GDP provided by national accounts. The problem is particularly severe for relatively open economies facing large swings in real exchange rates and relative prices. In our simulations, we therefore adopt national accounts concepts for GDP, TBAL, and their components, evaluating constant-dollar expenditures at any time t by using fixed steady-state prices instead of the corresponding relative prices at time t.

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Comment Lars E. O. Svensson

I enjoyed reading this fine paper by Faruqee, Laxton, Muir, and Pesenti. I believe it is worthwhile to see the paper in the context of the lively debate in the recent literature on current-account developments, especially given the large U.S. current-account deficit.

The recent literature includes much-noted contributions of Gourinchas and Rey (2005) and of Lane and Milesi-Ferretti (2005) on the role of the currency composition of gross assets and liabilities, revaluation effects, and return differences on home and foreign debt and assets.

Obstfeld and Rogoff (2004, 2005) have recently presented a more formal model of the relation between the current account and the real exchange rate for the U.S. economy, available in two-country and three-country versions. They emphasize the role of home bias in consumption and develop a static relation between the current account and the real exchange rate. The following ratios are defined:

$$\mathrm{ca} \equiv \frac{CA}{P_H Y_H}, f \equiv \frac{F}{P_H Y_H}, \tau \equiv \frac{P_F}{P_H}, x \equiv \frac{P_N}{P_T},$$

$$x^* \equiv \frac{P_N^*}{P_T^*}, \sigma_T \equiv \frac{Y_H}{Y_F}, \sigma_N \equiv \frac{Y_N}{Y_H}, \sigma_N^* \equiv \frac{Y_N^*}{Y_F}.$$

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Here, CA denotes the U.S. current account measured in dollars; P_H and Y_H are the dollar price and output of U.S.-produced tradable goods; $F < 0$ is U.S. net foreign assets (NFA) measured in dollars; P_F is the dollar price of foreign-produced tradable goods, so τ is the terms of trade; P_N is the dollar price of U.S.-produced nontradable goods; P_T is the tradable-goods U.S. consumption price index; P_N^* and P_T^* are the foreign-currency price of foreign-produced nontradable goods and the tradable-goods foreign consumption price index, respectively; Y_N is the output of U.S.-produced nontradable goods; and Y_N^* and Y_F are the outputs of foreign-produced nontradable and tradable goods, respectively. They derive three independent equations:

$$1 = \frac{\alpha}{(1-\alpha)\tau^{1-\eta}+\alpha}(1 + rf - \text{ca}) + \frac{1-\alpha}{\alpha\tau^{1-\eta}+(1-\alpha)}\left(\frac{\tau}{\sigma_T} - rf + \text{ca}\right)$$

$$\sigma_N = \left(\frac{1-\gamma}{\gamma}\right)x^{-\theta}[\alpha + (1-\alpha)\tau^{1-\eta}]^{-1/(1-\eta)}(1 + rf - \text{ca})$$

$$\sigma_N^* = \left(\frac{1-\gamma}{\gamma}\right)(x^*)^{-\theta}[\alpha + (1-\alpha)\tau^{-(1-\eta)}]^{-1/(1-\eta)}\left(1 - r\frac{\sigma_T}{\tau}f + \frac{\sigma_T}{\tau}\text{ca}\right)$$

Here, α is the consumption share of own-produced tradable goods in tradable goods consumption, so home bias in consumption is indicated by $\alpha > 1/2$; η is the elasticity of substitution in consumption between home- and foreign-produced tradable goods; r is the dollar rate of return on U.S. net foreign assets; γ is the consumption share of tradable goods in total consumption; and θ is the elasticity of substitution in consumption between tradable and nontradable goods. Given this, they solve for τ, x, x^* for given ca < 0 (the U.S. current account surplus as a fraction of U.S. tradable-goods output), f, σ_T, σ_N, and σ_N^*. Denote this solution as a function of ca by $\tau(\text{ca})$, $x(\text{ca})$, and $x^*(\text{ca})$. They then derive the real exchange rate, ε, as a function of ca as

$$\varepsilon(\text{ca}) \equiv \left[\frac{\alpha\tau(\text{ca})^{1-\eta} + (1-\alpha)}{(1-\alpha)\tau(\text{ca})^{1-\eta} + \alpha}\right]^{1/(1-\eta)}\left[\frac{\gamma + (1-\gamma)x^*(\text{ca})^{1-\theta}}{\gamma + (1-\gamma)x(\text{ca})^{1-\theta}}\right]^{1/(1-\theta)}.$$

Finally, they compute $\varepsilon(0) - \varepsilon(\text{ca})$, the change in the real exchange rate from reducing the U.S. current-account deficit to zero (that is, reducing ca from negative to zero).

The main result is that such a reduction of the U.S. current account deficit is associated with a relatively large real depreciation of the dollar. However, a problem with Obstfeld and Rogoff's analysis is that it is completely static. There is no dynamics, and there is no explicit saving and investment. Furthermore, the dollar-value of U.S. net foreign assets is mostly taken as given, although there are some cases where revaluation effects are discussed.

Blanchard, Giavazzi, and Sa (2005) have recently presented a more dynamic model than the Obstfeld and Rogoff one. They emphasize the importance of imperfect substitutability of U.S.- and foreign-based assets and of home bias in asset holdings. They derive a portfolio-balance relation,

$$X = \alpha(\underset{+}{R^e})(X + F) + [1 - \alpha^*(\underset{-}{R^e})](\varepsilon X^* - F).$$

Here, X and X^* are given stocks of U.S.- and foreign-based assets (measured in home and foreign goods, respectively); $\alpha(R^e)$ denotes the share of U.S. wealth held as U.S.-based assets and is increasing in the expected (real) rate-of-return difference between U.S.- and foreign-based assets,

$$R^e \equiv 1 + r - r^* - \frac{\dot{\varepsilon}^e}{\varepsilon},$$

where r and r^* now denote U.S. and foreign real interest rates; F now denotes U.S. net foreign assets *measured in U.S. goods;* $\alpha^*(R^e)$ is the share of foreign wealth held as foreign based assets and is decreasing in the expected rate-of-return difference. The current account dynamics is given by

$$\dot{F} = rF + [1 - \alpha(R^e)]\left(r^* + \frac{\dot{\varepsilon}}{\varepsilon} - r\right)(X + F) + \mathrm{TB}(\underset{+}{\varepsilon}),$$

where $\mathrm{TB}(\varepsilon)$ denotes the U.S. trade-balance surplus and is increasing in the real exchange rates (it increases with a real dollar depreciation). The steady state is characterized by $\dot{\varepsilon} = \dot{F} = 0$ and determines a steady-state relation between net foreign assets and the real exchange rate,

$$0 = rF - [1 - \alpha(1 + r - r^*)](r - r^*)(X + F) + \mathrm{TB}(\varepsilon).$$

A jump in the real exchange rate at date t, $\varepsilon(t) - \varepsilon(t-)$, results in a revaluation of net foreign assets according to

$$F(t) - F(t-) = [1 - \alpha(t-)][X + F(t-)]\left[\frac{\varepsilon(t)}{\varepsilon(t-)} - 1\right].$$

Blanchard, Giavazzi, and Sa (2005) examine the dynamic adjustment of the U.S. net foreign assets and the real exchange rate from current levels towards a steady state for a number of different shocks. The main result is that the steady state is characterized by a larger U.S. net foreign debt and a weaker real dollar than the current situation. However, a problem with the analysis is that it is only partial equilibrium: the home and foreign real interest rates, r and r^*, are simply given, and there is no explicit saving and investment. The trade-balance equation is too simple, especially in comparison with the trade-balance equation resulting from the Obstfeld-Rogoff model.

The paper by Faruqee, Laxton, Muir, and Pesenti allows a potential synthesis of and considerable improvement on the previously mentioned literature. They have an impressive multicountry dynamic general equilibrium model, a very sophisticated relation between the current account and the real exchange rate, endogenous saving and investment, and endogenous home and foreign interest rates. They can provide a sophisticated analysis of the dynamics of the current account.

But the authors do not seem to utilize their model's potential fully. Regarding revaluation effects, their model is too simple: net foreign assets are only denominated in U.S. currency (or a currency basket). It would be worthwhile to incorporate gross assets and liabilities and to allow different currency compositions of these for different countries.

What about the portfolio choice between home- and foreign-based assets? What about the degree of substitutability and home bias? Again, their impressive model is still too simple: Home- and foreign-based assets are perfect substitutes. Furthermore, there is a given target NFA-GDP ratio, independent of relative returns. (There are some intermediation fees incurred when actual NFA or GDP deviates from the target NFA-GDP ratio.) The portfolio-choice modeling could be improved considerably.

The Faruqee, Laxton, Muir, and Pesenti paper would benefit from discussing the previous literature in more detail and comparing its findings. In addition to the papers mentioned, there is also the dramatic crisis scenario presented by Roubini and Setser (2004) that the authors may want to comment on and compare with. This is so, in particular, as the simulations conducted in the Faruqee, Laxton, Muir, and Pesenti paper result in relatively benign outcomes. Are these really realistic?

There is a general problem with how monetary policy is modeled in the paper. The paper relies on so-called inflation forecast–based instrument rules (IFB rules), where the instrument rate fulfills a specified (equilibrium) relation with inflation projections. There are many problems with this approach, which I have emphasized in several different papers (for instance, Svensson [2001] and Svensson and Woodford [2003]). Probably anticipating my reaction, the authors state in footnote 18: "It is important to note that IFB rules are ad hoc. Svensson (1999) and Svensson and Woodford (2005) have proposed Inflation-Forecast-Targeting (IFT) rules based on optimizing loss functions and *it is only a question of time* before IFT rules are used extensively on linearized versions of models whose types and size are similar to ours." (Emphasis added.) If it is only a question of time, why not now? Why continue to use ad hoc instrument rules but not ad hoc consumption and investment rules? An ad hoc IFB rule is arguably even more ad hoc than an explicit (outcome-based) instrument rule (Svensson 2001; Levin, Wieland, and Williams 2003). There are better alternatives, namely optimizing monetary policy, first-order conditions or targeting rules, and so forth.

In summary, this is a very impressive and interesting model, with considerable flexibility for examining a number of different issues. The model has great potential, and this potential is far from exhausted in the current version. In particular, the points I make in the preceding do not seem difficult to incorporate, should the authors wish to do so.

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11

The Dot-Com Bubble, the Bush Deficits, and the U.S. Current Account

Aart Kraay and Jaume Ventura

11.1 Introduction

Since the early 1990s, the United States has experienced steadily widening current account deficits, reaching 5.7 percent of gross national product (GNP) in 2004 (see top panel of figure 11.1). These deficits are large relative to the postwar U.S. historical experience. With the exception of a brief period in the mid-1980s where current account deficits reached 3.3 percent of GNP, the U.S. current account has typically registered small surpluses or deficits averaging around 1 percent of GNP. As a consequence of the recent deficits, the U.S. net foreign asset position has declined sharply from –5 percent of GNP in 1995 to about –26 percent by the end of 2004 (see bottom panel of figure 11.5). The goal of this paper is to provide an account of this decline that relates it to other major macroeconomic events and helps us to grasp its implications for welfare and policy.

Any attempt to do this must take into consideration a major change in the pattern of asset trade between the United States and the rest of the world (see figure 11.2). During the second half of the 1990s, the United States accumulated foreign assets and liabilities at the rate of \$765 billion and \$965 billion per year. About two-thirds of this consisted of increases in the volume and value of equity holdings. This pattern reversed sharply

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We are grateful to Fernando Broner, Joseph Gagnon, and Maury Obstfeld for their useful comments, and to Pierre-Olivier Gourinchas and Hélène Rey for sharing their data. The views expressed here are those of the authors and do not reflect those of the World Bank, its executive directors, or the countries they represent.

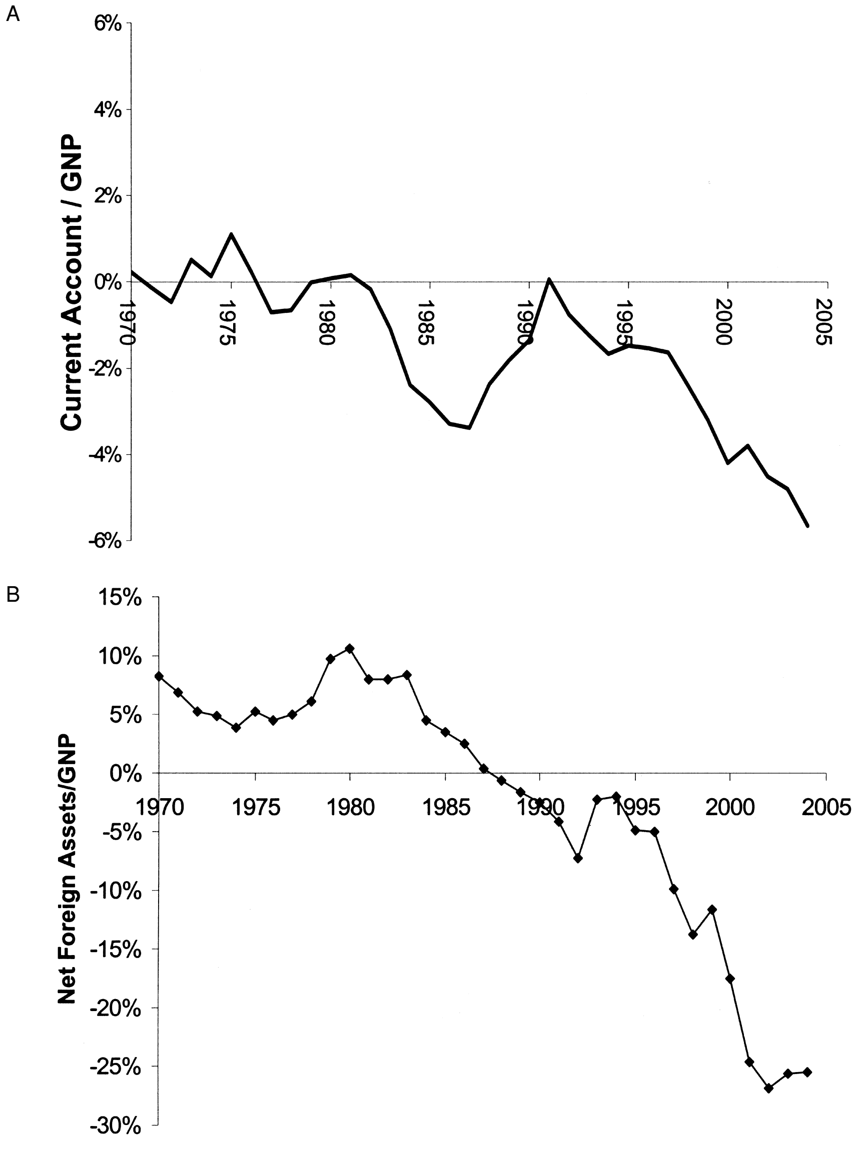

Fig. 11.1 U.S. current account and net foreign assets: *A*, Current account; *B*, Net foreign assets

Sources: Current account data are from U.S. Bureau of Economic Analysis. NFA data are from Gourinchas and Rey (chap. 1 in this volume).

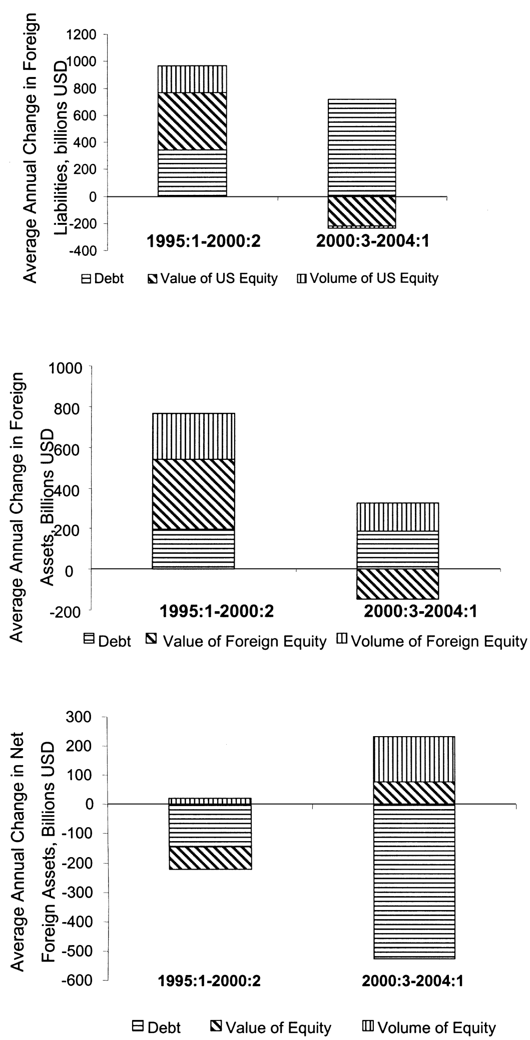

Fig. 11.2 Average annual changes in U.S. foreign assets and liabilities

Source: Gourinchas and Rey (chap. 1 in this volume).

Note: Change in value of equity estimated as sum over all quarters of difference between quarterly change in stocks and corresponding quarterly flows.

in the first half of the 2000s. The worldwide collapse in equity prices erased a substantial fraction of the assets and liabilities that the United States had accumulated during the 1990s, resulting in an increase of U.S. net holdings of equity of about \$232 billion per year. Despite this, the U.S. net foreign asset position declined at the rate of \$296 billion per year as U.S. net holdings of debt (both public and private) declined at the rate of \$528 billion per year. While in the second half of the 1990s equity was driving most of the changes in U.S. foreign assets and liabilities, in the first half of the 2000s, these changes were mainly driven by debt.

This change in the composition of the U.S. current account is a natural reflection of the two major macroeconomic events of this period. The first one is the dot-com bubble of the 1990s. Between 1990 and the peak in mid-2000, U.S. equity prices increased nearly fivefold, and the growth rate of equity prices accelerated from 10.4 percent per year between 1990 and 1995 to 21.2 percent per year between 1995 and 2000 (see panel A of figure 11.3).

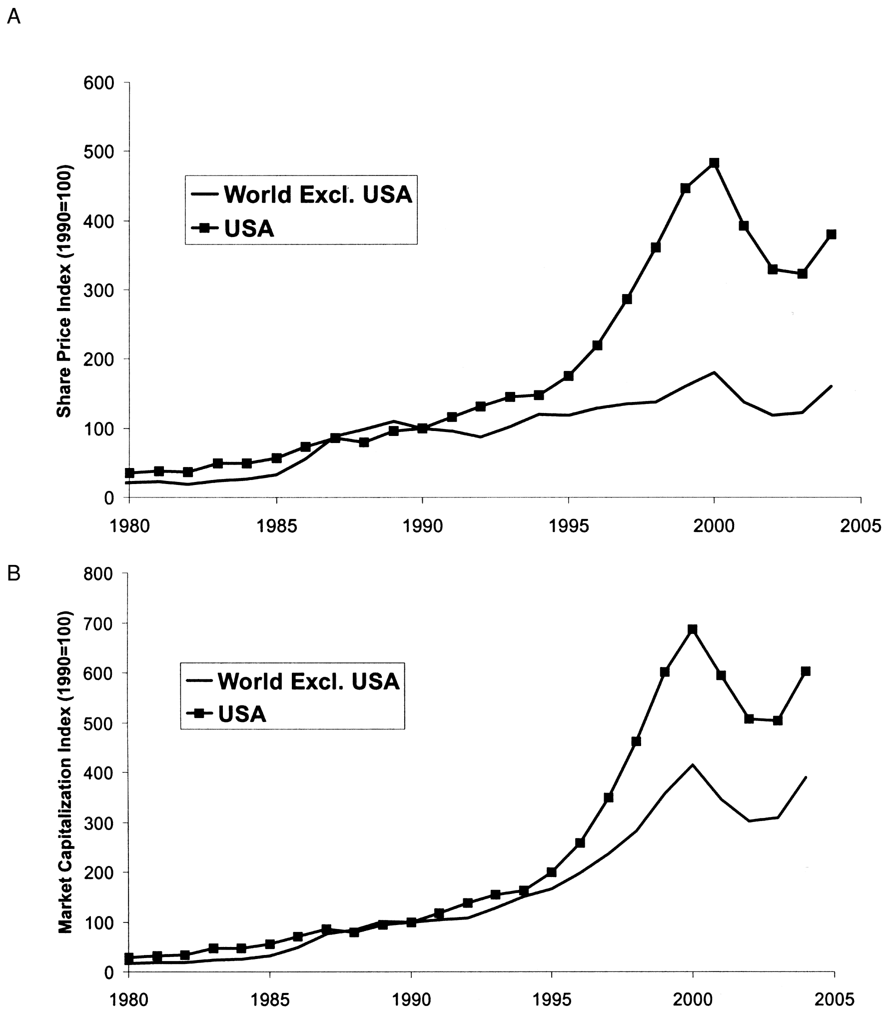

Fig. 11.3 Stock market boom of the 1990s: *A*, Share prices; *B*, Market capitalization

Source: Datastream.

The value of U.S. stock market capitalization grew even faster, doubling between 1990 and 1995, and then tripling between 1995 and the peak in 2000 (see panel B of figure 11.3). The stock market boom in the rest of the world was less spectacular but still quite impressive by historical standards. Equity prices in the major foreign markets grew 7.9 percent per year during the second half of the 1990s. As is well known, this episode ended with a sharp downward adjustment that started in 2000. By 2003, equity prices in the United States and abroad had fallen by 30 percent, and stock market capitalization had fallen by about 25 percent. Because these changes in equity prices have taken place against a background of relatively low interest rates and low inflation, being in the stock market surely was a good idea in the second half of the 1990s but a lousy one in the first half of the 2000s.

The second major macroeconomic event was the reemergence of large fiscal deficits in the United States after the Bush administration took over in 2001 (see figure 11.4). Unlike the 1980s, the 1990s were a period of declining budget deficits and small surpluses. After 2000, budget deficits reappeared with a vengeance, however, reaching 4.8 percent of GNP in 2004. As a result, U.S. public debt has increased from 33 to 37 percent of GNP between 2001 and 2004. An intriguing feature of this recent period is that large budget deficits have not been accompanied by any significant increase in the cost of borrowing for the federal government (see figure 11.4).

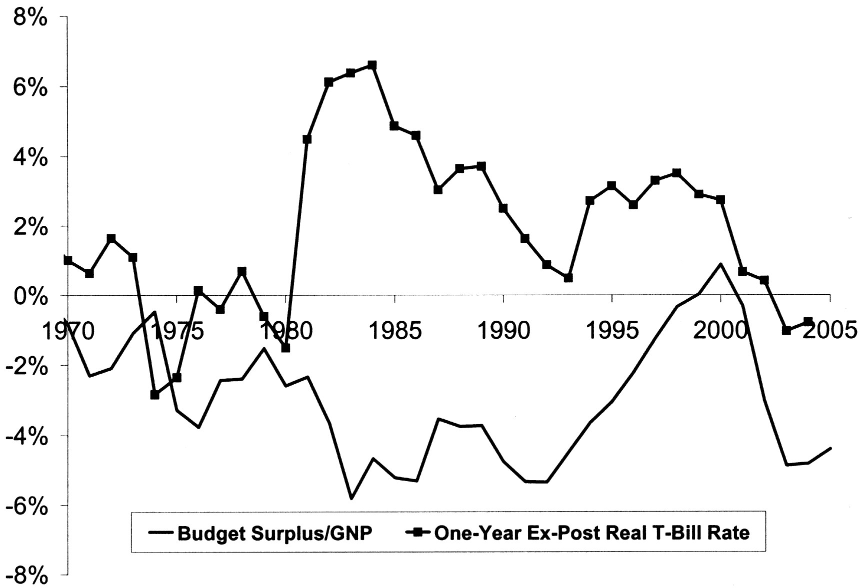

Fig. 11.4 Budget deficits and interest rates

Sources: Congressional Budget Office and Board of Governors of the Federal Reserve System.

Roughly speaking, the 1970s were characterized by low budget deficits and low interest rates, while the period 1980 to 1995 featured high budget deficits and high interest rates. But over the past ten years this pattern has unraveled, with fairly high interest rates and low deficits during the second half of the 1990s, followed by low interest rates and large budget deficits since 2000.

What are the links between the stock market bubbles, budget deficits, and current accounts? As a first cut at this question, we develop in sections 11.2 and 11.3 a conventional macroeconomic model that crudely, but effectively, encapsulates conventional views of the U.S. current account deficit. According to these views, its appearance in the second half of the 1990s reflected an increase in U.S. productivity relative to the rest of the world that led investors all over the world to place their savings in the U.S. stock market. The situation reversed, and U.S. productivity declined in 2000, leading to the stock market collapse. But the current account deficit continued despite this, now fueled by the drastic change in fiscal policy implemented by the Bush administration. This change is usually attributed to purely exogenous factors such as the cost of the wars in Afghanistan and Iraq as well as a desire to cut taxes. This policy is, however, unsustainable and something must eventually give. Most observers think that this episode will end with a painful fiscal adjustment although there are also those who argue that the resolution will entail some default on the part of the U.S. government.[1]

Although the conventional view is coherent and well grounded in theory, it has difficulty accounting for two aspects of the data. The first is observed movements in the stock market. If the stock market only contains productive firms, its value should reflect that of the price and quantity of capital they hold. But it is hard to find evidence of increases in either of these variables that would justify the more than threefold increase in U.S. stock market capitalization that occurred during the second half of the 1990s. And it is even harder to find evidence that would justify a one-quarter decline in the first few years of the 2000s.[2] The second aspect of the data is the behavior of interest rates. The model predicts that the U.S. fiscal expansion should increase the interest rate as government debt crowds out capital from the portfolios of investors. But the evidence shows exactly the oppo-

1. Few would argue that the U.S. government will fail to make stipulated payments, but still some think that there is some probability that the U.S. government effectively defaults on its obligations by engineering a high and unexpected inflation that reduces the real value of these payments.

2. Hall (2000, 2001) has argued that in fact such a large increase in the capital stock did occur during the 1990s. In particular, he argues that this increase took the form of intangible capital such as brand loyalty as well as unique organizational structures based on efficient use of information technology. While this view might have seemed reasonable in the late 1990s before the stock market declined, it is far less appealing today as it is difficult to explain why so much of this intangible capital abruptly vanished in the second half of 2000.

site. The real interest rate fell from above 3 percent in the second half of the 1990s to almost 0 percent in the early 2000s.[3]

What has been driving the stock market during the last decade? Why did the interest rate fall in the midst of one of the largest fiscal expansions in U.S. history? We argue in section 11.4 that the difficulties of the conventional view are closely linked to its underlying assumption that all savings are channeled into efficient investments. If financial markets do not work as well, the economy might contain investments that deliver a rate of return that is below the growth rate of the economy. These investments are inefficient as they absorb on average more resources than they produce.[4] It is well known that in this situation both stock market bubbles and government debt can play the useful role of displacing inefficient investments, raising the interest rate and hence the consumption and welfare of all. Moreover, those who create the bubbles or issue the debt receive rents that can be interpreted as a fee for providing this service.[5] A crucial and novel aspect of the model presented here is that it provides a formal description of how bubbles and debt interact with each other as they compete for a fixed pool of savings.

In sections 11.5 and 11.6 we show that these interactions provide a new perspective on recent macroeconomic events. In section 11.5 we construct an equilibrium in which the stock market initially creates a bubble that eliminates inefficient investments. The world economy operates efficiently, and the interest rate and welfare are both high. But sustaining a bubble requires that current investors believe that future investors will buy it from them. At some point, there will be a self-validating change in investor expectations about what other investors will do and this triggers the collapse of the bubble. As a result, inefficient investments reappear and the interest rate declines. The government reacts to this by running large budget deficits and expanding public debt sufficiently to crowd out these inefficient investments. According to this "benevolent" view, budget deficits constitute a welfare-improving policy response to the collapse of the bubble.

3. A popular explanation for the decline in interest rates is that a global glut of saving has appeared coincidentally at the same time as the fiscal deficits (see, for example, Bernanke 2005). According to this view, government debt need not displace capital from the portfolio of investors. As we shall see later, our story is consistent with this observation. In fact, we provide a novel explanation of the glut of saving based on the collapse of the bubble.

4. The resources devoted to keep these investments are roughly equal to the growth rate times the capital stock. The resources obtained from such investments are roughly equal to the rate of return times the capital stock. If the growth rate exceeds the rate of return, the economy obtains additional resources by eliminating these inefficient investments. See Abel et al. (1989).

5. The paper that discovered dynamic inefficiency is Samuelson (1958). See also Shell (1971) for a revealing discussion of this problem. For the analysis of government debt, see Diamond (1965), Woodford (1990), and Hellwig and Lorenzoni (2003). For the analysis of stock market bubbles, see Tirole (1985), Grossman and Yanagawa (1993), King and Ferguson (1993), Olivier (2000), and Ventura (2002, 2003).

Moreover, they also provide a windfall for the U.S. government as it allows it to appropriate the value of the bubble.

Section 11.6 constructs an alternative equilibrium that again begins with the stock market creating a bubble that eliminates inefficient investments. The government initially refrains from running budget deficits, and this creates space for the bubble to grow. At some point, investors revise upwards their expectations of the likelihood that there is a change in government, and the new government would use fiscal policy to appropriate the windfall associated with replacing the bubble with government debt. This change in investor expectations leads to the collapse of the bubble. There is then a change in government, and the new government starts a fiscal expansion that validates the expectations of investors. The interest rate need not increase because the collapse of the bubble forces savers to seek alternative investments, and this raises the demand for government debt. This fiscal policy implements a transfer from the owners of the bubble at home and abroad to the U.S. government. In this "cynical" view, budget deficits constitute a beggar-thy-neighbor policy that is responsible for the collapse of the bubble.

Interestingly, the benevolent and cynical views are observationally equivalent. In both of them, the collapse of the bubble is accompanied by a decline in the interest rate and a large fiscal expansion that leads to a high but stable level of debt. In both views, this high level of debt is compatible with the U.S. running budget deficits forever (although smaller than the current ones). In both of them, the U.S. net foreign asset position can remain negative forever. In both views, the collapse of the bubble generates a loss for shareholders at home and abroad and a windfall for the U.S. government. The only difference between the two views lies in the shock that caused this chain of events. While in the benevolent view this shock is a change in investor expectations about other investors, in the cynical view this shock is a change in investor expectations about the government. In both interpretations, subsequent events corroborated the corresponding change in investors' expectations.

Of course, this is not the first paper to be written on the U.S. current account deficit. A substantial literature in the past few years has studied the determinants and sustainability of the U.S. current account deficit. Much of this literature has adopted what we have termed as conventional views without much discussion and has instead focused on determining its implications. Most notably, Obstfeld and Rogoff (2000, 2004, and 2005), Blanchard, Giavazzi, and Sa (2005), and Roubini and Setser (2004) have all argued a large current account reversal is inevitable and will likely be accompanied by a large and disruptive depreciation in the dollar.[6]

6. We do not analyze the implications of our scenarios for the real exchange rate although it would be straightforward to do it. The results would also be straightforward and standard. The real exchange rate would move in opposite direction to the current account and the magnitude of the change would depend on the usual parameters, that is, the elasticity of substitution between traded and nontraded goods and the elasticity of substitution between traded goods produced at home and abroad.

The two papers that are perhaps closer to this one are Ventura (2001) and Caballero, Farhi, and Hammour (2005). Both of these papers challenge conventional views and stress instead the effects of an expectations-driven stock market bubble on the U.S. net foreign asset position. Ventura emphasized the role of the dot-com bubble as the main driver of the current account deficits during the second half of the 1990s and argued that those deficits would be sustainable in the absence of a bubble collapse. Unlike this paper, Ventura did not offer a formal model connecting stock market bubbles and the net foreign asset position, nor did he analyze the potential interactions between bubbles and fiscal deficits. Caballero, Farhi, and Hammour study a one-country model in which high expectations about the future create sufficient savings to fund the investment necessary to validate these expectations. In contrast, we work with a world equilibrium model in which there is a fixed pool of world savings, and the stock market bubble, capital, and public debt compete for it. While Caballero, Farhi, and Hammour place the savings decision and adjustment costs in investment at center stage of their story, we instead emphasize the portfolio decision and financial market imperfections.

11.2 A Model of Crowding-Out with Debt and Capital

This section presents a stylized model of productivity, debt, and deficits. It depicts a world where young individuals save to provide for their old age consumption. These savings are used to finance both productive investments and government deficits. Fiscal policy is used to redistribute consumption across different generations. In particular, deficits finance additional present consumption by crowding out productive investments and lowering future consumption. This model constitutes a useful starting point for our argument as it neatly encapsulates conventional views on the effects and the sustainability of fiscal deficits.

Consider a world with two regions: the United States (U.S.) and the rest of the world (ROW). This world is populated by overlapping generations of young and old. Each generation contains a continuum of members with aggregate size one that are evenly distributed across the two regions. Let I and I^* be the sets of U.S. and ROW residents, respectively. As usual, use an asterisk to denote ROW variables and omit the asterisk to denote U.S. variables. There is a single good that can be used for consumption and investment. Each generation receives an endowment of this good during youth, which is evenly distributed among all its members. The endowment grows from one generation to the next at a (gross) rate γ. We normalize units so that the endowment of generation t is equal to γ^t, and we express all quantity variables as a share of this endowment.

The young are patient and risk-neutral, and they maximize expected old age consumption. Given this objective, the young save all their income, and the old consume all of theirs. Because the income of the young consists only of the endowment mentioned above, our normalization implies that all the quantity variables are to be interpreted as a share of world savings. The income of the old consists of the return to their savings plus a transfer from the government which could be positive or negative. We shall assume throughout that this transfer is independent of an individual's actions. Therefore, the only important decision in any individual's life is how to invest his or her savings so as to maximize its expected return. This portfolio choice is at the heart of the story we want to tell here.

The menu of investment options available to the young consists of government debt and firms. Government debt consists of one-period bonds. We assume that fiscal policies are consistent in the sense that, if the market decided not to roll over the debt, the government would be able (and willing) to generate enough of a surplus so as to redeem all the bonds issued. This ensures that debt payments are made with probability one. It also implies that debt issued by U.S. and ROW governments must offer the same interest rate. Let r_{t+1} be this common (gross) interest rate for holding government debt from date t to date $t + 1$.

Firms are investment projects run by entrepreneurs. A fraction κ_t of these projects is located in the United States (although some of these projects might be managed by ROW entrepreneurs). We assume that this share can vary stochastically over time within the unit interval. Firms purchase capital during the entrepreneur's youth, produce during the entrepreneur's old age, and then distribute a single dividend per unit of capital before breaking up. This dividend or production is random and has a mean π. To finance the purchase of capital, firms can use private or internal funds (i.e., the entrepreneur's own savings) or they can go public and raise external funds in the stock market (i.e., the savings of young other than the entrepreneur). Firms that are financed by internal funds offer an expected gross return equal to π. Firms that are financed by external funds are subject to agency costs equal to α and offer an expected gross return $\pi - \alpha$.[7] Therefore, investing in self-financed firms is preferred to holding stocks of traded firms.

Throughout the paper, we assume that the economy is sufficiently productive, that is, $\pi > \gamma$. This ensures that the expected return to capital exceeds the growth rate of savings. For the next couple of sections, we further assume that agency costs are not too severe, that is, $\alpha < \pi - \gamma$. This is equivalent to saying that financial frictions are small, and the stock market is close enough to the frictionless paradigm. This assumption turns out to be crucial and will be removed in section 11.4.

7. Agency costs arise from incentive problems that are created by the separation between ownership and control. One example is the cost of monitoring the manager to ensure that he or she does not embezzle funds from the firm. Another example is the efficiency loss due to less than optimal effort in situations where shareholders imperfectly observe the manager's actions or information set.

Each generation contains two types of young: entrepreneurs and shareholders. The former have good investment projects that they can convert into a firm, while the latter do not. We assume the measure of the set of entrepreneurs is ε. For simplicity, assume both regions have the same distribution of types. It follows from our assumptions that entrepreneurs either invest in their own self-financed firms or buy government debt, while shareholders are forced to choose between holding stocks of publicly traded firms and government debt.[8] Therefore, we can write the expected consumption of the different individuals as follows:

$$(1)\qquad E_t C_{i,t+1} = \begin{cases} \max(\pi, r_{t+1}) + E_t T_{i,t+1} & \text{if } i \text{ is an entrepreneur,} \\ \max(\pi - \alpha, r_{t+1}) + E_t T_{i,t+1} & \text{if } i \text{ is a shareholder,} \end{cases}$$

where $T_{i,t+1}$ is the transfer that old individual i receives from its government[9] (remember that all quantity variables are expressed as a share of the world endowment). Unless $r_{t+1} \geq \pi$, entrepreneurs enjoy higher expected consumption and therefore higher welfare than shareholders because of their ability to manage firms.[10]

Let D_t be total (U.S. plus ROW) government debt, and let δ_t be the fraction of this total that has been issued by the United States. Then we can write debt dynamics as follows:

$$(2)\qquad D_{t+1} = \frac{r_{t+1}}{\gamma} \cdot D_t + \sum_{i \in I \cup I^*} T_{i,t+1}$$

$$(3)\qquad \delta_{t+1} \cdot D_{t+1} = \delta_t \cdot \left(D_{t+1} - \sum_{i \in I \cup I^*} T_{i,t+1}\right) + \sum_{i \in I} T_{i,t+1}$$

Equation (2) shows that debt equals to debt payments plus the primary deficit. The latter is nothing but the sum of all the transfers received by the old. Equation (3) shows how the U.S. share evolves, for given primary deficits of the two regions. We assume that governments never default on their debts. This assumption will be removed later, but it turns out not to be crucial.

8. Who runs publicly traded firms? Remember each generation contains a continuum of individuals with aggregate income equal to γ^t. Assume each (infinitesimal) entrepreneur can run a (noninfinitesimal) firm of size υ. If this entrepreneur uses only internal funds, his or her expected utility is $\pi \cdot \gamma^t \cdot di$. If this entrepreneur uses external funds, his or her expected utility is old age consumption is $(\pi - \alpha) \cdot \gamma^t \cdot di + m$; where m is the manager's fee. Because there is free entry, the equilibrium manager's fee is $m = \alpha \cdot \gamma^t \cdot di$. Because this fee is infinitesimal, it constitutes a negligible cost for a noninfinitesimal firm of size υ, and we can disregard it. Therefore, the model depicts a world where a small subset of entrepreneurs use external funds to build large firms that are traded in the stock market, while a large subset of entrepreneurs runs small firms using internal funds.

9. We are assuming here that only the old receive transfers.

10. This comparison holds both the transfer and the date of birth constant. Remember that expected consumption is measured as a share of the endowment, and therefore welfare is given by $\gamma^t \cdot E_t C_{i,t+1}$. A shareholder of a future generation might enjoy more welfare than an entrepreneur of the present generation.

The interest rate depends on the amount of debt that the government is trying to place in the market. In particular, we have the following:

$$(4) \qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } D_t < 1 - \varepsilon, \\ [\pi - \alpha, \pi] & \text{if } D_t = 1 - \varepsilon, \\ \pi & \text{if } D_t > 1 - \varepsilon. \end{cases}$$

Equation (4) shows how the interest rate increases with debt. For low values of debt, the interest rate is $\pi - \alpha$ as the marginal buyer is a shareholder. For high values of debt, the interest rate increases to π as the marginal buyer of debt is now an entrepreneur. An important observation is that the assumption that financial frictions are small implies that the interest rate always exceeds the growth rate.

Let K_t denote the world capital stock, which is

$$(5) \qquad K_t = 1 - D_t.$$

Equation (5) simply says that capital and debt must add to world savings as they are the only investment options available. Let NFA_t be the U.S. net foreign asset position, that is, the difference between U.S. wealth and the U.S. capital stock. This is a measure of U.S. capital exports to the rest of the world, and is given by

$$(6) \qquad \text{NFA}_t = (0.5 - \delta_t) \cdot D_t + (0.5 - \kappa_t) \cdot K_t.$$

Equation (6) shows that the net foreign asset position of the United States contains two pieces. The first term is the difference between the debt held by U.S. residents and the debt issued by the U.S. government, that is, the first term is U.S. net borrowing. The second term is the difference between the capital stock owned by U.S. residents and the capital stock located within the United States, that is, the second term is U.S. net holdings of equity.[11]

The mechanics of this model are as follows: equations (2) to (4) jointly determine the dynamics of debt and the interest rate for a given sequence of primary deficits. With these dynamics at hand, equations (5) and (6) determine the world capital stock and the pattern of trade. With the help of an additional assumption on how these deficits are distributed among old individuals, equation (1) describes the welfare of different individuals. It is straightforward to see that this world economy has a unique equilibrium.

11. Note that U.S. residents own half of the world debt and half of the world capital stock. This only because we have assumed both regions have the same population size, the same distribution of types, and the same endowment. This is just a harmless simplification as it is straightforward to generalize the model to include asymmetries in these variables. Note also that since we have assumed that government debt consists of one-period bonds and firms last only one period, the current account is equal to the net foreign asset position and we can use equation (6) to talk about either concept. This is another simplification, of course, as the real world contains long-lived assets. But it will not play a role in what follows.

We use it next to interpret the evolution of the world economy during the last decade.

11.3 Conventional Views

Although stylized, this model captures well conventional views of the sources and effects of the large and persistent deterioration in the U.S. net foreign asset position during the last decade. According to these views, in the second half of the 1990s, the United States became a more attractive place to invest relative to the rest of the world. That is, the number of good investment projects in the United States grew relative to ROW (i.e., there was an increase in κ_t). Many have identified the boom in the information technology (IT) sector as a main reason for this. Although this sector grew rapidly worldwide in the second half of the 1990s, the United States benefited more from this growth due to its strong technological lead relative to Europe and Japan. Others have pointed to the flurry of currency and banking crises in emerging markets as the main reason for the United States becoming a more attractive place to invest relative to ROW. These crises, which started in Mexico and moved to East Asia and Russia, led to a downward reassessment of the expected return to emerging market projects.

For either or both of these reasons, the story goes, investors all over the world decided to put their savings into the U.S. stock market, and this is what generated the current account deficits of the second half of the 1990s. This is consistent with the evidence reported in figure 11.2 that, in the second half of the 1990s, a large component of the change in the U.S. net foreign asset position consisted of a decline in net holdings of equity. The story becomes a bit fuzzy when it comes to explaining the reversal in net holdings of equity that took place in the first half of the 2000s, also reported in figure 11.2. In the context of our model, this reversal could be seen as a decline in the number of good investment projects in the United States relative to ROW (i.e., there was a decrease in κ_t), although there is scant direct evidence supporting this view.

Although this account might sound reasonable at a superficial level, it should be met with a healthy dose of skepticism after looking at the actual numbers. Remember that the value of the stock market increased threefold from 1995 to 2000 and then declined by one-quarter from 2000 to 2003. If the stock market contains only productive firms, its value must reflect that of the stock of capital held by these firms. That is, the increase in stock market capitalization requires a comparable increase in the price of capital, in the quantity of capital or in both. To the extent that capital is reproducible, its price cannot exceed the cost of producing additional units. In the model, this cost is constant and equal to one. Naturally, we could extend the model to allow for congestion effects on the cost of capital as in the popular Q-theory of investment. But it seems unlikely that such an extension would be able to explain much of the rise in the value of the stock market.[12]

It also seems unlikely that this rise and fall can be explained by changes in the quantity of capital. In the model world savings grow at a constant rate γ, and so a large increase in the U.S. stock of capital would have to be associated with a decline in ROW's stock of capital. However, the increase in stock market capitalization took place all around the industrial world. Naturally, one could extend the model to allow for exogenous increases in savings and therefore the capital stock. But this would not get us very far quantitatively. Because the U.S. capital stock is about twice U.S. GNP, a threefold increase in the capital stock during the second half of the 1990s would have required astronomical investment rates!

Some have argued that the boom in the stock market in part reflected the accumulation of intangible capital, such as brand loyalty or unique organizational structures.[13] The accumulation of this kind of capital did not require investment as conventionally measured and therefore constituted a windfall to its owners. There was, in fact, some evidence in the 1990s pointing in this direction: for example, the emergence of business models built on the efficient use of information technology as a valuable form of intangible capital (most notably, various forms of e-commerce). However, while the accumulation of this intangible capital could in principle account for the run-up in the value of stockmarket during the 1990s, it seems much harder to argue that it was the decumulation of this form of capital that was behind the stock market decline in the second half of 2000. Why would the value of organizational forms based on the use of information technology such as e-commerce suddenly have vanished in the second half of 2000? The question thus remains: how did the value of the stock market grow so much in the second half of the 1990s and then drop in the first half of the 2000s?

Of course, there have also been many voices arguing that the U.S. stock market during this period was fueled by a bubble rather than by an increase in U.S. productivity relative to the rest of the world. According to this alternative view, foreign investors were not buying U.S. firms in the IT sector because of their high productivity. Instead, they were buying them because they were expecting to resell later at a higher price. The appearance of a bubble might bring huge capital gains to those that are able to create it, and this could explain the massive increases in equity prices during the second half of the 1990s. But to realize these capital gains, one must first find buy-

12. Hall (2001) estimates the price of installed capital in the United States since 1946, and finds that this price increased by only about 25 percent during the second half of the 1990s. See also Hall (2004) for an attempt to measure the cost of capital.

13. See Hall (2000, 2001). It could also be that this intangible capital already existed, and it was the demand for it that increased during this time. To the extent that intangible capital was irreproducible, its price could also have increased.

ers for the bubble, and this is only possible if the bubble promises a sufficiently attractive return. That is, a bubble can be created if and only if it is expected to grow fast enough so as to justify buying it.

It is possible to examine this alternative interpretation within our model. To do this, we formally define a stock market bubble as a situation in which firms without capital are valued and traded in the stock market. We refer to these firms as "bubbly" firms, as opposed to the "productive" firms that own the capital stock. The question is whether bubbly firms can survive in a stock market that also contains productive firms. Let B_t be the asset bubble (or aggregate value of bubbly firms as a share of world savings). Because bubbly firms do not distribute dividends, the return to holding them consists only of their price appreciation. Therefore, the young will buy these firms if and only if the expected rate of price appreciation is high enough:

$$\gamma \cdot \frac{E_t B_{t+1}}{B_t} \geq r_{t+1} \text{ if } B_t > 0 \tag{7}$$

Otherwise, the young would prefer to hold shares in productive firms or government bonds. A bubble can therefore create its own demand only by growing on average as fast or faster than the interest rate. But the growth of the bubble cannot be so fast so as to outgrow world savings, that is, $B_t \leq 1$ must hold in all dates and states of nature. And this requirement is incompatible with equation (7) if the interest rate exceeds the growth rate. Therefore, we conclude that bubbly firms cannot survive in the stock market in this case. Our assumption that financial frictions are small implies that the interest rate always exceeds the growth rate and therefore rules out the possibility of stock market bubbles. This, we think, is the first serious shortcoming of the standard or conventional view.

This view also holds that the current account deficits continued after 2000 due to the sharp change in fiscal policy implemented by the Bush administration (i.e., an increase in the U.S. primary deficit that leads to an increase in δ_t). This fiscal policy consists of spending more, cutting taxes, and financing the resulting budget deficits by issuing government debt. Overwhelmingly, this change in policy has been interpreted as a political decision and not as an economic policy response to a specific macroeconomic disturbance. In other words, the U.S. fiscal expansion has been treated as an exogenous shock to the macroeconomic landscape. Much of the increment to public debt has been placed abroad. Between end-2000 and end-2003, U.S. public debt increased by $500 billion, while foreign holdings of U.S. Treasury bills increased by almost the same amount. And to the extent that public debt has been placed at home, it likely has crowded out U.S. corporate debt and forced firms to place an increasing fraction of their own debt abroad. Through these direct and indirect channels, the budget deficits of the Bush administration account for a substantial part of the large increase in net borrowing from abroad shown in figure 11.2. The important question is whether this situation is sustainable and, if it is not, how the necessary adjustment will look.

To answer this question, we use the model to analyze the effects of a fiscal expansion in the United States. The experiment is as follows. Initially both regions have no debt and follow balanced-budget policies, that is, $D_t = 0$ and $\Sigma_{i \in I \cup I^*} T_{i,t} = 0$. At some date, the United States switches its policy for exogenous reasons and decides to increase spending, cut taxes, and finance the resulting deficit by going into debt, while ROW keeps its budget balanced, that is, $\Sigma_{i \in I} T_{i,t} = \overline{T} > 0$ and $\Sigma_{i \in I^*} T_{i,t} = 0$. The questions we address next are What are the possible endings for this fiscal episode? and What are its welfare consequences?

When the fiscal deficits appear, government debt starts growing at an accelerating rate, crowding out the investments of the shareholders. The growth of the debt is fueled directly by the deficits but also indirectly by unfavorable debt dynamics resulting from the interest rate exceeding the growth rate. In fact, it is this second component growing over time that leads to accelerating debt growth. If the fiscal expansion lasts long enough, the debt also starts crowding out the investments of the entrepreneurs. At this point the interest rate goes up, debt dynamics become more unfavorable and debt accumulation further accelerates. As debt accumulates, U.S. net borrowing abroad increases. Because the debt crowds out capital from the portfolios of investors worldwide, U.S. net holdings of equity decline in absolute value.

This situation is not sustainable as the accelerating growth rate of debt is incompatible with a fixed pool of savings, and the U.S. eventually must go through a period of fiscal adjustment. This essentially means that the U.S. must reverse its fiscal policy (as it does not want to default) and start running sufficiently large surpluses, that is, $\Sigma_{i \in I} T_{i,t} = T < (\gamma - r_t/\gamma) \cdot D_t$. Not surprisingly, the magnitude of the fiscal adjustment increases with the level of debt. When the debt is higher, the surpluses need to be larger, last longer, or both.

Assuming that the U.S. government only makes transfers to U.S. citizens, the fiscal expansion increases the welfare of current U.S. generations in detriment of future ones. After all, in this model a policy of budget deficits is nothing but a policy of passing the bill forward. When this policy is implemented, the old consume beyond the return to their savings and pass the bill to the next generation. This bill includes their extra consumption plus the interest. Rather than paying the bill, the next generation further increases it by also consuming more than the return to their savings and then passes the bill along to the following generation. This keeps going on for as long as the government follows a policy of running deficits and rolling over the debt. But the bill is growing too fast and must eventually be paid. This is what a fiscal adjustment is all about. The longer it takes for this adjustment to happen, the larger is the final bill and the costlier will be for the United States to face it.

The welfare of present generations is also affected by the fiscal expansion indirectly through its effects on the interest rate. High interest rates raise the expected consumption of young shareholders both in the United States and ROW. Because interest rate costs are added to the bill, future generations of U.S. residents are also supporting higher consumption of current ROW generations. This constitutes a positive spillover of the U.S. fiscal expansion on ROW. The fiscal adjustment will eliminate it, and this is why ROW residents might prefer this to happen as late as possible.

Of course, one could argue that this scenario is unrealistic as it assumes that the U.S. government will honor its debt in all contingencies. But relaxing this assumption has only minor effects on the overall story. To see this, replace equations (2) and (4) for these straightforward generalizations:[14]

$$(8) \qquad D_{t+1} = \begin{cases} \dfrac{r_{t+1}}{\gamma} \cdot D_t + \sum\limits_{i \in I \cup I^*} T_{i,t+1} & \text{with probability } 1 - \mu_t, \\ 0 & \text{with probability } \mu_t. \end{cases}$$

$$(9) \qquad r_{t+1} = \begin{cases} \pi - \alpha + \mu_t & \text{if } D_t < 1 - \varepsilon, \\ [\pi - \alpha + \mu_t, \pi + \mu_t] & \text{if } D_t = 1 - \varepsilon, \\ \pi + \mu_t & \text{if } D_t > 1 - \varepsilon, \end{cases}$$

where μ_t is the (exogenous) probability that the U.S. government defaults on its debt. A reasonable assumption is that this probability grows as the debt increases, but we need not make it here. Equation (8) recognizes that now debt can be defaulted upon, while equation (9) recognizes that the expected return on government debt includes the promised return minus the expected loss from default. Note that default risk makes debt dynamics even more unfavorable by raising the interest rate. In other words, default risk makes the current situation even more unsustainable.

With a positive default probability, the U.S. fiscal expansion might have a different ending. If the current deficit goes on long enough and the required fiscal adjustment becomes too large, the U.S. government might simply default on its debt. In this case, the adjustment takes place in a dramatic fashion. The generation of old (U.S. and ROW) shareholders that suffers the default pays the entire bill for the excess consumption of its U.S. predecessors. Because half of the shareholders are not U.S. residents, half

14. One can think of default as surprise inflation that erases the real value of the debt. Here we are also assuming that the ROW government keeps with its policy of having no debt. Otherwise, we should also break down equations (8) to (9) into their two regional components.

of the bill is therefore paid by ROW citizens. In this scenario, current U.S. economic policy is simply increasing consumption and welfare of current U.S. residents at the expense of future U.S. and ROW residents. This constitutes a negative spillover of the U.S. fiscal expansion on ROW. A fiscal adjustment would ensure that this scenario does not happen and, as a result, ROW residents might prefer the United States to reduce its budget deficits even if this lowers the interest rate.

Another problem with this standard story is the behavior of the interest rate. While the model predicts that the U.S. fiscal expansion will increase the interest rate, the evidence shows exactly the opposite. Figure 11.4 showed that, in the midst of one of the largest fiscal expansions in U.S. history, the interest rate fell from above 3 percent to close to 0 percent. The model can account for this observation if there is a decline in the expected return to capital (i.e., a decline in π or ε) or an increase in agency costs (i.e., an increase in α).[15] Given the magnitude of both the fall in interest rates and the increase in budget deficits, the decline in productivity or an increase in agency costs would have to be very large. There is scant evidence for a major decline in world productivity. And despite the intense media coverage of some financial scandals such as Enron or Parmalat, it also seems unlikely that frictions in financial markets increased dramatically overnight.

Another popular hypothesis for why interest rates have fallen is that a global "glut of saving" appeared (see Bernanke 2005). According to this hypothesis, the increase in saving exceeded the increase in public debt, leading to a decline in interest rates. There are various explanations for where these savings are coming from, including an increased appetite for reserves by Asian central bankers and a windfall of rising oil prices in the high-saving oil producing countries. While these stories about exogenous shocks are reasonable, we shall argue in the following that another explanation for the glut of saving is the collapse of the bubble itself. Once the bubble was no longer available, savers endogenously shifted to other assets, most notably, U.S. government debt.

To sum up, the model crudely but effectively encapsulates conventional views of the U.S. current account deficit. Its appearance in the second half of the 1990s reflects an increase in U.S. productivity relative to the rest of the world that led investors all over the world to place their savings in the U.S. stock market. This situation ended with the stock market collapse in 2000. But the current account deficits continued after this now fueled by the drastic change in fiscal policy implemented by the Bush administration. This policy is, however, unsustainable, and something must eventu-

15. We have assumed that π, α, and ε are constant. Note, however, that all the equations of the model still apply if we assume that these parameters vary stochastically over time.

ally give. Most observers think that this episode will end with a painful fiscal adjustment although there are also those who argue that the resolution will entail some default on the part of the U.S. government. The stylized model developed in the preceding shows how all of these observations fit together.

But the model is not free of problems, though. It cannot explain observed movements in equity prices, and it can only explain why the interest rate fell in the midst of one of the largest fiscal expansions in U.S. history by appealing to exogenous changes in saving or productivity. How can we come to grips with these observations? The preceding analysis relies to a large extent on the condition that the interest rate exceeds the growth rate. This condition rules out the existence of stock market bubbles and underlies the notion that a policy of continued fiscal deficits is unsustainable. But this condition is not satisfied in the data. Figure 11.5 plots the ex-post real one-year Treasury bill rate and the real GDP growth rate for the United States since 1970. With the exception of the 1980s, the interest rate has been consistently below the growth rate for almost all years during this period. More important for our purposes, since 1992 interest rates have averaged 1.7 percent while GDP growth has averaged 3.3 percent. As we shall show next, the behavior of the world economy is quite different when the growth rate exceeds the interest rate.

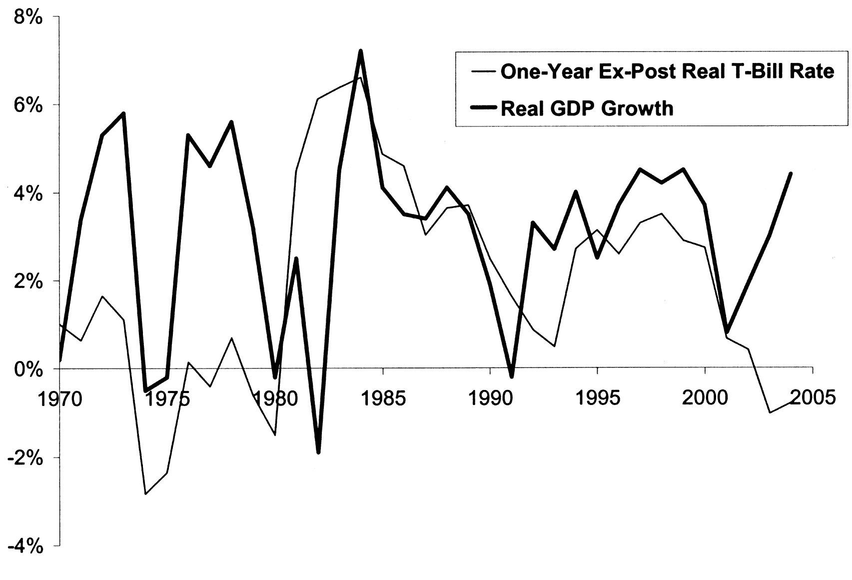

Fig. 11.5 Interest rates and growth rates

Sources: GDP growth is from U.S. Bureau of Economic Analysis, and interest rates are from the Board of Governors of the Federal Reserve System.

11.4 A Model of Crowding-Out with Debt, Bubbles, and Capital

Assume next that agency costs are severe, that is, $\alpha > \pi - \gamma$. This is equivalent to saying that financial frictions are large, and the stock market is far from the frictionless paradigm. In this case, the world economy can experience stock market bubbles, that is, the stock market might contain unproductive or bubbly firms that never deliver a dividend. The only reason to hold these firms is to realize capital gains. We assume that creating bubbly firms is simply a matter of luck and entails negligible costs. Naturally, all young try to create them and those that are successful obtain a rent by selling their bubbly firm during old age.[16] Let $N_{i,t}$ be the rent that individual i receives. We generalize equation (1) as follows:

$$(10)\quad E_tC_{i,t+1} = \begin{cases} \max\left[\pi, r_{t+1}, \gamma \cdot \dfrac{E_t(B_{t+1} - N_{t+1})}{B_t}\right] + E_tT_{i,t+1} + E_tN_{i,t+1} & \text{if } i \text{ is an entrepreneur,} \\ \max\left[\pi - \alpha, r_{t+1}, \gamma \cdot \dfrac{E_t(B_{t+1} - N_{t+1}}{B_t}\right] + E_tT_{i,t+1} + E_tN_{i,t+1} & \text{if } i \text{ is a shareholder,} \end{cases}$$

where $N_t = \Sigma_{i\in I\cup I^*} N_{i,t}$ is the total value of the bubbly firms that appear at date t. Note that the expected (gross) return on holding a bubbly firm is equal to the (gross) growth rate of its price. This growth rate is equal to the expected value of tomorrow's bubbly firms at date $t + 1$, $\gamma^{t+1} \cdot E_t(B_{t+1} - N_{t+1})$; divided by their value at date i, that is, $\gamma^t \cdot B_t$.[17] Equation (10) exhibits two differences with respect to equation (1). Bubbly firms are now included in the menu of assets, and this affects the expected return on the savings of the young. In addition, the creation of new bubbly firms generates rents for the old, and this constitutes an additional source of income.

Equations (2) and (3) describing debt dynamics still apply, but we must modify equation (4) describing the interest rate as follows:[18]

$$(11)\qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } D_t < 1 - \varepsilon - B_t, \\ [\pi - \alpha, \pi] & \text{if } D_t = 1 - \varepsilon - B_t, \\ \pi & \text{if } D_t > 1 - \varepsilon - B_t. \end{cases}$$

16. Success is nothing but a positive realization of an individual-specific sunspot.

17. Equation (6) implicitly assumed a fixed number of bubbly firms. In this case, the expected growth rate of the bubble equals the expected price appreciation of existing bubbly firms.

18. We assume again that governments never default on their debts. As shown before, it is straightforward to generalize the analysis to the case in which there is an exogenous probability that governments default on their debts.

Equation (11) recognizes that debt and the bubble both compete with capital for the savings of the young. In order to create its own demand, the bubble must grow sufficiently fast:

$$\text{(12)} \qquad \frac{E_t(B_{t+1} - N_{t+1})}{B_t} = \frac{r_{t+1}}{\gamma} \quad \text{if } B_t > 0$$

Equation (12) ensures that the young are willing to buy bubbly firms. It applies whenever bubbly firms have a positive value in equilibrium. We shall construct later equilibria in which bubbly firms not only survive in the stock market, but also drive all productive firms out of it. Finally, let β_t be the share of all bubbly firms created by U.S. residents. It then follows that

$$\text{(13)} \qquad \beta_{t+1} \cdot B_{t+1} = \beta_t \cdot (B_{t+1} - \sum_{i \in I \cup I^*} N_{i,t+1}) + \sum_{i \in I} N_{i,t+1}.$$

The presence of a bubble naturally affects asset trade. The world capital stock is now given by

$$\text{(14)} \qquad K_t = 1 - D_t - B_t,$$

and the capital stock of the United States is then $\kappa_t \cdot (1 - D_t - B_t)$. The U.S. net foreign asset position is now given as follows:

$$\text{(15)} \quad \text{NFA}_t = (0.5 - \delta_t) \cdot D_t + (0.5 - \beta_t) \cdot B_t + (0.5 - \kappa_t) \cdot (1 - D_t - B_t)$$

Equation (15) is a natural generalization of equation (6) and includes an additional piece of the net foreign asset position of the United States. This piece is the second term and consists of the difference between the share of the bubble held by U.S. residents and the share of the bubble created by them. Now the U.S. net holdings of equity are given by the sum of the second and third terms of equation (6).

The mechanics of this model are very close to those of the model in section 11.2. Equations (2), (11), (12), and (13) describe the dynamics of debt and the interest rate for a given sequence of bubbles and deficits. With these dynamics at hand, equations (14) and (15) determine the world capital stock and the pattern of trade. With the help of additional assumptions about the creation of new bubbly firms and the distribution of deficits among individuals, equation (10) describes the welfare of each individual. This world economy has many equilibria now, each of them corresponding to a different set of (consistent) assumptions about the behavior of bubbles and deficits. We shall later construct some of these equilibria and examine their implications.

This model allows us to study the large and persistent deterioration of the U.S. net foreign asset position under the more realistic assumption that the interest rate falls short of the growth rate. As is well known, this condition implies that the world economy contains pockets of dynamically inefficient investments.[19] The logic behind this inefficiency is disarmingly simple and well understood: every period young shareholders invest $\gamma^t \cdot (1 - \varepsilon)$ units of the single good, while old shareholders receive a return to their savings that on average equals $r_t \cdot \gamma^{t-1} \cdot (1 - \varepsilon)$. If $r_t < \gamma$, it is welfare-improving to implement a social contract whereby all young shareholders are forced to stop investing and instead give all of their income to the old shareholders. This social contract would liberate an amount of resources equal to $(\gamma - r_t) \cdot \gamma^{t-1} \cdot (1 - \varepsilon)$ per period, and these resources would go directly to the pockets of the future shareholders. Moreover, the generation that starts the social contract would get an upfront fee (for its service to society) that equals the endowment of the first generation of young that participate in the social contract, that is, $\gamma^t \cdot (1 - \varepsilon)$. This social contract therefore improves on the market and raises the consumption and welfare of all generations.[20]

At first sight, the practical difficulties in implementing this social contract appear overwhelming. But this is only a false appearance. It has been known for a long time that government debt and stock market bubbles can both crowd out inefficient investments and improve welfare. Complying with the social contract during youth and giving the endowment to the old can be seen as equivalent to purchasing the right to receive the endowment of the young during old age. But this is exactly what government debt or stock market bubbles are. When the young buy any of these assets from the old (and thus give the old their endowment), they are doing so in the expectation of reselling them to the young later during their old age (and therefore receiving the endowment of the young). In this way, government debt and stock market bubbles eliminate inefficient investments and liberate resources that increase the consumption of all future generations. Because issuing debt or creating bubbly firms has negligible costs, those that create them receive in addition an upfront fee or rent that equals the full value of the asset created. This upfront fee or pure rent is exactly what $T_{i,t}$ and $N_{i,t}$ are.

As the previous discussion hints, the presence of pockets of dynamically

19. In an influential paper, Abel et al. (1989) noticed that capital income exceeds investment in industrial countries and then argued that this observation is incompatible with the view that these countries contain dynamically inefficient investments. Their argument is misleading, however. To see this, note that in our world economy capital income is $[\pi - \alpha \cdot (1 - \varepsilon)] \cdot \gamma^{t-1}$, while investment is γ^t. The observation that capital income exceeds investment, that is, $\pi - \alpha \cdot (1 - \varepsilon) > \gamma$, does not rule out the possibility that there exist pockets of dynamic inefficiency, that is, $\gamma > \pi - \alpha$. The observation that capital income exceeds investment only implies that the average investment is dynamically efficient. But this is not incompatible with the statement that the marginal investment be dynamically inefficient. Abel et al. (1989) did not notice this because they assumed throughout that financial markets are frictionless and, as a result, all investments exhibit the same return. This corresponds to the special case of our model in which $\alpha = 0$. This is a crucial and yet unrealistic assumption. Once we remove it, the argument of Abel et al. does not go through.

20. Because entrepreneurs receive an expected gross return to their savings that exceeds the growth rate, their investments are dynamically efficient and the government should not try to eliminate them.

inefficient investments might lead to a substantial rethinking of the role of fiscal policy. Naturally, fiscal policy still redistributes consumption across generations. But now it also eliminates inefficient investments. Because bubbles are an alternative and market-generated solution to the same problem, this observation raises some interesting and still unanswered questions: under what conditions does fiscal policy complement stock market bubbles as a mechanism to eliminate inefficient investments? Under what conditions does fiscal policy compete with stock market bubbles for this role? What are the welfare implications of these interactions between bubbles and deficits? We next show that the answers to these questions lead to new and somewhat surprising views on U.S. economic policy.

11.5 A "Benevolent" View of U.S. Economic Policy

We next construct an equilibrium in which the stock market initially creates a bubble that is large enough to crowd out all inefficient investments. The world economy operates efficiently, and welfare is high. But there is a change in investor sentiment that triggers the collapse of the bubble. The result is that inefficient investments reappear. The U.S. government reacts to this by running large deficits that crowd out some of these investments and improve the functioning of the world economy. In this equilibrium, the U.S. fiscal expansion constitutes a welfare-improving policy response to the bubble collapse.

Consider the case of a world economy in which investor sentiment fluctuates between two states: $S_t \in \{L, H\}$. In the L (or low) state, investors are pessimistic, bubbly firms are not valued, and the stock market contains only productive firms. In the H (or high) state, investors are optimistic, bubbly firms are valued, and they completely crowd productive firms out of the stock market. That is, we assume that the bubble evolves as follows:

$$B_t = \begin{cases} 0 & \text{if } S_t = L, \\ 1 - \varepsilon - D_t & \text{if } S_t = H_t. \end{cases} \tag{16}$$

We shall assume also that $N_t = 0$ for all t, except for those dates in which the world economy transitions from L to H and $N_t = B_t$. That is, all bubbly firms appear at the onset of the bubble. After this, no more bubbly firms are created, and the stock market bubble contains only a fixed number of firms whose value fluctuates over time until the bubble bursts. After a period without bubble, the cycle starts again.

How do these changes in investor sentiment happen? We assume that individuals coordinate to an equilibrium using a sunspot variable that moves between the high and low states. We refer to this variable as "investor sentiment." Assume the transition probability or probability that there is a change in investor sentiment is λ. When a generation is optimistic, it believes that the probability the next generation will buy the bubble is $1 - \lambda$. When a generation is pessimistic, it believes that the probability the next generation will buy the bubble is λ. If λ is sufficiently small, optimistic generations buy the bubble, pessimistic generations do not, and the probabilities assigned by both types of generations are exactly the equilibrium ones. We assume from now on that $\gamma \cdot (1 - \lambda) > \pi - \alpha > \gamma \cdot \lambda$. This ensures that these changes in investor sentiment are an equilibrium. We shall see that a change in investor sentiment that moves the world economy from the high to the low state is nothing but a coordination failure as the low state provides less welfare than the high state.

The U.S. government recognizes the beneficial role that bubbly firms play in the world economy and avoids competing with them. When investor sentiment is high, the government refrains from running budget deficits and lets the (stock) market eliminate the inefficient investments on its own. When investor sentiment is low, the market cannot do this, and the government runs budget deficits in order to help. These deficits raise government debt and crowd out the inefficient investments that the market is unable to eliminate by itself. In particular, we assume the United States follows this fiscal policy:

$$\sum_{i\in I} T_{i,t} = \begin{cases} \dfrac{\gamma - r_t}{\gamma} \cdot (1 - \varepsilon) & \text{if } S_t = L, \\ 0 & \text{if } S_t = H. \end{cases} \tag{17}$$

This fiscal policy ensures that government debt eventually absorbs all inefficient investments if investor sentiment remains low indefinitely. However, consistent with the view that the government is trying to remedy market failures, debt will never crowd out the investments of entrepreneurs. Throughout, and only for simplicity, we assume that ROW has no debt and follows a balanced-budget policy, that is, $\delta_t = 1$ and $\Sigma_{i\in I^*} T_{i,t} = 0$.

The assumptions made allow us to determine the equilibrium interest rate as follows:[21]

$$r_{t+1} = \begin{cases} \pi - \alpha & \text{if } S_t = L, \\ \gamma \cdot \dfrac{(1 - \lambda) \cdot (1 - \varepsilon)}{1 - \varepsilon - \lambda \cdot D_t} & \text{if } S_t = H. \end{cases} \tag{18}$$

Equation (18) shows that the implications of increased government debt on the interest rate depend crucially on investor sentiment. Note that the assumptions made ensure that the interest rate is always higher when investor

21. To derive the interest rate when $S_t = H$, substitute equations (2), (16), and (17) into equation (12) and then solve for the interest rate. Note that when $S_t = L$ and $D_t = 1 - \varepsilon$, any $r_t \in [\pi - \alpha, \gamma]$ is also an equilibrium.

sentiment is high. When investor sentiment is low, the interest rate is low because debt competes with capital, and the latter offers a low expected return to shareholders. When investor sentiment is high, the interest rate is high because debt competes with the bubble, which is a better asset than capital. It follows from equation (15) and the assumption that $N_t = 0$ that the interest rate is nothing but the expected (gross) growth rate of the bubble.

To understand what is behind equation (18), assume first that there is no government debt. Then, the expected growth rate of the bubble is γ if there is no change in investor sentiment, but zero if there is a change in investor sentiment. Because the latter happens with probability λ, the expected growth rate of the bubble is $\gamma \cdot (1 - \lambda)$, and this is what the interest rate must be when $D_t = 0$. Assume instead that there is some debt in the world economy. Because debt dynamics are favorable, and both governments follow a policy of balanced budgets, we have that the debt is falling, and the bubble is replacing it. Therefore, the bubble grows faster than the world economy as it absorbs an increasing fraction of the shareholders' savings. The larger is the debt, the faster it falls and the faster is the growth of the bubble and the interest rate.

Under the assumptions made about bubbles and deficits, the dynamics of debt are given by equations (2) and (17) to (18). Substituting these dynamics into equation (16), we also obtain the dynamics of the bubble. It is straightforward to check that, under our parameter restrictions, the sequences of bubbles and debt generated by these equations constitute an equilibrium of the world economy. We use next this equilibrium to reinterpret the main macroeconomic developments of the last decade.

This equilibrium portrays an alternative and benevolent view of current U.S. economic policy. The story goes as follows. Initially, the world starts in the pessimistic state, with the United States having some intermediate level of debt and a low interest rate, that is, $0 < D_t < 1 - \varepsilon$ and $r_t = \pi - \alpha$. At some date, there is a change in investor sentiment, and a stock market bubble appears. The bulk of this bubble consists of U.S. bubbly firms, that is, $\Sigma_{i \in I} N_{i,t} > 0.5$. After a few periods, there is a new change in investor sentiment that moves the world economy back into the pessimistic state. This brings about a collapse in the bubble that forces savers to seek alternative assets. The questions we address next are what are the macroeconomic effects of the appearance and bursting of the bubble? What are the effects of U.S. fiscal policy?

Figure 11.6 illustrates the dynamics of debt by plotting D_{t+1} as a function of D_t. The convex upward-sloping line captures the dynamics of debt when investor sentiment is high, while the straight upward-sloping line shows the same when investor sentiment is low. The economy starts out with low investor sentiment and an initial level of debt D^*. Debt dynamics are favorable, and debt increases at a decreasing rate. Absent any further shocks, it

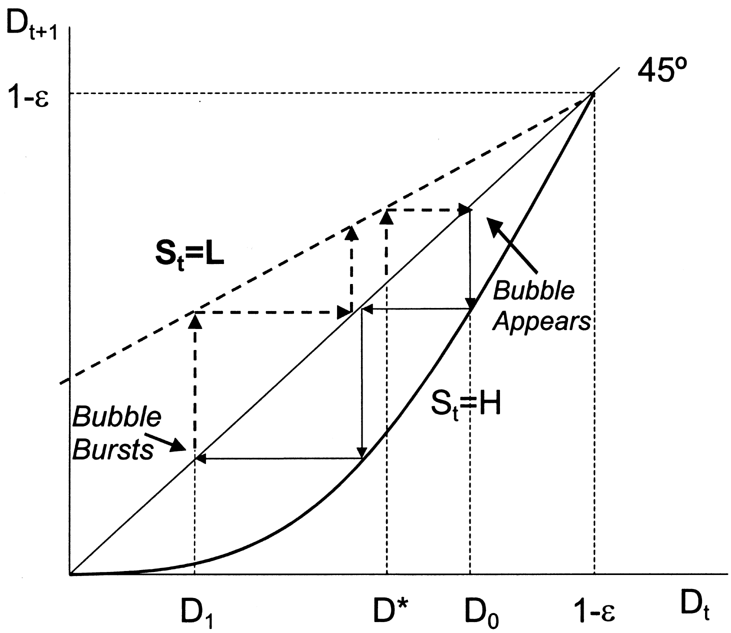

Fig. 11.6 Debt dynamics in the benevolent view

would asymptotically reach an upper bound of 1 – ε where it would fully crowd out all the inefficient investments of the shareholders. However, before this (when debt is equal to D_0), investor sentiment changes, and a bubble appears in the stock market. The government reacts to this by eliminating the budget deficit, and debt begins to fall. Absent any further shocks debt would asymptotically reach zero as it is no longer needed to crowd out inefficient investments. Before this happens, there is again a change in investor sentiment (when debt is equal to D_1), and the bubble collapses. The government responds with fiscal deficits that set debt on an upward trajectory again.

During the period before the bubble appears, U.S. debt accumulates gradually, and the net foreign asset position becomes more negative as some of this debt is held by foreigners. The government responds to the appearance of the bubble by eliminating the budget deficit, and debt accordingly begins to decline. The bubble provides shareholders with a more attractive investment option and therefore crowds out all productive firms from the stock market. As time passes, government debt declines, and the bubble keeps growing and absorbing an increasing fraction of the savings of the shareholders. Despite the elimination of the budget deficit, the interest rate jumps up as government debt must now compete with the bubble for the savings of shareholders. The interest rate then declines slowly as the growth rate of the bubble also declines over time. The net foreign asset position jumps down as the U.S. old sell their bubbly firms to the ROW young, and the composition of the net foreign asset position of the United States shifts from debt to equity.

This rosy situation changes overnight as a result of a change in investor sentiment that brings about a collapse in the bubble. Suddenly, savers no longer have access to this asset and must seek alternative investments. This situation can be thought of as a glut of savings. Initially, the inefficient investments of shareholders return, but the U.S. government reacts to this situation by engineering a fiscal expansion that eliminates these inefficient investments over time. Unlike the analysis of section 11.3, debt dynamics are favorable, and the debt grows at a decelerating rate, eventually stabilizing without the need for a fiscal adjustment. Despite the appearance of budget deficits, the interest rate jumps down and stays low as debt no longer competes with the bubble. The collapse of the bubble erases a fraction of the negative U.S. net holdings of equity and leads to a sharp increase in net foreign assets. But this is quickly reversed as U.S. government debt accumulates.

This story is therefore broadly consistent with the evidence presented in the introduction. It can account for the boom in the stock market and the sharp decline in budget deficits during the second half of the 1990s as well as the collapse of the stock market and the reemergence of fiscal deficits during the early 2000s. It can explain why interest rates were high during a period of low budget deficits but fell when high budget deficits returned. It can account for the decline in the net foreign asset position associated with the appearance of the bubble. Moreover, by virtue of the assumption that the bubble was created primarily in the United States, it can account for the large expansion in foreign purchases of U.S. equity during the second half of the 1990s, followed by a sharp reversal. This reversal in U.S. net holdings of equity is offset by a decline in U.S. net holdings of debt as the U.S. government issues debt and sells part of it to foreigners.

The welfare implications of this scenario are easy to spot. The appearance of the bubble brings about an extraordinary bonanza for the current generation of old as they cash in the rents from bubble creation and enjoy an unexpectedly high level of consumption. This windfall is equivalent to the upfront fee of implementing the part of the social contract that the debt was not implementing, that is, $\gamma' \cdot (1 - \varepsilon - D_t)$. This fee is unevenly distributed as we have assumed that most of the bubble was created by U.S. residents. The following generations of U.S. and ROW shareholders are not so well off as the previous one as there is no further creation of bubbly firms. But they still enjoy the benefit of a high interest rate, and this increases the consumption and welfare of shareholders all around the world. Through the high interest, shareholders receive all the gains from eliminating their inefficient investments just as in the social contract, that is $(\gamma -$

$\pi + \alpha) \cdot \gamma^{t-1} \cdot (1 - \varepsilon)$.[22] In this world economy, a stock market bubble is a very good thing as it implements the social contract and everybody benefits.

The collapse of the bubble brings substantial hardship to the contemporary generation of shareholders, who bought the bubble during their youth and find out in their old age that it is worthless. Somewhat unfairly, this generation of shareholders pays a dear price for the fact that the next generation of the young decides to break the social contract and not buy the bubble from them. This price can be understood as the devolution of the upfront fee for destroying the social contract, that is, $\gamma^t \cdot (1 - \varepsilon - D_t)$. Subsequent generations do not suffer as much although they still find that interest rates are low and, as a result, so are their consumption and welfare. The gains from eliminating the inefficient investments are lost. The bursting of the bubble is a coordination failure and everybody loses from it.

The U.S. fiscal expansion offsets part of this loss for U.S. residents. To see this, note that we can use equation (2) to decompose the revenues from the fiscal expansion, that is, $\gamma^t \cdot \Sigma_{i\in I} T_{i,t}$, into two components. The first one consists of the gains from eliminating inefficient investments, that is $(\gamma - r_t) \cdot \gamma^{t-1} \cdot D_t$. The second one consists of the upfront fee for creating debt, that is, $\gamma^t \cdot (D_{t+1} - D_t)$. That is, the U.S. government is gradually implementing the social contract and distributing the gains to the different U.S. generations in the form of transfers, that is, higher spending and lower taxes. The ROW residents do not benefit from this U.S. fiscal policy because they are assumed not to receive transfer from the U.S. government, and the interest rate remains low throughout.[23]

This analysis departs fundamentally from the conventional view in two important respects. The first one is that the fiscal expansion is now seen as sustainable, while in section 11.3 it was deemed unsustainable. The second difference is that the fiscal expansion is now seen as benefiting all generations, while in section 11.3 it was perceived as a means to redistribute consumption from future to present generations. Both of these differences, of course, are a direct consequence of removing the unrealistic assumption, which underlies conventional views, that the interest rate exceeds the growth rate.

How plausible is this benevolent view of U.S. economic policy? An immediate objection to it comes from a simple numerical observation. Favorable debt dynamics mean that debt accumulation decelerates and eventually stabilizes. But this requires that the deficits not be too large. To see

22. To understand the welfare implications for the subsequent generations, simply remember that trading the bubble essentially means that each generation of shareholders receives the endowment of the next one in exchange of its own.

23. They would benefit too though, if we had postulated a concave technology rather than a linear one as the debt would raise the interest rate. And this would be a positive spillover of the U.S. fiscal expansion abroad.

this, assume now that $\Sigma_{i\in I} T_{i,t} > \gamma - r_t/\gamma \cdot (1 - \varepsilon)$. In this case, government debt starts crowding out efficient investments before stabilizing and this turns favorable debt dynamics into unfavorable ones. If the deficits are too large, the situation is unsustainable even if the world economy contains pockets of dynamically inefficient investments. This seems to be the situation nowadays. The U.S. economy is about 40 percent of the world economy. Its (net) growth rate is about 3 percent, the (net) interest rate is about 1.5 percent, and the budget deficit remains at 5 percent of U.S. GNP. Under these assumptions, by the time U.S. government debt stabilizes it has already surpassed world savings by almost 40 percent! The current budget deficits are not sustainable, and this seems an unobjectionable conclusion to us.

But this does not mean, however, that the benevolent view is incorrect. The essence of this view is that the U.S. government is supplying an asset (government debt) that is useful to eliminate inefficient investments, and it is receiving payments (deficits) for this service. The time profile of deficits reflects how these payments are distributed across the different generations. We made the simple assumption in equation (16) that these benefits grew at the same rate as the world economy, that is, so that generation t obtained $\gamma^{t+1} \cdot T$. But this is obviously not the option that the current U.S. government has chosen. We get much closer to the actual behavior of the U.S. government if we replace equation (17) by the following one:

$$(19)\qquad \sum_{i\in I} T_{i,t} = \begin{cases} \dfrac{\gamma - r_t}{\gamma} \cdot (1 - \varepsilon) & \text{if } S_t = S_{t-1} = L, \\ 1 - \varepsilon - \dfrac{r_t}{\gamma} \cdot D_{t-1} & \text{if } S_t = L \text{ and } S_{t-1} = H, \\ 0 & \text{if } S_t = H. \end{cases}$$

Under this new assumption on fiscal policy, equation (18) describing the interest rate still applies. The dynamics of debt under this fiscal policy are now however very different. When the bubble bursts, the United States responds by engineering a very large fiscal expansion. In particular, it immediately expands debt by exactly the amount required to absorb all of the savings of the shareholders and then stabilizes debt at this level by running much smaller deficits. The first generation after the bubble collapses receives the entire upfront fee. Future generations then simply receive the gains from eliminating inefficient investments. Whether this choice of distribution of gains corresponds to a preference for the current generation or, instead, to a desire to compensate the generation that lost the bubble is unclear. But to make the benevolent view consistent with observed policy, one must assume that the lion's share of the gains that accrue from supplying government debt are being reaped by the current generation.

This view comes surprisingly close to capturing actual U.S. fiscal policy.

Suppose that the decline in the value of the stock market between 2000 and 2003, equaling a bit more than $3 trillion, represents the elimination of the bubble. According to this benevolent view, the U.S. government should run large fiscal deficits to quickly expand public debt by about the same amount. Interestingly, according to the baseline projections of the U.S. Congressional Budget Office, public debt will expand by $2.6 trillion between 2000 and 2012 and then stabilize thanks to much smaller projected budget deficits of around 2 percent of GDP. This suggests that projected fiscal policy over the next several years will be successful in eliminating almost as many inefficient investments as the stock market bubble did in the 1990s.

Of course, it is possible that a bubble reappears in the stock market in the future, and this would require an adjustment in fiscal policy. According to the benevolent view, the government should respond to the reappearance of a stock market bubble by eliminating the fiscal deficits. In the context of our model, whether this fiscal adjustment will be painful depends on who issues the bubble. If the United States is lucky and the new bubble is mostly created by U.S. residents, then the rents from bubble creation will make for most of the lost budget deficits. And if this is the case, the U.S. net foreign asset position will remain negative as U.S. residents on net sell their bubbly firms to foreigners. If, instead, it is mostly ROW residents that issue the new bubble, then the fiscal adjustment would be costly as U.S. residents would not be compensated for the loss of the budget deficits. In this case, the U.S. net foreign asset position would turn positive as U.S. debt declines and ROW residents sell bubbly firms to U.S. ones.

Central to our model is the result that providing an asset that eliminates inefficient investments yields a benefit or fee to those that create it. According to the benevolent view, the government is altruistic: it lets the private sector appropriate this benefit (rents from bubbly creation) and only intervenes when the market is incapable of providing itself with the appropriate asset. When this is the case, the government also receives part of this benefit (the budget deficits). But why would the government not want to appropriate this benefit even when the market works? One can also imagine that the government could be opportunistic and try to displace an existing bubble in order to capture all the benefits from providing an asset that eliminates inefficient investments. These benefits can then be redistributed to its constituents. We examine next this possibility.

11.6 A "Cynical" View of U.S. Economic Policy

We consider next a situation in which there are two types of government, *altruistic* and *opportunistic.* The altruistic government acts as in the previous section, and allows the private sector to capture the rents from bubble creation. The opportunistic government expands public debt and crowds out the bubble in order to capture these rents and distribute them to its constituents. We construct an equilibrium in which initially the altruistic government is in power, and the stock market creates a bubble that is large enough to crowd out all inefficient investments. The government responds by eliminating its budget deficits and making room for the bubble to grow. But there is a change in government, and this leads to a drastic change in fiscal policy. The opportunistic government starts a fiscal expansion whose objective is to crowd out the bubble and in this way appropriate its value. In this equilibrium, the U.S. fiscal expansion constitutes a beggar-thy-neighbor policy that is responsible for the collapse in the stock market.

Let $G_t \in \{A, O\}$ be a state variable indicating whether the altruistic ($G_t = A$) or the opportunistic ($G_t = O$) government is in power, and let ϕ be the probability the U.S. government changes type. As in the previous section, the altruistic government uses fiscal policy to immediately eliminate inefficient investments whenever the stock market fails to do so. Therefore equation (19) still applies when $G_t = A$. Instead, the opportunistic government uses fiscal policy to appropriate as many resources as possible and then distributes them as it sees fit. As a result, when $G_t = O$, we must replace equation (19) with the following:

$$(20) \qquad \sum_{i \in I} T_{i,t} = \begin{cases} \chi \cdot \left(1 - \varepsilon - \dfrac{r_t}{\gamma} \cdot D_{t-1}\right) & \text{if } D_{t-1} < 1 - \varepsilon, \\ \dfrac{\gamma - r_t}{\gamma} \cdot (1 - \varepsilon) & \text{if } D_{t-1} = 1 - \varepsilon, \end{cases}$$

where $\chi \in (0, 1]$. Because $1 - \varepsilon - r_t/\gamma \cdot D_{t-1}$ is the value of productive and bubbly firms owned by shareholders, equation (20) is simply saying that the opportunistic government runs budgets deficits that crowd out a fraction χ of these firms. Note that this fiscal policy does not depend on investor sentiment. The government always expands debt when it arrives to power, regardless of whether this displaces inefficient investments or a stock market bubble.

Is the bubble in equation (16) consistent with the existence of the opportunistic government? Assume first that χ is small so that when investor sentiment is high the opportunistic government would displace bubble slowly and only in part. In this case, the expected growth rate of the bubble still exceeds the return to the inefficient investments. And, as a result, the bubble in equation (16) still constitutes an equilibrium. The interest rate (which can be obtained by the same procedure we obtained equation [18]) depends on which government is in power. In particular, when investor sentiment is high, the interest rate will be lower when the opportunistic government is in power. This reflects the effect of fiscal policy on the size of the bubble and therefore the return it offers. The opportunistic government makes the bubble a worse asset, and debt does not need to offer a high interest rate to compete with it.

Assume instead that χ is large so that when investor sentiment is high the opportunistic government would displace the bubble rapidly and completely. Anticipating this, the demand for the bubble drops to zero, and the bubble bursts, forcing holders of the bubble to find alternative investments. The arrival of an opportunistic government bursts the bubble on impact and leads to the reemergence of inefficient investments. As a result, equation (16) no longer constitutes an equilibrium and must be replaced by the following one:[24]

$$(21) \qquad B_t = \begin{cases} 0 & \text{if } S_t = L \text{ or } G_t = O, \\ 1 - \varepsilon - D_t & \text{if } S_t = H \text{ and } G_t = A. \end{cases}$$

Equation (21) recognizes that, if χ is high enough, the bubble can only exist if investor sentiment is high and the government is altruistic. From now on, we shall assume that the opportunistic government crowds out the bubble immediately, that is, $\chi \to 1$, and we consider the bubble in equation (21). Note that in this case, there is a bubbly state where both the altruistic government is in power and investor sentiment is high and a nonbubbly state where either investor sentiment is low, the opportunistic government is in power, or both.

Given our assumptions, we have now that the equilibrium interest rate is given by[25]

$$(22) \qquad r_{t+1} = \begin{cases} \pi - \alpha & \text{if } S_t = L \text{ or } G_t = O, \\ \dfrac{\gamma \cdot (1-\varepsilon) \cdot (1-\eta)}{1 - \varepsilon - \eta \cdot D_t} & \text{if } S_t = H \text{ and } G_t = A, \end{cases}$$

where $\eta = 1 - (1 - \lambda) \cdot (1 - \phi)$ is the probability that the economy transitions from the bubbly to the nonbubbly state. Note that the expression for the interest rate is identical to that in equation (18), with the exception that we must replace the transition probability λ with η. The intuitions are also identical: in the absence of a bubble, the interest rate is low because debt competes with capital, and the latter offers a low expected return to shareholders. When the bubble appears, the interest rate is high because debt competes with the bubble, which is a better asset than capital.

Interestingly, the equilibrium of this section is observationally equivalent to that of the previous section. In both equilibria, when the bubble exists, budget deficits are zero, and the bubble absorbs all of the inefficient in-

24. Can the bubble exist even if there is an altruistic government in power? The answer is positive if the transition probability ϕ is low enough (one example was the model of the previous section that is nothing but the limiting case where $\phi \to 0$). We assume this now, but we shall come back to this important point later.

25. Once again, note that when $S_t = L$ or $G_t = 0$ and $D_t = 1 - \varepsilon$, any $r_t \in (\pi - \alpha, \gamma)$ is also an equilibrium.

vestments of the shareholders. In both equilibria, the bursting of the bubble is accompanied by a glut of saving followed by a large fiscal expansion that ensures that debt now performs the same task of eliminating inefficient investments. The welfare consequences of these two equilibria are also the same. When the bubble collapses, both U.S. and ROW shareholders suffer large losses. The U.S. shareholders of the current generation are compensated for this loss by the large fiscal deficit that corresponds to the up-front fee for creating debt, but ROW shareholders receive none of this. The collapse of the bubble therefore implements a transfer from ROW to the United States.

The key difference between the two equilibria lies in the underlying shock that leads to the bursting of the bubble. The first possibility corresponds to the benevolent view that we have already discussed: investor sentiment changes exogenously, and an altruistic government responds by running large fiscal deficits. This policy reaction does not hurt ROW residents because the bubble bursts anyway but helps U.S. residents. The other possibility corresponds to a more cynical view: when the opportunistic government comes into power, it immediately crowds out the bubble in order to appropriate its value. This policy reaction hurts ROW residents as the bubble would not have burst without it. In this case, U.S. fiscal policy is a beggar-thy-neighbor type of policy.

Is this cynical view a good description of macroeconomic events over the past ten years? An immediate objection has to do with the timing of collapse of the bubble and the emergence of budget deficits. After all, in the United States the Nasdaq peaked in March of 2000, and the Standard & Poor's (S&P) 500 peaked in September of 2000, while the new administration took office in January of 2001. But this does not mean, however, that the cynical view is incorrect. Note that a bubble is not feasible if $\eta = 1 - (1 - \lambda) \cdot (1 - \phi)$ is high enough. At the cost of further notation, it is possible to make ϕ vary stochastically over time. In such a setup, an increase in the probability that the opportunistic government takes over is all that is needed to create the collapse of the bubble.

This immediately suggests a slightly modified version of the cynical view that can account for the timing of the bubble collapse and the appearance of the budget deficits. It goes as follows: as the elections approached, investors revised upwards their expectations of the arrival of an opportunistic government (Democrat or Republican, the theory has nothing to say about this). This leads to the collapse of the bubble. When the new administration arrived, it engineered a fiscal expansion, and this confirmed investor expectations. Or did it not? After all, a benevolent government would also have engineered a fiscal expansion in this situation. Because government intentions are not observable to us, we can only conclude that an increased probability of the appearance of an opportunistic government can break the bubble. Whether the subsequent government run large budget deficits because it is opportunistic or benevolent is impossible to tell. But it does not really matter for the story.

11.7 Final Remarks

We have provided a joint account of some of the major U.S. macroeconomic events of the past decade: large current account deficits and a steady decline in the net foreign asset position, the large boom and subsequent crash in the stock market, and the emergence of large fiscal deficits. According to the conventional view, the evolution of the stock market and fiscal deficits are more or less unrelated events, with the former driven by sharp swings in U.S. productivity and the latter by shifting U.S. political considerations. Both of these in turn fueled current account deficits that must eventually be reversed as the accumulation of public debt becomes excessive.

We instead propose two alternative views in which the stock market and the fiscal deficits are closely linked. Central to our account is the notion that the world economy contains pockets of dynamically inefficient investments. This opens the possibility for asset bubbles to exist, which in turn provides a more plausible explanation for the large swings in equity values over the past decade. The appearance of a bubble in the U.S. stock market in the second half of the 1990s accounts for much of the decline in U.S. net foreign assets during this period. At the same time, the bubble raised welfare worldwide by eliminating inefficient investments.

According to the benevolent view, the collapse of the stock market in 2000 was the result of a coordination failure or change in investor sentiment, and the rapid expansion of public debt since then served to displace inefficient investments in the same way that the bubble did. Viewed in this light, the large budget deficits of the Bush administration can be interpreted as a welfare-improving response to this market failure. But there is also a more cynical interpretation that is observationally equivalent to the benevolent view. Under this interpretation, the increased probability of a fiscal expansion is what caused the collapse of the bubble. The subsequent budget deficits validated this change in expectations about government behavior. This view interprets the large budget deficits of the Bush administration as a successful attempt to appropriate the value of the bubble from its U.S. and foreign owners.

To explore these ideas, we have used a minimalist model that puts a large weight on theoretical clarity even at the cost of leaving out many important aspects of reality. The advantage of this approach is that, by clearly exposing the main mechanisms at work, it provides a simple but rigorous framework to think about the interactions between stock market bubbles, budget deficits, and the current account. This framework has been used to provide a *qualitative* account of the recent U.S. macroeconomic experience. But this can only be seen as a first step toward a fuller understanding of this period of U.S. economic history. The natural next step is to use the framework presented here to provide a *quantitative* account of the recent U.S. macroeconomic experience. This will no doubt require enriching the theory by bringing back some of those important aspects of reality that have been left out here.

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Comment Joseph E. Gagnon

The paper by Kraay and Ventura provides an original and provocative interpretation of the forces behind the U.S. current account deficit. In one sense, however, this interpretation is conventional in that it focuses on developments in the United States rather than in the rest of the world. As an explanation of the past ten years, I find Kraay and Ventura unconvincing. I think that more persuasive explanations focus on developments in the rest of the world in an otherwise more conventional setting. However, over the past few years, the continued secular decline in private rates of return—despite the recovery from recession—raises the possibility that the nonconventional approach of Kraay and Ventura may have useful applications.

The critical assertion of Kraay and Ventura is that the global economy is dynamically inefficient because the marginal product of capital, net of agency costs, is less than the growth rate of the economy. In support of this assertion, Kraay and Ventura show that ex post real returns on one-year U.S. Treasury bills have rarely exceeded, and have often been far lower than, the growth rate of U.S. real GDP over the past thirty-five years.

Abel et al. (1989) argue that the riskless return on Treasury bills is not an appropriate measure of the marginal productivity of capital because investors are willing to forego a large risk premium to hold safe government bills. Abel et al. showed that an alternative gauge of dynamic efficiency on a steady-state growth path is whether the flow of income from private cap-

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ital exceeds the resources invested in private capital. Using national accounts data, they found that this condition was satisfied in the United States for every year since 1929 and in six other industrial countries for every year since 1960.

Kraay and Ventura point out that Abel et al. (1989) is based on the implicit assumption that the marginal returns to capital equal the average returns. In the model of Kraay and Ventura, nonentrepreneurs are the marginal investors in private capital and they must forego an agency cost that prevents them from earning the true marginal product of capital. Entrepreneurs, on the other hand, do reap the full returns from capital, but they are inframarginal. Kraay and Ventura argue that the capital income of entrepreneurs may be large enough to raise total capital income in the economy above total capital expenditures, and yet the marginal return to capital may be lower than the growth rate.

Careful consideration of the data for the United States does not support Kraay and Ventura's claim. Entrepreneurs are to be found among the proprietors of non-incorporated businesses, including landlords, and among the upper management of corporations. Thus, a conservative measure of capital returns to nonentrepreneurs would exclude proprietors' and rental income as well as employee salaries and benefits paid by corporations. Abel et al. (1989) anticipated these concerns, and they presented alternative calculations based on the profits and net interest paid of the U.S. nonfinancial corporate sector.[1] Extending their analysis to more recent years (for the total corporate sector) does not reverse the result.[2]

The second approach to measuring the marginal return on private capital is to use the yield on median-rated corporate bonds. Figure 11C.1 displays the Baa corporate bond yield and the nominal growth rate of U.S. GDP since 1975. Except for the unanticipated inflation of the late 1970s and the last two years, the corporate bond yield has comfortably exceeded the growth rate of GDP. Subtracting 30 to 40 basis points to correct for historical default losses on these bonds would not reverse this result.[3] Given that equities are even more risky than corporate bonds, it is plausible to suppose that much of the excess of capital income over capital expenditure documented by Abel et al. (1989) flows to equity holders, who are also marginal investors.

It may be argued that there are specific firms within the universe of bond and equity issuers that are bubbly, but there is no reason to believe that traditional efficient firms are not also borrowing at the margin. And, given that marginal returns on capital do exceed the growth rate, the coexistence

1. Despite the recent controversy over expensing of employee stock options in accounting statements, the Bureau of Economic Analysis has always subtracted the value of exercised options from corporate profits in the national income accounts.

2. To be specific, in 2004 corporate profits including capital consumption allowance plus net business interest equaled about 15 percent of GDP. Private nonresidential investment equaled less than 11 percent of GDP.

3. This is based on ten-year cumulative default and recovery rates from Hamilton, Varma, Ou, and Cantor (2005).

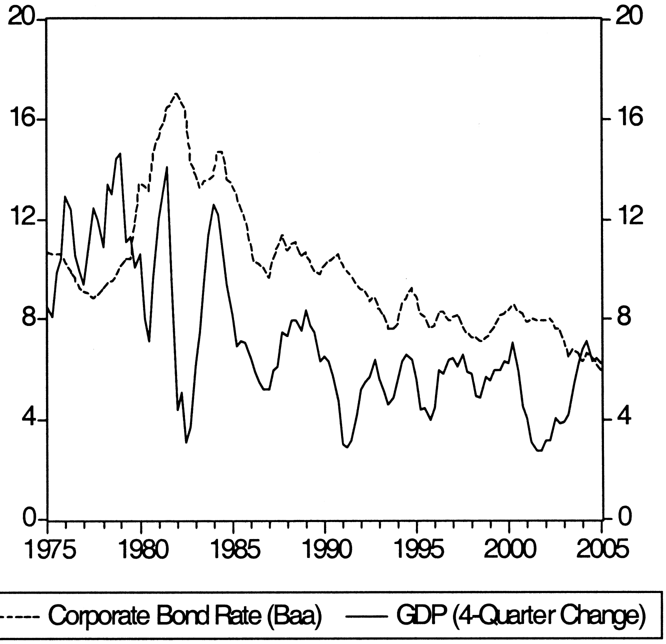

Fig. 11C.1 U.S. corporate bond yield and GDP growth (nominal, percent)

of efficient and bubbly firms relies on an element of market irrationality that Kraay and Ventura have sought to avoid.

Given the originality and simplicity of Kraay and Ventura's analysis, it would be churlish to criticize it too heavily for omitting real-world complications. Thus, I will simply point out a few issues that would benefit from further analysis in future work: (a) the model does not allow for diminishing returns to capital and there is no complementarity between labor and capital; (b) both goods and financial markets are perfectly integrated across countries; (c) prices are perfectly flexible, and there are no cyclical movements in output; thus there is no scope for countercyclical monetary or fiscal policy, despite the fact that fiscal policy is central to the paper; and (d) as already mentioned, there are no risk premiums in financial markets.

The following is one point on the benevolent versus the cynical view of U.S. fiscal policy: the benevolent view fits the timing of events much better than the cynical view. The stock market correction (at least in the tech-heavy Nasdaq where the bubble was concentrated) began a year before the Bush administration came to power. Kraay and Ventura argue that changing expectations about the election outcome and future fiscal policy could have been sufficient to prick the equity bubble far in advance of any legislated policy change. However, they present no evidence that the timing of the stock market correction had anything to do with expectations of future fiscal policy. Indeed, most analysts continued to predict future fiscal surpluses for months *after* the Bush administration took office.[4] The fall in equity prices and the subsequent recession clearly have led to a larger and more persistent fiscal deficit than would have been likely had there been no crash and no recession.[5]

I think a more plausible story is that the equity boom and bust reflect the difficulty of evaluating the profit implications of the technology surge.[6] When dot-com firms proved less profitable than hoped, the market tanked.[7] The subsequent fiscal expansion may have had an exogenous political component, but it clearly was well timed as countercyclical policy. Together, these two factors supported the current account deficit. But other important factors were at work. The secular economic slowdowns in Europe and Japan led to an outflow of saving. The emerging market financial crises of the 1990s led to disillusionment about the ability of fast-growing developing countries to absorb more capital productively. The result has been a flood of capital into the United States and low worldwide interest rates.

The glut of foreign saving relative to foreign investment is likely responsible for the decline in corporate bond yields recently. The central assumption of Kraay and Ventura—that the world is dynamically inefficient because the return to capital is less than the economic growth rate—may hold true in the future even if it was not true in the 1990s. Thus, there may yet be a payoff to the nonconventional analysis of Kraay and Ventura.

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4. The September 2001 issue of *Consensus Forecasts* showed a mean forecast of the fiscal year 2002 budget balance of $168 billion, and not a single survey participant predicted a surplus less than $75 billion. In the event there was a deficit of $158 billion.

5. The recession directly increased the fiscal deficit through automatic stabilizers. It also indirectly increased the deficit through political pressure for countercyclical policy. This is not to deny that the election of George Bush had an independent influence on fiscal policy.

6. Note that the Kraay and Ventura model ignores the significant and sustained acceleration of productivity after 1995.

7. Kraay and Ventura view deviations in the market value of equity from the underlying replacement cost of capital as evidence of bubblelike behavior. Hall (2001) interprets these deviations as reflecting the value of intangible capital such as patents, brands, and business processes. Kraay and Ventura ask why this value declined sharply after 2000. In fact, as shown in Kraay and Ventura's figure 11.3, most of the run-up in share prices in the 1990s had not disappeared as of 2004. The stock market bubble is more appropriately described as a moderate and short-lived hump on the back of an enormous fundamental surge in valuations.

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