GROWTH, EQUITY, ENVIRONMENT AND POPULATION

Economic and Sociological Perspectives

Edited by

Kanchan Chopra and C.H. Hanumantha Rao

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The SAGE Team: Sugata Ghosh, Anushree Tiwari and Sanjeev Sharma

To

Professor V.K.R.V. Rao
(1908–1991)

Founder of the IEG

On the Occasion of his Birth Centenary

Contents

SECTION III
Environment

SECTION IV
Population and Health

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This volume is being published as part of the IEG series on 'Studies in Economic and Social Development' (Number 69 of the series earlier called Studies in Economic Development and Planning). Work on putting together the essays in this volume was initiated in early 2007. We wrote to IEG faculty and Honorary Professors to contribute towards this effort undertaken with the forthcoming Golden Jubilee year in mind. We were overwhelmed with the enthusiastic response. We would like to put on record our thanks to colleagues who sent in their papers so readily.

We also wish to thank publishers of the journals and edited volumes in which the papers or their earlier versions were first published, mostly between 2000 and 2007. Each of them saw the worth of this exercise of reaching out collectively to an audience of researchers on topical issues such as growth, equity, environment and population, in particular when economic and sociological perspectives were both being addressed. The publishers are listed separately elsewhere in this volume.

No book can be put together without a great deal of background effort of co-ordination. Shri Sushil Kumar Sen, Academic Programmes Officer at IEG and his staff provided this critical input. Several drafts, different versions of papers and intense e-mailing across continents to establish contact with publishers preceded the finalization of this volume within the short time period at our disposal. We are grateful to them for doing all this with patience and a smile.

By a gratuitous co-incidence, the Golden Jubilee year of the IEG coincides with the birth centenary of its founder and this volume is dedicated to him, with the fond hope that readers will find in its contents at least a partial fulfillment of his dream 'to foster both technical competence and social awareness'.

Delhi
September 21, 2007

Kanchan Chopra
C.H. Hanumantha Rao

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Journals

Oxford University Press
B.B. Bhattacharya and Sabyasachi Kar, "Domestic and External Shocks and their Impact on Economic Growth", *Macroeconomic Reforms, Growth and Stability,* 2007.

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List of Tables

List of Illustrations

Chapter 1

Introduction and Overview

KANCHAN CHOPRA AND C.H. HANUMANTHA RAO

Inspired by the forthcoming Golden Jubilee Year of the Institute of Economic Growth (IEG), this volume of essays entitled *Growth, Equity, Environment and Population: Economic and Sociological Perspectives* is an effort at compiling a representative collection of the work of researchers at the IEG in the last few years. It also seeks to address the question: to what extent has our work addressed, even if partially, issues which concern India at the beginning of the twenty-first century. We found that underlying the essays were common concerns for growth, equity, environment and human resources from economic and social perspectives. Several common threads linking individual research agendas did indeed exist. This resulted in the grouping of essays into sections.

Section I comprises of essays addressing issues concerning growth: these are addressed from the macroeconomic perspective and from the sectoral perspectives of agriculture and industry. B.B. Bhattacharya and Sabyasachi Kar in Chapter 2, examine the effect of two domestic shocks (rainfall shortage and fiscal profligacy) and three external shocks (oil price hike, world trade shock and capital flow shock) on the growth of the Indian economy. Using a macro model of the Indian economy, the authors conclude that rainfall shortage and fiscal profligacy shocks have a stronger growth-retarding effect than realistic scenarios of the three external shocks, both in the short and long-term. Moreover, the oil price hike, the capital flow shock and fiscal profligacy show strong pervasiveness in the long run along with the economy being more resilient to the rainfall shock and the world trade shock in the long run.

The two other essays on the macroeconomic issues focus on interest rates and exchange rate dynamics. Pradeep Agrawal in Chapter 3, studies interest rates in four East Asian economies and concludes that in these countries higher interest rate caused greater availability of bank credit, which in turn led to higher investment rates, at least up to real interest rates of 9 per cent. The cost of capital was found to have an insignificant effect on investment rates up to this point. The optimal financial markets policy suggested seems to be closest to that of 'restrained financial liberalization' or liberalization with a moderate upper limit

(about 6 or 7 per cent) on real interest rates beyond which the central banks must watch other banks carefully. N.R. Bhanumurthy in Chapter 4, studies day to day determinants of movements in the foreign exchange market. Basing his results on a structured questionnaire canvassed among foreign exchange dealers in India, he concludes that the role of macro-fundamentals in exchange rate determination is realized only in the long run. Intraday changes in exchange rate are effected most by speculation and central bank intervention. Also, the market responds fastest to interest rate and with a greater time lag to announcements on other macro variables such as trade deficit, money supply, Gross Domestic Product (GDP) and inflation.

Chapters 5, 6 and 7 study aspects of Indian industry during the post-1991 era: for instance, export performance of multinational enterprises in the information technology industry in India, productivity growth in Indian manufacturing and the performance of small-scale units. N.S. Siddharthan and Stanley Nollen in Chapter 5, study export performance of 145 firms of the information technology sector. They show that a better understanding of export performance can be achieved by disaggregating firms into groups based on their foreign collaboration, and by breaking down technology resources acquired internationally into different categories. For affiliates of multinational enterprises (MNEs), both explicit technology transfer from purchase of licenses and payment of royalties and tacit technology transfer received from foreign ownership contribute to greater export intensity. Bishwanath Goldar and Anita Kumari in Chapter 6, examine Total Factor Productivity (TFP) in Indian manufacturing in the nineties, as compared to the eighties. They find that there was a deceleration in TFP in the nineties. However, after making adjustments for changes in capacity utilization which was lower in the nineties, TFP estimates were about the same. Further industrial productivity was impacted favourably by tariff reforms. But slower growth of agriculture in the nineties and gestation lags in investment projects may have had an adverse effect on TFP growth in Indian manufacturing.

T.A. Bhavani in Chapter 7, examines the pathways by which competititive strength and commercial viability of small-scale units can be ensured in the changing global scenario. Using results from in-depth studies of the garment, electronic and auto-components industries, she postulates that economic policy reforms make it inevitable for these industries to integrate with the global industry through global commodity chains in terms of technology employed, organization and the product quality. An impediment to this is created by existing policies which create incentives for these firms to remain small and operate in an isolated manner—revamping of policy is indicated.

Ramesh Chand in Chapter 8, provides an overarching review of the indifferent performance of Indian agriculture. Directions for policy are listed, significant among them being a substantial increase in public investment, withdrawal of subsidies, urgent attention to land and water availability, region specific resource conserving technologies and location specific technology development and its dissemination. Remarking on the role of trade liberalization and diversification in Indian agriculture, Nilabja Ghosh, in Chapter 9 echoes similar views. Using alternative crop diversification indices, she notes that in the nineties, most states moved towards superior cereal crops and away from coarse cereals, despite geographical heterogeneity.

She concludes that, in the short run, there is a role for government in ensuring a sustainable cropping pattern within the traditional choices, supporting farmers in difficult conditions and negotiating for more reasonable terms of trade enabling them to operate in difficult regional environments. Brajesh Jha in Chapter 10 examines trade liberalization in the context of the livestock sector. Observing that free trade would result in import of milk, he examines impact on consumer and producer welfare in select states of the country. While consumers gain in the short-term, in particular in coastal states, long-term loss of employment is indicated. Hence, further reduction in tariff in this sector is not indicated by this study.

Section II comprises of three essays on regional and gender aspects of equity. Sabyasachi Kar and S. Sakthivel in Chapter 11 examine the contribution of different sectors to regional income divergence in the period 1990–91 to 1999–2000. When contributions from three dimensions of divergence (namely contribution from sectoral divergence, from the changing relative share of sectors and from changing linkages) are aggregated, it is found that the agricultural sector contributes the least and the services sector contributes the most to the divergence. The analysis suggests that a policy package for inclusive growth needs to target towards growth and development of the services and agricultural sectors of the relatively poorer states.

C.H. Hanumantha Rao in Chapter 12 notes that inter-state disparities in income have grown in the post-reform period and analyzes the causal factors leading to this phenomenon. He observes that priority for action in backward regions needs to be given to improvement in social and economic infrastructure and speeding up social transformation through empowerment of the people as well as measures for good governance. He also argues for a re-examination of the existing pattern of central assistance to states in order to enable poorer states to step up their developmental expenditure. The concluding chapter, in this theme, by Bina Agarwal reflects on a critical divergence between law and prevailing social norms in the context of gender equity. She analyses different facets of gender inequity and concludes that, 'to build economically and socially equal partnerships between men and women, we will need to re-examine our assumptions about key social institutions, in particular the family, and about men's and women's roles within the home and society'.

Section III consists of four chapters on the economics and sociology of environmental issues. Kanchan Chopra and Saroj Kumar Adhikari in Chapter 14, examine the linkage between concepts of economic and ecological value through simulation modeling of a wetland in Northern India for a period of 23 years. They conclude that direct and indirect income from the wetland depends critically on ecological health indices. Further, the benefits to be accrued from improved maintenance for ecological conservation per unit effort are more at higher levels of conservation. In other words, once conservation increases attractiveness of the wetland above a certain level, the impact is cumulative and returns in terms of income rise more than proportionately. M.N. Murty, Surender Kumar and Kishore K. Dhavala, in Chapter 15, estimate technical and environmental efficiency of some coal-fired thermal power stations. They find that thermal power generating industry in Andhra Pradesh could increase

production of electricity by 6 per cent, while at the same time decreasing generation of pollution by 6 per cent by complying with environmental regulations. The result illustrates that there are win-win opportunities for firms which call for the use of economic instruments like pollution taxes to reduce air pollution. Vikram Dayal in Chapter 16, studies biomass extraction from a national park in Central India. A strong positive relationship exists between grazing and collection of fodder and fuelwood; hence policy formulation needs to take cognizance of both the factors simultaneously. Villages which are closer to towns and have greater employment opportunities collect less biomass than those closer to the park. In other words, urbanization and higher incomes reduce households' biomass extraction; they move up the energy ladder as well. From a different perspective, Amita Baviskar in Chapter 17, views a development project (the watershed mission in Jhabua district) through the lens of a sociologist. She refers to the project as a 'dream machine' which different groups wanted to engineer to their specifications. The convergence of different 'dreams' gives the watershed mission its particular power which may enable its use to fulfill diverse agendas.

Section IV of the volume is about issues of population, migration and health. S.C. Gulati in Chapter 18, highlights linkages among fertility, mother and child health care utilization, usage of contraception and certain socio-economic variables. Using data from 593 districts of India, he finds that female literacy has significant effects on fertility containment, mother and childcare utilization and poverty reduction—accessibility of mother and childcare also being facilitated by female literacy and employment. The joint effects of such use together with contraception have a strong inhibitive effect on fertility, thereby accelerating the process of population stabilization. Alok Ranjan Chaurasia in Chapter 19, observing the high risk of death associated with pregnancy and delivery in Central India, argues for universalization of obstetric care to reduce the high risk of deaths. The importance of a continuum of health care—moving from community based care to skilled medical backup is emphasized.

Chapters 20 and 21 focus on issues of occupational choice and migration and their causal factors. Based on a micro survey of slum households in Delhi, Arup Mitra in Chapter 20 highlights the important role of networks in the context of occupational choice and earnings. It is found that a great deal of information on the urban labour market flows through informal channels. Policy interventions with regard to labour markets need to take this into account in order to be cost-effective. R.S. Bora, in the next chapter, looks at the impact of out-migration on the region from which it takes place. His study illustrates that out-migration from Uttaranchal is not beneficial to the hill state—he argues for measures to check its further growth.

Specific and emerging health issues form the focus of the next two chapters. Moneer Alam and M. Mukherjee in Chapter 22, study the problems of aging in India, based on secondary as well as primary survey-based data. Gender, previous health stock and lifestyle are some of the causal factors which determine the degree of age-related disabilities. Keeping in mind that the proportion of the elderly in India's population is likely to rise, public health policy needs to address the issue. Indrani Gupta, Mayur Trivedi and Subodh Kandamuthan in Chapter 23 examine the cost of Antiretroviral Treatment programmes (ART) for HIV/AIDS in India. The annual unit cost of provision is about $1 per day, including costs to individual it amounts

to $1.07. This is lower as compared to certain other countries such as Thailand. The study indicates the presence of economies of scale in provision at most study sites. Further, the 2007 estimates of the ART programme indicate that they comprise 2 per cent of the total health and family welfare budget. These are of course illustrative estimates and more complete financial sustainability planning is indicated.

The last two chapters constitute sociological perspectives on religion and family, themes touched earlier on, somewhat tangentially in different chapters. T.N. Madan, in his chapter, reflects on the sociology of Hinduism. He positions 'the field view' giving primacy to ritual and action in contrast to the 'book' view which leans heavily on a reading and interpretation of texts. Fieldwork, in his analysis, adds substantially to the many facets and crosscutting aspects of religion. Patricia Uberoi in her chapter, brings us back to the institution of 'family' and its place in modern society. Official thinking on the family in China and India is examined in a comparative perspective in the context of the International Year of the Family—1994 was declared as such by the United Nations. In both countries, it is argued that the retreat of welfare implies the return to dependence on families and communities. So, while radical pledges to democratize the family abound, valorization of the traditional family exists in both the Indian and Chinese official documents.

While the themes and sub-themes covered in the different sections of this volume represent the areas within Economics, Sociology and Demography that researchers at IEG delve on, a note on the eclectic nature of the methodological diversity is in order. The discerning reader will find a predilection towards the use of econometric techniques of analysis, use of time series analysis, macroeconomic modeling, simulation modeling, distance functions, simultaneous equation models, multinomials and the like—this will perhaps always remain our forte. However, a space has always existed for the narrative as the methodology and for an analysis of the qualitative as against the quantitative. The two approaches constitute for each other the touchstone against which the validity of the other is to be tested. This characterizes our interactions within the IEG with a distinctive mode of working while, hopefully, adding to the quality of analysis.

Section I

Growth

(a) Macroeconomic Issues

Chapter 2

Domestic and External Shocks and their Impact on Economic Growth

B.B. Bhattacharya and Sabyasachi Kar

1. Introduction

Evaluating the impact of domestic and external shocks on the growth of developing economies is of utmost importance, as the consequences of these shocks push millions of people into abject poverty and deprivation. It is in this context that we have studied the impact of domestic and external shocks on the Indian economy. A closer look at the last fifty year's experience reveals that broadly, there are five distinct types of shocks that have affected the performance of the Indian economy, sometimes working in tandem.

The first two types, discussed below, are domestic shocks.

1. Drought, i.e., below normal rainfall. Since the agricultural sector is still a significant part of the economy and has strong demand and supply interlinkages with the rest of the economy, this is perhaps the shock that causes maximum damage to the Indian economy.
2. Fiscal profligacy of the government, which is a non-developmental expenditure undertaken due to political compulsion or to mitigate the effect of other shocks, leading to a fiscal burden.

The next three types that we discuss are external shocks.

1. Hike in the international price of oil (petroleum). This is a major import item and is highly price inelastic as a result of which it has a strong impact on the economy.

2. Stagnation or fall in world trade. World trade is a strong determinant of Indian exports and hence any fluctuation in this also affects the economy adversely.
3. Sudden capital outflow induced foreign exchange market shock. This is a phenomenon that has precipitated a crisis in many developing economies and India is no exception to that.

The purpose of this study is to analyse the effect of these five types of shocks on the growth in the Indian economy. Section 2 gives a brief description of the methodology of the study. Section 3 describes the structure of the full model. Section 4 presents some simulation results that help in evaluating the effect of shocks on the Indian economy. Section 5 concludes the study. The appendix contains the full model.

2. Methodology for Evaluating Impact of Shocks

Given the objectives of this study, the most appropriate tool that can be used for an analysis of these issues is a structural macro-modelling framework. Macro-modelling is based primarily on the 'structural modelling' methodology associated with the Cowles Commission. For our estimation exercise, we have used annual data collected from various sources to estimate a model for the Indian economy. A simultaneous estimation of all the equations will not be feasible as the number of observations is usually not sufficiently large and hence the equations have been estimated separately using the OLS method. In a number of cases where found suitable, the equations have been estimated using the logarithms of the variables. In order to keep the model tractable, we have chosen a few explanatory variables for each behavioral equation. This sometimes results in omitted variable bias leading to serial correlation and poor Durbin Watson statistics. In such cases we have estimated the functions with AR (1) errors. In order to incorporate both short run and long run effects of the shocks, we have incorporated a dynamic impact in a number of equations by using lagged dependent variables as regressors. In such cases, the Durbin Watson statistics become irrelevant and we have calculated the Durbin's h statistics.

The framework of the model is based on known stylized facts about the Indian macroeconomy. Macroeconomic model builders are usually faced with a choice between the Neoclassical and the Keynesian paradigms depending on the role that is assigned to output and/or price adjustments in bringing about macroeconomic equilibrium. A third alternative that came up specifically in the context of developing economies is known in the literature as Structuralism. In practice however, most macroeconomic models of developing economies have put together different aspects of all these paradigms. This is known in the literature as the eclectic approach. In this study, we have adopted this approach. Keeping in view the liberalization process introduced in the economy in 1991, the model has been designed to represent a market-oriented economy. It is broadly classified into the production, fiscal, monetary and external sectors.

3. The Model

In order to measure the impact of domestic and external shocks on growth, we have built a macro model of the Indian economy. The whole model including estimated behavioral equations and identities is given in the Appendix 1. In this section, we shall describe the structure of the model. The Indian economy is heterogeneous in terms of production, investment and price behavior. Hence we have divided the economy into three sectors, i.e., agriculture, industry and tertiary sector and for each sector we have an output, private investment and price function (GDP Deflator). To incorporate dynamic behavior and to distinguish between the short and long run effects, we have incorporated lagged dependent variables in the estimation of all these functions. In the case of output, this would represent the generalized distributed lag behavior between output and capital. In the case of investment this would represent the discrepancy between the desired and actual investment behavior. In the case of prices, the lagged dependent variable will incorporate the adaptive expectations in price formation.

Agricultural output is supply constrained. Capital stock in agriculture and rainfall affects agricultural output significantly. The agricultural output function has an irregular dummy DUMXA (representing the extreme drought effect of 1979) and a structural dummy D80S (in order to take care of the productivity fall starting in the eighties). Industrial and tertiary sector output is determined by the productive capacity in these sectors and the capacity utilization rates. The productive capacity is determined by the capital stock while large pools of unemployed labor ensure that there are no labor constraints in these sectors. Consistent with some recent theoretical and empirical studies on India, we postulate that output and capacity utilization in industry and the tertiary sector are sensitive to changes in demand. In industrial output function, domestic and external demand are represented by the autonomous expenditure (sum of government expenditure and exports of goods and services). Industry also depends on agricultural demand. Moreover, industrial output is negatively related to industrial price, again reflecting the demand constraint nature of this sector. The industrial output function has two structural dummies, DPLIB (representing the partial liberalization of the economy in the mid eighties) and D95 (representing the peak effect of liberalization in 1995 following large deregulation of the economy in 1994). In the tertiary sector, the demand constraints are captured by the output in the other two sectors. The tertiary output function has two dummies DPLIB (partial liberalization) and DUMPAY (representing the impact of large hikes in the salaries and wages of public administration that inflate the value added in the tertiary sector).

The private investment functions are a synthesis of a flexible accelerator theory and a Keynesian investment function (represented by interest rate). It may be noted that due to institutional constraints, non-agriculturalists cannot invest in agriculture. Hence the agricultural investment function is based on agricultural output whereas the same in industry and tertiary sectors are dependent on aggregate GDP. Agricultural investments have a structural dummy D80S (representing the productivity fall starting in the eighties). Real interest rates

are found to have a weak impact on industrial and tertiary sector investment. In the industrial sector, this is partly due to the fact that investors are worried of inflationary tendencies. The nature of government expenditures also plays a crucial role in investments. We have postulated that public investment plays a positive role by crowding in private investments, reflecting the fact that the India economy is still constrained by physical infrastructure etc. On the other hand, other government expenditure (including government consumption and transfers) loosely representing the fiscal profligacy of the government, crowd out private investment by using up investible resources. The industrial and tertiary sector investment functions have an irregular dummy D95 (peak liberalization effect). As far as public investment is concerned, it is assumed that the government exogenously determines their nominal values in all three sectors.

The demand side of the economy is largely determined by private consumption, while the other components are government consumption and investment, private investment and net exports. As in many developing economies, private consumption is largely determined by private disposable income. The private consumption function has a lagged dependent variable representing long run adjustments of consumption to income and a structural dummy DWTO (representing the effect of higher consumption of imported goods following the opening up of trade under WTO agreement). Private disposable income is determined by nominal output at factor cost, which is estimated to have a unitary elasticity with nominal output at market prices.

The aggregate GDP deflator is assumed to be a weighted average of the sectoral deflators—the weights being the share of the sectors in real output in the base year (1993). Agricultural prices are determined by both demand and supply factors. Agricultural output determines the supply in this sector while private disposable income determines demand for agricultural output. The agricultural price function has an outlier dummy DUMPA (that takes care of the unusually high agricultural prices in 1973 and 1974 as a result of severe drought conditions in those years). The industrial sector is assumed to have mark up pricing and hence cost factors determine industrial prices. The cost factors include agricultural prices, tariff rates and import prices of oil and non-oil commodities separately. The tertiary sector prices are assumed to adjust to the agricultural and industrial prices.

In the monetary sector, we assume that the demand and supply of money determines interest rate, which in our model is the prime lending rate of commercial banks. The demand for money in real terms is estimated to be a function of real output and real interest rates. The coefficient of real interest rates has the wrong sign (positive) but shows the right sign (negative) with a slope dummy DFEMRPLR for financial and external sector liberalization. This is due to the fact that the monetary sector was stringently controlled before the liberalization of the economy and hence the positive relation between interest and money before liberalization actually represents the money supply function. In other words, the market determined interest rate is a post-liberalization phenomenon. The demand for money function has an irregular dummy

DUMM3 and a structural dummy DWTO (representing higher consumption demand for money corresponding the rise in consumption in that period). Given the demand for money, the interest rate is determined by the supply for money, which is assumed to be a function of the reserve money in the economy and the money multiplier. We postulate that the money multiplier is a function of interest rate and two monetary policy mechanisms, i.e., the bank rate and the cash reserve ratio. In the model, we invert the supply function of money by estimating interest rate as a function of money supply, reserve money and the monetary policy variables. It may be noted that the reserve money has two main components—monetized debt of the government and foreign exchange reserves.

In the fiscal sector, government expenditure is equal to government consumption, investments and transfers, all of which are assumed to be exogenous variables. The revenue side consists of tax and non-tax revenue of which the latter is assumed to be exogenous. Tax revenue is estimated as a function of nominal output. The tax function has two dummies DLIB (representing the effects of lowering of domestic tax rates as a part of the liberalization process) and DWTO (representing effects of lowering customs duties following India joining the WTO). The difference between the revenue earned and the expenditure gives the gross fiscal deficit.

In the external sector, the current account balance in determined by net exports and remittances etc. Exports are determined largely by the volume of world trade, which is proxied in our model by world imports. Depreciation in the real exchange rate is also found to boost exports. The export function has three structural change dummies—D80S (representing the beginning of export promotion policies since the eighties), DFEM (representing the effect of trade and exchange rate deregulation in 1993) and DWTO (representing the positive effect on exports of joining the WTO). It also has an irregular dummy DUMEGS. Imports are divided into two parts—oil imports and non-oil imports. It may be noted that oil imports were extremely volatile before 1985 due to the two oil shocks as well as the discovery and extraction of large volumes of oil since the beginning of the eighties. Hence we have estimated the oil import function post 1985. We postulate that oil imports are strongly related to commodity production (the tertiary sector is much less oil intensive), import price of oil, domestic prices and exchange rate (the last three determining the relative price of oil). It also has an irregular dummy DUMMGSO. The non-oil import function is postulated to be a function of output, import price of non-oil, domestic prices, exchange rate as well as tariff rates. The non-oil import function also has two structural dummies D95 (peak liberalization effect) and DWTO (effect of joining WTO). The foreign exchange reserves are determined by past reserves, the current account balance and the capital account balance. The capital account balance is assumed to be an exogenous variable. The exchange rate is influenced by the size of the foreign exchange reserve, as well as prices in the economy. The exchange rate is also found to adjust to past values. There is a dummy in the exchange rate equation DEV91 (representing the large devaluation that was undertaken in 1991).

4. Impact of Domestic and External Shocks on the Economy

Once the behavioral equations are estimated and the identities and technical equation are determined, the model is complete and ready for simulation. The simulation is done using the Gauss-Seidel methodology that solves for the endogenous variables corresponding to alternative assumptions about the exogenous variables. We have chosen the period 1997 to 2003 to evaluate the impact of external and domestic shocks on the economy. This period has been chosen for two reasons. Firstly, most of the policy changes that ushered in the liberalization of the economy had been adopted by this time and hence this period permits an analysis of the effects of liberalization. Secondly, it allows us to evaluate the impact of the shocks as close to the present as possible. In other words, this exercise may be interpreted to represent the present characteristics of the economy.

We evaluate the impact of shocks on the growth rates of the Indian economy by comparing the equilibrium values of growth rates and related variables under base-run (normal) and alternate scenarios (with shocks). It may be noted that one of the objectives of this study was to differentiate between the short run and the long run impact of the shocks. In the model, the long-run effects have been incorporated in terms of dynamic specifications of some behavioral equations using lagged dependent variables. In the shock simulations, we assume the shocks to impact the economy in the first two years of the chosen period, i.e., 1997 and 1998. Correspondingly, the average performance in these two years will represent the short run impact of the shocks. The average performance for the whole period, i.e., 1997 to 2003, will represent the long run impact of the shocks.

In the simulation exercises, we focus on five aspects of the impact of the shocks on growth. The first aspect is the actual impact of the shock on the aggregate growth rate, i.e., whether the shock leads to a mild or large fall in growth rate (as a percentage over base-run values). The second aspect is the sectoral distribution of the shock, i.e., how much each of the three sectors (agriculture, industry and tertiary) contributes to the negative impact of the shocks on growth rates. The third aspect is to find whether the shock leads to a stagflationary situation or not. This is particularly important from the policy point of view since non-stagflationary shocks can be mitigated by using demand management policies while stagflationary situations sometimes worsen with the use of such policies. The fourth aspect that we focus on is the effect of the shocks on the fiscal and external sectors. This is important because a large increase in the deficits in these sectors (in terms of rising fiscal deficit ratio and falling foreign exchange reserves) have the potential to destabilize future growth rates by affecting investor confidence in the economy. Thus, it is important to look at the impact on the actual growth rate and on these variables. The fifth and final aspect that we look into is the pervasiveness of the shock, i.e., how much of the short run impact of the shock spills over to the long run. This is again important from policy perspective, since a pervasive shock indicates that the economy is not very resilient to this shock, making counter shock policies that much more important.

External Shocks

Oil Price Shock

The first scenario represents an oil price shock. We assume that the price index of oil imports rises by 100 per cent over actual values in 1997 and 1998. Thus, the price index goes up in 1997 from 540 to 1080 and in 1998 from 440 to 880, respectively. The average price during this period jumps by about 50 per cent over 1996. This may be compared to the oil shock in 1979–80 when the corresponding jump was about 125 per cent. Thus it is a plausible shock though not of the extreme nature as the first and second international oil price shocks. The results of the simulation together with the base-run are given in Table 1.

TABLE 1
Effect of Oil Price Shock

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Aggregate Inflation*	*Industrial Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	7.3	5.6	7.6	36.1
	Shock	6.5	3.2	4.3	9.9	8.4	8.4	8.0	26.9
	% Change	–3.0	–3.0	–8.5	–2.9	15.1	50.0	5.3	–25.5
Long run	Base-run	5.9	2.6	5.7	8.0	4.9	4.7	11.0	58.6
	Shock	5.7	2.5	5.5	7.7	5.1	4.9	10.8	55.0
	% Change	–3.4	–3.8	–3.5	–3.8	4.1	4.3	–1.8	–6.1

***Note*:** In the shock scenario, oil price index is assumed to be 1080 in 1997 instead of 540 (base-run value) and in 1998 it is assumed to be 880 instead of 440 (base-run value).

The row showing '% Change' measures percentage increases in value of variables in shock scenario over base run values. Thus, for shock scenario values that are lower than base run values, '% Change' is negative.

Table 1 indicates that in the short run there is a small decrease in the growth rate (3 per cent) as a result of this shock. This fall is largely due to a corresponding fall in the industrial growth rates, with the other sectors contributing much less to this fall. Inflation rises by 15 per cent as a result of a large rise in industrial inflation, leading to a slightly stagflationary situation. There is no instability to the growth process from the fiscal sector but a significant fall in the foreign exchange reserves as a result of the shock, gives rise to some instability to growth from the external sector. In the long run, the growth falls by 3.4 per cent, which is slightly larger than the fall in the short run. This indicates that the impact of the shock is pervasive, i.e., the impact does not become weaker in the long run. The fall in the long run growth rate is the result of a similar fall in all the sectors. This indicates that the shock has a greater long run impact on the growth of the agricultural and tertiary sectors. The rise in inflation is more muted and there is no instability from the fiscal or external sectors.

World Trade Shock

The second scenario represents a world trade shock. In this scenario, we assume that the rate of growth of world imports is zero in 1997 instead of an actual growth of about 3.3 per cent and it is assumed to be –4 per cent in 1998 instead of an actual growth rate of –1.4 per cent. Thus the average growth in world imports in this period is assumed to be about –2 per cent, while the actual average growth was about 1 per cent, i.e., a fall of about 3 per cent. This is comparable to an average fall of about 3 per cent in 1981 and 1982, the sharpest fall in world imports in the recent past. It may be noted that although stagnation in world trade can also lead to changes in prices of imports, this scenario does not assume any such changes in import prices. The results of the simulation together with the base-run are given in Table 2.

TABLE 2
Effect of World Trade Shock

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Exports*	*Aggregate Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	47.5	7.3	7.6	36.1
	Shock	6.5	3.3	4.4	9.8	42.8	6.4	8.3	31.3
	% Change	–3.0	–0.0	–6.4	–3.9	–9.9	–12.3	9.2	–13.3
Long run	Base-run	5.9	2.6	5.7	8.0	63.3	4.9	11.0	58.6
	Shock	5.9	2.6	5.8	7.9	62.2	4.8	11.3	56.5
	% Change	0.0	0.0	1.8	–1.3	–1.7	–2.0	2.7	–3.6

***Note*:** In the shock scenario, rate of growth of world imports is assumed to be zero in 1997 instead of 3.3 per cent (base-run value), and in 1998 it is assumed to be –4 per cent instead of –1.4 per cent (base-run value).

The row showing '% Change' measures percentage increases in value of variables in shock scenario over base run values.

The table shows that in the short run, there is a small fall in the growth rate as a result of this shock (3 per cent). The world trade shock leads to a fall in exports demand and this brings down the industrial and tertiary growth rates, while agricultural growth rates are untouched. The fall in aggregate demand (as a result of the fall of exports demand) dampens the inflation rate and hence, there is no stagflationary situation in this case. The fiscal balance and external reserves deteriorate, bringing some instability to the growth process. In the long run, there is no effect on the growth rate, indicating that this shock is completely temporary and not pervasive at all. This is due to the fact that while the shock has no impact on agriculture and some negative impact on the tertiary sector, the industrial sector gets a positive boost from this shock in the long run due to a fall in inflation rates (since industrial output is inversely related to price) and this more than makes up for the fall in growth rates in the tertiary sector. There is no instability in the long run from the fiscal or external sectors.

Capital Flow Shock

The third scenario represents a capital flow shock. It may be noted that the initial years of the simulation period saw the incidence of global financial market instability and the resultant East Asia crisis. Although India was left largely untouched by this shock, it would be worthwhile to see what would have happened if it did have an impact. In this scenario, we assume that the capital account balance is zero in both 1997 and 1998 instead of actual values of 10 billion dollars and 8.2 billion dollars, respectively. The results of the simulation together with the base-run are given in Table 3.

TABLE 3
Effect of Capital Flow Shock

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Aggregate Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	7.3	7.6	36.1
	Shock	6.6	3.3	4.9	9.7	7.2	7.6	25.5
	% Change	–1.5	0.0	4.3	–4.9	–1.4	0.0	–29.4
Long run	Base-run	5.9	2.6	5.7	8.0	4.9	11.0	58.6
	Shock	5.8	2.6	5.7	7.7	5.0	10.8	54.3
	% Change	–1.7	0.0	0.0	–3.8	2.0	–1.8	–7.3

Note: In the shock scenario, capital account balance is assumed to be zero in both 1997 and 1998 instead of 10 billion dollars and 8.2 billion dollars respectively (base-run values).

The row showing '% Change' measures percentage increases in value of variables in shock scenario over base run values.

The table shows that the shock has a very small impact on the growth rate in the short run. This is due to the fact that the shock leaves the agricultural sector completely untouched and gives a boost to industrial growth rates even in the short run, by bringing down inflation rates. Thus it is only the negative impact on the tertiary sector that results in a fall in GDP growth rates. The fall in inflation rates ensures that the situation is not stagflationary. There is no instability to the growth process from the fiscal sector but a sharp fall in the foreign exchange reserves as a result of the shock, gives rise to some instability to growth from the external sector. In the long run, the percentage fall is small (1.7 per cent) but it is larger than the short run impact, indicating the pervasive nature of this shock. The fall in growth is completely due to the tertiary sector, while the other two sectors have no long run impact. There is no instability in the long run from the fiscal or external sectors.

Domestic Shocks

Rainfall Shock

The fourth scenario represents a rainfall shock. Here, the rainfall index is assumed to be 80 in both 1997 and 1998, whereas the actual values were 102 and 106, respectively. It may be noted

that the index is 100 in case of normal rainfall, and a value of 80 has given rise to drought conditions in 1979, 1987 and more recently in 2002. It may also be noted, that although such conditions are usually accompanied by government intervention, this scenario does not assume any reaction to the drought by the government. The results of the simulation and the base-run are given in Table 4.

TABLE 4
Effect of Rainfall Shock

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Aggregate Inflation*	*Agricultural Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	7.3	9.0	7.6	36.1
	Shock	4.3	–1.7	0.7	10.1	11.7	16.2	6.5	35.3
	% Change	–35.8	–151.5	–85.1	–1.0	60.3	80.0	–14.5	–2.2
Long run	Base-run	5.9	2.6	5.7	8.0	4.9	4.8	11.0	58.6
	Shock	5.3	2.0	4.5	7.6	5.9	6.1	10.0	59.7
	% Change	–10.2	–23.1	–21.1	–5.0	20.4	27.1	–9.1	1.9

Note: In the shock scenario, rainfall index is assumed to be 80 in both 1997 and 1998 instead of 102 and 106 respectively (base-run values).

The row showing '% Change' measures percentage increases in the value of the variables in shock scenario over base run values.

The table indicates that there is a substantial fall in growth rates (almost 36 per cent) in the short run, as a result of this shock. This is due to a debilitating impact on the agricultural growth rates, which also has a significant spillover onto the industrial growth rates. The tertiary sector is almost unaffected by this shock in the short run. There is a large increase in the inflation rates (about 60 per cent) - largely due to high agricultural inflation - leading to an acute stagflationary situation. There are no significant changes in the fiscal and external situation. The long run growth also falls significantly (by about 10 per cent) but it is a much smaller fall compared to the short run, indicating that the resilience of the economy to this shock makes it less pervasive. The fall in long run growth rates is again almost entirely due to the agricultural and industrial sector, while the tertiary sector is much less affected. The inflation rates also rise significantly leading to a long run stagflationary situation. There is no instability in the long run from the fiscal or external sectors.

Fiscal Profligacy

The fifth scenario represents a case of fiscal profligacy. As we have discussed earlier, there is no objective definition of fiscal profligacy though it is loosely used to describe unproductive expenditure of the government. For our study, we have assumed fiscal profligacy to mean an increase in the state's revenue expenditure, which is financed (at least partly) by cutting back capital expenditure. In this scenario it is assumed that both government transfer and government consumption are 1 per cent (of nominal GDP) higher than in the base-run in both

1997 and 1998. Simultaneously, public investment is assumed to be 1 per cent (of nominal GDP) lower than the base-run in both the years. Since the cut in public investments does not fully cover the increase in revenue expenditure, this implies an increase in fiscal deficit. The results of the simulation together with the base-run are given in Table 5.

TABLE 5
Effect of Fiscal Profligacy

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Aggregate Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	7.3	7.6	36.1
	Shock	5.8	1.4	3.9	9.6	8.2	9.0	36.2
	% Change	–13.4	–57.6	–17.0	–5.9	12.3	18.4	0.3
Long run	Base-run	5.9	2.6	5.7	8.0	4.9	11.0	58.6
	Shock	5.1	1.6	4.2	7.6	6.0	10.8	59.6
	% Change	–13.6	–38.5	–26.3	–5.0	22.4	–1.8	1.7

Note: In the shock scenario, government transfer and government consumption are both assumed to be 1 per cent (of nominal GDP) higher than in the base-run in both 1997 and 1998. Simultaneously, public investment is assumed to be 1 per cent (of nominal GDP) lower than the base-run in both the years.

The row showing '% Change' measures percentage increases in value of variables in shock scenario over base run values.

The table indicates a significant fall in growth rates (about 13 per cent) in the short run corresponding to the shock. This is largely due to a fall in agricultural and industrial growth rates which result from the cut in public investments in these sectors. There is not much impact on the inflation rate or the external sector, but the fiscal deficit goes up significantly, contributing some instability to the growth process. In the long run, the percentage fall in growth rate is very similar to that in the short run, indicating that this shock is pervasive. Moreover, the rise in inflation is proportionately more in the long run leading to a stagflationary situation. There is no instability in the long run from the fiscal or external sectors.

Multiple Shocks

One of the objectives of this study was to examine the impact of multiple shocks. In the next simulation we do this by assuming that all the five shocks that we have discussed earlier impact the economy simultaneously. This will test the resilience of the economy to shocks and provide an idea about the worst possible performance by the economy under such conditions. The period under study is the same as in the earlier simulations, i.e., 1997 to 2003. The results of the simulation together with the base-run are given in Table 6.

The table shows that there is approximately 64 per cent fall in the growth rate in the short run. This is due to both the agricultural and industrial sectors showing retrogression (negative growth) during this period. Despite the multiple shocks, the services sector continues to

TABLE 6
Effect of Multiple Shocks

Variables		*GDP Growth*	*Agricultural Growth*	*Industrial Growth*	*Tertiary Growth*	*Aggregate Inflation*	*Gross Fiscal Deficit Ratio*	*Foreign Exchange Reserves*
Short run	Base-run	6.7	3.3	4.7	10.2	7.3	7.6	36.1
	Shock	2.4	–3.5	–1.9	8.7	14.4	4.8	12.6
	% Change	–64.2	–206.1	–140.4	–14.7	97.3	–36.8	–65.1
Long run	Base-run	5.9	2.6	5.7	8.0	4.9	11.0	58.6
	Shock	4.1	0.9	2.8	6.6	7.7	8.0	53.0
	% Change	–30.5	–65.4	–50.9	–17.5	57.1	–27.3	–9.6

Note: In the shock scenario, all the assumptions of the five individual shock scenarios hold simultaneously. The row showing '% Change' measures percentage increases in value of variables in shock scenario over base run values.

grow at almost 9 per cent and this keeps the aggregate economy from sinking into retrogression. The inflation rates almost double, making for a stagflationary situation. The external sector also deteriorates, leading to an unstable growth process. In the long run, the proportionate fall in growth is much smaller than in the short run (about 30 per cent), indicating that the economy is resilient to multiple shocks and its impact is not very pervasive. The rise in inflation is substantial even in the long run leading to a persistent stagflationary situation. There is no instability in the long run from the fiscal or external sectors. Finally, the most important conclusion that can be drawn from this table is that even in the worst possible scenario, the economy will continue to show a long-run growth of more than 4 per cent, which is a reasonable performance even in ordinary circumstances.

So how does one interpret the overall impact of the multiple shocks? It may be noted that the Indian economy is a comparatively stable one among the developing countries in the world. During the last fifty-five years, the economy witnessed only three instances of negative annual GDP growth rates and every five-year average GDP growth rate has varied between 3.5 per cent and 6.4 per cent. Thus even a 2 per cent point decline in the long run growth rate (as in the multiple shock case) may be considered to be severe by Indian standards. However, it would be very mild compared to the experience of some Latin American and African economies, which have witnessed sharp fluctuations in the past. In terms of international comparison therefore, the Indian economy is far more resilient to domestic and external shocks.

5. Summary and Conclusions

We have defined and studied the effect of five shocks that we believe might have affected the growth of the Indian economy. These include two domestic shocks (rainfall shortage and fiscal profligacy) and three external shocks (oil price hike, world trade shock and capital flow shock). Next, we have constructed realistic shock scenarios and estimated the effects of these shocks on the growth process. Shocks can have an impact on various aspects of

the growth process. These aspects include (i) the magnitude of the impact on growth rates, (ii) the pervasiveness of the shocks in the long run, (iii) the capability of the shock to give rise to stagflationary situations, and (iv) the capability of the shock to give rise to instability in the fiscal or external sectors. It is important to classify the shocks according to what effect they have on these aspects of the growth process.

The primary focus in this study is the effect of shocks on the aggregate growth rates. In this context, it is fair to say that realistic rainfall and fiscal profligacy shocks have a stronger growth retarding effect compared to realistic scenarios of the other three shocks, both in the short as well as the long run. Thus, the two domestic shocks are the comparatively big shocks both in the short and long run.

The second issue of interest is the pervasiveness of the shocks, i.e., their long run persistence. Here we find that the oil price hike, the capital flow shock and fiscal profligacy show strong pervasiveness, while the economy is much more resilient to the rainfall shock and the world trade shock in the long run.

The third issue that is studied is whether the shock leads to a stagflationary situation or not. This is because demand management policies can be used in non-stagflationary situations while stagflationary situations sometimes worsen with the use of such policies. We find that the rainfall shock and fiscal profligacy is stagflationary in the long run, while the oil price hike, capital flow shock and world trade shocks are not stagflationary in the long run.

The fourth and final point of interest is to study whether the shock leads to some instability in the growth process by enlarging the disequilibrium in the fiscal or the external sectors. As we have mentioned, a large increase in the deficits in these sectors has the potential to destabilize future growth rates by affecting investor confidence in the economy. We find from our study that the oil shock, world trade shock and the capital flow shocks (i.e., the external shocks) give rise to some instability in the external sector in the short run. Similarly, the fiscal profligacy shock and the world tr ade shock give rise to some short run instability in the fiscal sector. However, in the long run we find that none of the shocks have any significant negative impact on either the fiscal deficit or the external reserves.

There are a number of insights gained from this study that can aid in prescribing appropriate counter shock policies. These are:

1. Any shock that affects the supply side, such as the rainfall shock, will have a big impact on GDP growth. The impact is pervasive because rainfall deficiency not only reduces agricultural output but also non-agricultural output via sectoral interlinkages. The long run impact of this shock depends on the magnitude of the accelerator. However, since rainfall moves in cycles, it has a tendency to restore balance in the long run and hence the long run impact is more muted than the short run impact.
2. The shocks affecting the demand side lower the output first in the industrial sector (which is demand constrained) and then in the tertiary sector through inter-sectoral linkages. The long run impact of demand-induced shocks again depends on the accelerator.
3. The fiscal profligacy shock affects both aggregate demand and supply. A rise in government expenditure may stimulate the industrial demand in the short run but has a marginal

effect in the long run. However, a cut in public investment operates perversely through both aggregate demand and supply and thereby leads to a lasting long run impact.

4. In the case of the trade shock, the long run impact is neutralized by the exchange rate adjustment and hence this results in a marginal change in the long run growth rate corresponding to this shock. Clearly, the deregulation of exchange rate has introduced a built-in stability in the operation of this multiplier.

On balance, it appears that the Indian economy has become more resilient to shocks because of the reforms. This is clear from the section on the effect of liberalization, which shows that in the absence of such liberalization, the economy would end up with a balance of payments crisis as a result of a multiple shock. However, the lack of reform in the fiscal sector - a failure to protect public investment - has lowered the long run growth prospects. This is supported by the results in the section on alternative fiscal policies. As far as counter shock policies are concerned, all major domestic and external shocks must be countered through contra-cyclical fiscal and monetary policies. In the short run, this may lead to higher inflation due to a tradeoff between growth and inflation in case of certain shocks that are stagflationary. The long run effect of the counter shock policies will depend on their impact on investments. In this context our estimation results indicate that in spite of interest rate deregulation, the overall impact of interest rate or private investment is small, and hence monetary policy is not very effective as a long run counter shock policy. The alternative is therefore to go in for a more bold fiscal policy involving higher public investment financed by the lowering of other government expenditure.

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Appendix 1
Model for the Indian Economy

GDP at Factor Cost

1. XGDP = XA + XI + XT
2. GR = 100* (XGDP – XGDP(–1))/XGDP(–1)
3. XA = EXP(–8.16+ 1.43*LOG(KA) + 0.27*LOG(RF) – 0.12*D80S – 0.14*DUMXA + 0.10*LOG(XA(–1)))
4. XAG = 100*(XA–XA(–1))/XA(–1)
5. XI = EXP(–2.57 + 0.08*LOG(KI) + 0.34*LOG(XA) + 0.18*LOG(RAE) – 0.06*LOG(PI) + 0.02*DPLIB + 0.6*LOG(XI(–1)) + 0.04*D95)
6. XIG = 100*(XI–XI(–1))/XI(–1)
7. XT = EXP(–5.06 + 0.67*LOG(KT) + 0.13*LOG(XCOM) + 0.01*DUMPAY +0.02*DPLIB + 0.52*LOG(XT(–1)))
8. XTG = 100*(XT–XT(–1))/XT(–1)
9. XCOM = XA + XI
10. RAE = 100*(GE + EGSR)/PGDP

Capital Stock

11. K = KA + KI + KT
12. KA = KA(–1) *(1–DKAR) + IGA + IPA
13. KI = KI(–1) * (1–DKIR) + IGI + IPI
14. KT = KT(–1) * (1–DKTR) + IGT + IPT

Private Investment

15. IP = IPA + IPI + IPT
16. IPN = (IP * PGDP*.01)+EIPN
17. IPA = –4714.17 + 0.05*XA + 0.44*IGA – 2700.76*D80S + 0.28*IPA(–1)
18. IPI = –25029.76 + 0.20*XGDP + 0.71*IGI – 0.56*ORGE – 649.003*RPLR – 939.56*IFR + 41506.12*D95 + 0.22*IPI(–1)
19. IPT = –33116.9 + 0.08*XGDP + 0.71*IGT – 663.11*RPLR – 2920.68*DFEMRPLR + 0.45*IPT(–1)
20. RPLR = PLR – IFR

Public Investment

21. IGA= 100*IGAN/PGDP
22. IGI = 100*IGIN/PGDP

23. IGT = 100*IGTN/PGDP
24. IG = IGA + IGI + IGT
25. IGN = IGAN + IGIN + IGTN + EIGN

Total Investment

26. INV = IGN + IPN
27. INVR = 100*INV/GDPMP

Aggregate Demand

28. GDPMP = CP + GC + IGN + IPN + EGSR – MGSR + RESGDP
29. CP = RCP * PGDP*.01
30. RCP = EXP(2.89 + 0.65*LOG(RPDI) + 0.03*DWTO + 0.11*LOG(RCP(–1)))
31. PDI = YGDP – TAX + GTR + OPDI
32. RPDI = PDI*100/PGDP
33. YGDP = EXP(–0.08 + 0.99*LOG(GDPMP)) + [AR(1)=0.66]

Price

34. PGDP=0.309*PA+0.26*PI+0.42*PT
35. IFR = 100*(PGDP – PGDP(–1))/PGDP(–1)
36. PA = EXP(4.002 – 0.71*LOG(XA) + 0.59*LOG(PDI) + 0.12*DUMPA + 0.31*LOG(PA(–1)))
37. PI = EXP(–0.20 + 0.37*LOG(PA) + 0.05*LOG(PMO) + 0.01*LOG(PMN) + 0.53*LOG(PI(–1)) + 0.06*LOG(TRF))
38. PT = EXP(0.11 + 0.16*LOG(PA) + 0.42*LOG(PI) + 0.39*LOG(PT(–1)))

Money and Interest

39. M3 = RM3*PGDP/100
40. RM3 = EXP(–9.801 + 1.68*LOG(XGDP) + 0.008*RPLR – 0.01*DFEMRPLR + 0.19*DUMM3 – 0.07*DWTO)
41. PLR = 0.49 + 1.65e–05*M3 – 7.2e–05*M0 + 0.43*CRR + 1.13*BR
42. M3G = 100*(M3 – M3(–1))/M3(–1)
43. M0 = FERR + GSRBI – NNML
44. FERR = FER * EXR/10
45. GSRBI = GSRBI(–1) + MGFD

Fiscal Sector

46. GE = GC + IGN + GTR
47. RGE = GE *100/PGDP
48. ORGE = RGE – IG
49. GFD = GE – TAX – NTAX
50. GFDR = 100*GFD/GDPMP
51. TAX = EXP(–2.95 + 1.08*LOG(GDPMP) – 0.104*DLIB – 0.11*DWTO)

External Transactions

52. FER = FER (–1) + CAB + KAB + RESFER
53. CAB = EGS – MGS + REM
54. CABR = 100*(CAB*EXR*0.1)/GDPMP
55. EGS = EXP(–6.62 + 1.02*LOG(WT) + 0.34*LOG(REXR) + 0.09*D80S + 0.12*DFEM + 0.14*DWTO + 0.23*DUMEGS)
56. EGSR = EGS*EXR/10
57. MGS = MGSO+MGSN
58. MGSO = EXP(–3.26 + 0.43*LOG(XCOM) + 1.005*LOG(PMO) + 0.55*LOG(PGDP) – 0.69*LOG(EXR) + 0.05*DUMMGSO)
59. MGSN = EXP(–10.22 + 1.37*LOG(XGDP) + 0.09*LOG(PMN) + 1.36*LOG(PGDP) – 1.34*LOG(EXR) – 0.18*LOG(TRF) + 0.18*D95 + 0.05*DWTO)
60. MGSR = MGS*EXR/10
61. PM = 0.2788*PMO + 0.7212*PMN
62. EXR = EXP(0.39 – 0.07*LOG(FER) + 0.27*LOG(PGDP) + 0.19*DEV91 + 0.69*LOG(EXR(–1))
63. REXR = 100*EXR/PGDP

Appendix 2
Variable List

AR Auto-regressive; **BR** Bank rate set by central bank; **CAB** Capital account balance; **CABR** Capital account balance ratio; **CP** Nominal personal consumption expenditure; **CRR** Cash Reserve Ratio set by central bank; **D80S** Dummy for structural changes since the eighties; **D95** Dummy for peak liberalization effect; **DEV91** Dummy for large devaluation in 1991; **DFEM** Dummy for financial and external market liberalization in 1993; **DFEMRPLR** Slope dummy for effect of DFEM on RPLR; **DKAR** Depreciation rate of agricultural capital stock;

DKIR Depreciation rate of industrial capital stock; **DKTR** Depreciation rate of tertiary sector capital stock; **DLIB** Dummy for liberalization in 1991; **DPLIB** Dummy for partial liberalization in mid eighties; **DUMEGS** Outlier dummy for exports; **DUMM3** Outlier dummy for money demand; **DUMMGSO** Outlier dummy for oil imports; **DUMPA** Outlier dummy for agricultural prices; **DUMPAY** Dummy for pay hike in public administration; **DUMXA** Outlier dummy for agricultural output; **DWTO** Dummy for effect of joining WTO; **EGS** Export of goods and services in dollars; **EGSR** Export of goods and services in rupees; **EIGN** Errors and omissions in IGN; **EIPN** Errors and omissions in IPN; **EOINV** Errors and omissions in INV; **EXR** Exchange rate; **FER** Foreign exchange reserves in dollars; **FERR** Foreign exchange reserves in rupees; **GC** Government consumption; **GDPMP** Nominal GDP at market price; **GE** Government expenditure; **GFD** Nominal gross fiscal deficit; **GFDR** Gross fiscal deficit ratio; **GR** GDP growth; **GSRBI** Central bank credit to government; **GTR** Government transfer payments; **IFR** Inflation rate based on GDP deflator; **IG** Real public investment; **IGA** Real public investment in agriculture; **IGAN** Nominal public investment in agriculture; **IGI** Real public investment in industry; **IGIN** Nominal public investment in industry; **IGN** Nominal public investment; **IGT** Real public investment in tertiary sector; **IGTN** Nominal public investment in tertiary sector; **INV** Total nominal investment; **INVR** Total real investment; **IP** Real private investment; **IPA** Real private investment in agriculture; **IPI** Real private investment in industry; **IPN** Nominal private investment; **IPT** Real private investment in tertiary sector; **K** Capital stock; **KA** Capital stock in agriculture; **KAB** Capital account Balance; **KI** Capital stock in industry; **KT** Capital stock in tertiary sector; **M0** Nominal reserve money; **M3** Nominal money supply; **M3G** Nominal money supply growth rate; **MGFD** Monetized gross fiscal deficit; **MGS** Nominal Imports of goods and services in dollars; **MGSN** Nominal Imports of non-oil goods and services in dollars**; MGSO** Nominal Imports of oil in dollars; **MGSR** Nominal Imports of goods and services in rupees; **NNML** Net non-monetary liabilities; **NTAX** Non tax revenues; **OLS** Ordinary Least Squares; **ORGE** Other real government expenditure (other than public investments); **PA** Agricultural deflator; **PDI** Nominal private disposable income; **PGDP** GDP deflator; **PI** Industrial deflator; **PLR** Interest rate (Prime lending rate); **PM** Import price; **PMN** Import price of non-oil products; **PMO** Import price of oil; **PT** Tertiary sector deflator; **RAE** Real autonomous expenditure; **RCP** Real personal consumption expenditure; **REM** Remittances etc.; **RESFER** Errors and omissions in BOP account; **RESGDP** Errors in 'GDP at market prices' identity; **REXR** Real exchange rate; **RF** Rainfall index; **RGE** Real government expenditure; **RM3** Real money supply; **RMGS** Real imports of goods and services in dollars; **RPDI** Real private disposable income; **RPLR** Real interest rate; **TAX** Tax revenues; **TRF** Average tariff rate; **XA** Real agricultural output; **XAG** Growth in agricultural output; **XCOM** Real commodity output; **XGDP** Real GDP; **XI** Real industrial output; **XIG** Growth in industrial output**; XT** Real tertiary sector output; **XTG** Growth in tertiary output**; YGDP** Nominal GDP at factor cost.

Chapter 3

The Optimal Level of Interest Rate in Emerging Economies: Evidence from East Asia

PRADEEP AGRAWAL

1. Introduction

This paper attempts to shed light on the appropriate interest rate policy in the process of economic development. To this end, we empirically examine whether higher real interest rates on bank deposits are associated with higher investment rates in several East Asian countries. The issue is important since higher investment is associated with higher rates of economic growth (Levine and Renelt, 1992). However, it has remained controversial despite several well-noted contributions.[1]

Until the early 1970s, it was generally believed that low interest rates on bank loans and deposits would promote investment spending and growth — a notion consistent with the Keynesian and neoclassical analyses where the interest rate is part of the cost of capital (Keynes, 1936; Jorgenson, 1967). This prompted many countries to impose interest rate ceilings at below market-clearing levels.

McKinnon (1973) and Shaw (1973) challenged this conventional wisdom. They argued that raising interest rates (to market-clearing level) increase the amount people are willing to hold as financial assets by decreasing the holdings of non-financial assets such as cash, gold, commodities, land, etc. Thereby, the domestic financial system is able to extend more loans to the investors and hence the equilibrium rate of investment increases. This is further enhanced

[1] See Williamson and Mahar (1998) and Fry (1995) for excellent overviews and syntheses of previous literature.

if the cost of intermediation by banks were kept low by having a competitive banking structure and minimum taxation on financial intermediation. Thus, McKinnon and Shaw argued in favour of "financial liberalization". Following the work of McKinnon and Shaw, many countries have undertaken financial liberalization. The outcome of these reforms has been mixed. While financial liberalization produced improved economic performance in some countries, it also led to financial distress and crisis in many others (Williamson and Mahar, 1998; Caprio and Klingebiel, 1996; World Bank, 1993 and 1989; Diaz Alejandro, 1985). This mixed outcome has led to a reassessment of the case for financial liberalization.

The "neo-structuralist" economists argued that higher bank interest rates lead to higher bank deposits simply due to the transfer of funds away from alternative asset holdings (Taylor, 1983), such as the informal credit markets (Edwards, 1988; Van Wijnbergen, 1982) or share markets. They also argued that some of these, such as the informal credit markets, might be more efficient means of financing investment since these are unregulated and do not need to hold reserves (as banks do). Thus according to the neo-structuralists, raising interest rates on bank deposits would decrease, rather than increase, the investment rate in the economy. However, Kapur (1992) and Bencivenga and Smith (1992) have shown that the argument about the greater efficiency of the informal sector due to the lack of a formal reserve requirement is not valid if the central bank makes proper use of the banks' reserves, thereby ensuring that the reserves do not have a social cost. This implies that as long as a part of the additional assets come to the banking sector from non-financial assets (McKinnon-Shaw) and/or foreign assets (Agrawal, 2001), raising bank interest rates would be desirable.

More recently, Stiglitz (1994) and others have argued against unbridled financial liberalization and instead, supported 'mild financial repression' on several counts: (1a) The results of earlier empirical studies (such as, King and Levine, 1993) reporting beneficial effects of higher real interest rates may have been driven by episodes of severe financial repression so that, if the countries (or periods) of negative real interest rates were excluded from the sample, the higher real interest rates might be associated with lower rates of growth (Stiglitz and Uy, 1996) apparently because financial development (and credit availability) would not be significantly affected by increasing real interest rates beyond zero which would take money away from investors (and give it to savers), which may lower investment. Thus, 'mild financial repression' with the real interest rate close to zero or slightly positive, may well be optimal (Murdock and Stiglitz, 1993). (1b) Pervasive market failures and the severe negative externality from failure of one bank (which lead to explicit or implicit government guarantees on bank deposits) imply that stiff competition may not be desirable in financial markets (Stiglitz, 1994) and it may be socially optimum to allow banks to earn extra profits by keeping deposit rates below market clearing rates[2] (Hellman, Murdock and Stiglitz, 1997). (2) High real interest rates may be accompanied by significantly increased riskiness in the banks' loans portfolio as

[2] Given that most developing countries do not have a perfectly competitive banking sector to begin with and that typical bank intermediation costs are only about 2 per cent of the deposits, a substantial reduction in deposit rates (of, say, more than 1 per cent) appears hard to justify on these grounds.

the investors with safe but low return projects, who are unlikely to default, drop out of the applicant pool while investors with riskier projects remain (Stiglitz and Weiss, 1981; Stiglitz, 1994). These arguments have been criticized on the grounds that government interventions to counter market failures have their own problems and that they have not been tested empirically (Jaramillo-Vallejo, 1993).

Finally, in his more recent writings, McKinnon[3] (1993, chaps 3 and 7), while accommodating some of Stiglitz's asymmetric information and risk arguments, has advocated 'restrained financial liberalization', that is, financial liberalization with a moderate upper limit on the real interest rates. McKinnon (1993, p. 41) advocates real interest rates (on intermediate term bank deposits) in the range of 5-9 per cent. This position is to be contrasted with Stiglitz's (1994) 'mild financial repression' position that will restrict real interest rates to be close to zero or slightly positive.

Given these varied analytical arguments, and the fact that policies regarding interest rates have economy wide impact, it is important to evaluate them empirically. Thus, in this paper we estimate an investment function and then evaluate the impact on investment rate of raising real deposit rates for Korea, Malaysia, Thailand, and Indonesia. The choice of countries was based on: (1) their having experienced a wide range of real interest rates which makes it possible to analyse the impact of different levels of real interest rates; and (2) their exemplary investment and growth rates from mid 1960's to mid 1990's, which have evoked considerable interest in their development experiences. Four countries are considered simultaneously in the expectation that the lessons that emerge will carry greater conviction than single country case studies can provide.

Previously, there exists an extensive literature on the determinants of investment (see, for example, Rama, 1993; Fry 1998, 1995; Schmidt-Hebbel *et al*., 1996). However, only a few such studies have attempted to evaluate the relative merits of the McKinnon-Shaw and the neo-structuralist hypotheses while the Stiglitz (1994) and McKinnon (1993) hypotheses have remained mostly untested.[4] Even among these studies, many suffer from a methodological problem (they include both the credit and interest rate variables which leads to incorrect conclusions about the impact of interest rate on investment rate because this mainly comes about through increased credit availability—see Section 2.3). Further, all of them use classical econometric procedures, which may not be valid since most of the variables appear to be non-stationary. It is therefore not surprising that they arrive at conflicting conclusions regarding the impact of higher interest rates on the investment rate. Further none of these studies address the issue of direction of causality—it is not clear whether the investment rate changes were caused by changes in the interest rate or credit policies or the other way round.

In this paper, we evaluate the Stiglitz (1994) and McKinnon (1993) positions, along with the McKinnon-Shaw and neo-structuralist hypotheses. We avoid the methodological problems of most of the previous studies (see Section 2.2) and use the recent co-integration procedures.

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[3] Also see McKinnon and Pill (1997).

[4] Except for Rittenberg (1991), who tests some aspects of the Stiglitz hypothesis.

For enhanced reliability, two separate estimation procedures are used for many estimations: the ECM co-integration procedure recently proposed by Banerjee, Dolado and Mestre, 1998, and the Dynamic OLS (DOLS) procedure of Stock and Watson, 1993 (see Section 2.3). We also undertake causality tests to show that in the countries studied here, higher interest rates Granger-caused increased availability of bank credit, which in turn, Granger caused higher investment rates.

The plan for the rest of the paper is as follows. In Section 2 we specify the functional form for the investment function and explain how various financial liberalization hypotheses are tested and causality tests carried out. In Section 3, we discuss the results of our causality tests and the tests of various financial liberalization hypotheses. Some concluding remarks are made in Section 4. Sources of data and results of unit root tests on various variables of interest are reported in Appendix A.

2. The Investment Function and Econometric Procedures

In this section we consider various variables that affect investment and specify a likely functional form for the investment function (Section 2.1). We then describe how we econometrically test the relative merits of the McKinnon-Shaw, Neo-structuralist, Stiglitz (1994), and McKinnon (1993) hypotheses (Section 2.2). Finally, a brief description of the econometric procedures used is provided in Section 2.3.

2.1 Specification of the Investment Function

There exists a vast literature on the determinants of the investment rate (cited earlier in the introduction). The explanatory variables commonly used in the context of a flexible accelerator model for developing countries (Fry 1995, Schmidt-Hebbel *et al*., 1996) where firms' investment often suffers from credit and foreign exchange constraints include: GDP growth rate (G), domestic credit availability (CRDT), foreign private capital inflows (FCIpvt), an index of terms of trade (TOT) and real exchange rate (RER). On the other hand, the neo-classical theory of investment (see Jorgenson, 1967 and Rama, 1993) emphasizes the role of cost of capital (COC) and growth rate of real wages (GW). Rama (1993) develops an interesting synthesis of various analytical approaches to investment decisions of firms and argues that even in developing countries, while some firms may face credit and foreign exchange constraints, others might not — and the neoclassical model would be applicable to this latter group. Thus, he recommends synthesizing the explanatory variables suggested by the neoclassical and other approaches. Following Rama (1993), we consider the following long run relation:

$$\begin{aligned} \mathrm{INV}/\mathrm{Y}_t = {} & b_o + b_1 G_t + b_2\,\mathrm{CRDT}/\mathrm{Y}_t + b_3\,\mathrm{FCIpvt}/\mathrm{Y}_t + b_4 \mathrm{TOT}_t + b_5\,\mathrm{RER} \\ & + b_6\,\mathrm{COC}_t + b_7\,\mathrm{GW}_t \end{aligned} \tag{1}$$

The dependent variable is the investment rate (INV/Y), defined as the ratio of gross fixed domestic investment (INV) to gross domestic product (Y).[5] The explanatory variables are briefly described below.

The real GDP growth rate (G) over the previous year is an important determinant of investment since higher growth would imply higher capital requirement and hence higher investment rate. Further, growth rate is also a good proxy for the quality of institutions and policies being pursued in an economy at a given time. These, in turn, affect the profit opportunities available in the economy and thereby the investment rate.

The availability of bank credit as a fraction of GDP (CRDT/Y) is likely to be important in a credit market where the interest rates are controlled at below market clearing levels and/or directed credit programs exist for selected industrial sectors.[6] Banks specialize in acquiring information on default risk. This information is highly specific to each client. Hence, the market for bank loans is a customer market, in which borrowers and lenders are very imperfect substitutes. A credit squeeze rations out some bank borrowers who may be unable to find loans elsewhere and so be unable to finance their investment projects (Blinder and Stiglitz, 1983, p. 300). Also, asymmetric information will lead to credit rationing even in perfectly competitive liberalized markets.

The inflow of foreign capital to the private sector as a fraction of GDP (FCIpvt/Y) can be an important determinant of investment rate since the foreign capital, be it foreign direct investment, portfolio investment, trade credit or other forms of loans, constitute a source of funds for investment.[7] From the point of view of the domestic investor, each type of inflow is probably a comparable source of funds. For this reason the inflow of foreign capital to the private sector as a whole is considered to be a determinant of the investment.

An improvement in the terms of trade, TOT (the unit price of exports divided by the unit price of imports) can increase investment by making capital goods (mostly importables in developing countries) cheaper relative to the domestic goods and by increasing real income. However, the overall effect on investment is ambiguous since it could also decrease investment by decreasing the demand for domestic goods compared to importables (see, for example, Cardoso, 1993).

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[5] We have used gross domestic fixed investment as sufficiently long series were not available for private investment for the countries under consideration. Similarly, while theory (see e.g. Rama, 1993) would suggest considering the ratio of investment to total capital stock, we have scaled it by GDP because reliable estimates of the capital stock are usually not available for the countries under consideration.

[6] S. Korea initiated financial sector reforms in 1980 but maintained a ceiling of 10 per cent on interest rates. Malaysia deregulated interest rates in 1978 but re-imposed controls over 1985–91 following a banking crises beginning in 1985. Thailand substantially raised the interest rate ceiling in 1979 and lifted it in 1990. Indonesia initiated interest rate deregulation in 1983. However, directed credit programmes have continued in these countries although they were reduced in scope and/or in the extent of the interest rate subsidy following banking reforms.

[7] Government foreign borrowing is not included as it often goes into financing trade or budget deficits and thereby encourages consumption rather than investment (see for example, Schmidt-Hebbel, 1996; Edwards 1996; Fry, 1995, Ch. 8).

Next, consider the effect of the real exchange rate (RER), which is defined as:

$$\text{RER} = X.P^f/P, \tag{2}$$

where X is the exchange rate (number of domestic currency units per Dollar), P is the domestic price level (the GDP deflator) and P^f is the foreign price level (proxied here by the US GDP deflator, given that the USA is the most important trading partner of the countries being studied). An increase in RER would increase the price of imported capital and intermediate goods and result in a contraction of investment (Serven and Solimano, 1992; Fry, 1995). Van Wijnbergen (1985) develops a two-sector model that shows that the net effect of a real depreciation is ambiguous—investment in tradable goods increases while that in domestic goods declines.[8]

True domestic costs of capital (COC) are difficult to measure in the countries examined here because of selective credit policies and dis-equilibrium institutional interest rates. We have used the measure of cost of capital suggested by Jorgenson (1967):

$$\text{COC} = (R_l + \delta - \hat{P}_k^e)P_k/P \tag{3}$$

where R_l is the interest rate on bank loans, δ is the depreciation rate (set at 15 per cent), P_k is the price of capital goods (proxied by the implicit price deflator of fixed investment), $\hat{P}_k^e$ is its expected growth rate (proxied by the per cent rate of growth of P_k over the following year) and P is the general price level of output, proxied by the GDP deflator. This measure excludes the effect of changes in tax policies, for which adequate data was lacking.

Growth rate of real wages (GW) is measured as growth rate of monthly average of real wages of the non-agricultural sector. Real wages are obtained by dividing the nominal wages by a general price index (GDP deflator). Another variable used where this variable and COC were found insignificant is growth rate of the relative price of capital to labor, i.e. G(COC/W)—see Rama (1993). An increase in the growth rate of real wages is expected to lower profits and the investment rate. Similarly, an increase in the growth rate of relative price of capital to labour is expected to lower investment.

2.2 Evaluating Various Financial Liberalization Hypotheses

First, consider testing between the McKinnon-Shaw and the neo-structuralist hypotheses. Ideally, one would like to explicitly take into account all the effects of an increase in bank

[8] Although both TOT and RER are measuring somewhat related effects, they are not identical. In particular, while RER measures the impact of changes in inflation and exchange rates, TOT also includes the effect of changes in international prices and competitiveness of various tradable goods. The absolute value of the correlation coefficient between TOT and RER was in the range of 0.42 to 0.65 for the four countries studied here (which is considerably below the level (about 0.9) for co-linearity to be considered a serious problem).

deposit rate, R_d: the increase in bank deposits and credit suggested by McKinnon-Shaw and also any simultaneous decline in finance from other financial sectors such as the informal credit markets, etc. suggested by the neo-structuralists. Unfortunately the data is not available to do this explicitly (by their very nature, accurate data on the volume of credit and interest rates prevailing in the informal financial sector are hard to compile). Thus, we propose an indirect test that consists of re-estimating the investment function, by including real interest rate on bank deposits (R_d) as an explanatory variable while dropping the credit ratio (CRDT/Y). That is, we estimate the following long run investment relation:

$$\text{INV/Y} = b_0 + b_1 G + b_2 R_d + b_3 \text{FCIpvt/Y} + b_4 \text{TOT} + b_5 \text{RER} + b_6 \text{COC} + b_7 \text{GW} \qquad (4)$$

Then R_d captures the overall impact of raising real interest rate and its coefficient is expected to be positive according to McKinnon-Shaw and negative according to the neo-structuralist. Note that when the formal credit ratio (CRDT/Y) is included in the regression, the coefficient of real interest rate, R_d, would not provide a proper test of the McKinnon-Shaw and neo-structuralist hypotheses. This is so because the formal credit ratio, CRDT/Y, already captures most of the effect of raising the interest rates and the co-efficient of R_d would be expected to be insignificant when the availability of credit is the primary constraint on investment (as is the case with the countries considered here — see Section 3.1 below). From an econometric perspective, the variables CRDT/Y and R_d will be strongly correlated so that putting both together will result in an unreliable inference.[9]

Next consider testing the Stiglitz hypothesis which argues that a positive co-efficient of R_d could be driven by episodes of negative real interest rates so that raising real interest rates beyond a modest level (close to zero) might actually decrease the investment (and growth) rates. In order to evaluate this argument, we estimate the following long run relation:

$$\begin{aligned}\text{INV/Y} = {} & b_0 + b_1\, G + b_2 R_d + b_2'\, R_d\, D(\underline{R}) + b_3\, \text{FCIpvt/Y} + b_4\, \text{TOT} \\ & + b_5\, \text{RER} + b_6\, \text{COC} + b_7\, \text{GW} \end{aligned} \qquad (5)$$

where $D(\underline{R})$ is a dummy variable which takes the value 1 whenever $R_d > \underline{R}$ and the value 0 whenever $R_d < \underline{R}$. We have repeated estimation of (5) for values of $\underline{R}$ ranging from 0 to 12 (there were few observations with still higher values of R_d) at intervals of 1 percentage point. Note that with this formulation, when $R_d < \underline{R}$, (5) reduces to:

$$\text{INV/Y} = b_0 + b_1\, G + b_2\, R_d + b_3\, \text{FCIpvt/Y} + b_4 \text{TOT} + b_5\, \text{RER} + b_6 \text{COC} + b_7\, \text{GW} \qquad (5')$$

[9] One might be concerned if private foreign capital inflows could also be correlated with the real interest rates on bank deposits. Note that the term includes foreign direct investment, foreign portfolio investment and private foreign debt inflows. The first two terms do not depend much on interest rates. Even the foreign borrowing of domestic companies, is affected considerably by business conditions and sentiments, although interest rates could also be a determinant. These arguments are corroborated by the relatively low absolute value of the correlation coefficient between capital inflows and interest rates for the four countries (between 0.08 and 0.26).

and when $R_d > \underline{R}$, (5) becomes:

$$\text{INV/Y} = b_0 + b_1\, G + (b_2 + b_2')\, R_d + b_3\text{FCIpvt/Y} + b_4\text{TOT} + b_5\, \text{RER} + b_6\text{COC} + b_7\, \text{GW} \qquad (5'')$$

Thus, if Stiglitz's argument were correct, we would expect b_2 to be positive and b_2' as well as $b_2 + b_2'$ to be negative for $\underline{R}$ close to zero. On the other hand, if $\underline{R}$ turns out to be high (9 per cent or more), McKinnon's (1993) position favouring 'restrained financial liberalization' will be supported. Finally, if $\underline{R}$ is non-existent, that is, if increases in real interest rates at all levels are associated with increases in investment rates, then the full-fledged financial liberalization as originally suggested by McKinnon-Shaw, would be supported.

However, there is another dimension to Stiglitz's argument—he also suggests that high interest rates may lead to riskier loan portfolios of banks which may contribute to increased probability of bank failures or financial crisis (Stiglitz, 1994; Stiglitz and Uy, 1996; Stiglitz and Weiss, 1981). Thus, we also examine evidence on whether high real interest rates can lead to banking crisis (Section 3.3). If high interest rates were indeed associated with considerably increased risk of banking crisis, Stiglitz hypothesis would be supported as it would then be difficult to support the case for high interest rates even if $\underline{R}$ was high or even non existent.

2.3 Econometric Issues and Procedures

Here, our perspective is on analysing how to improve long run investment rate (and GDP growth) rather than any transitional details. Thus, we are primarily interested in estimating the long run impact of credit/real interest rates and other explanatory variables on the investment rate. In accordance with the modern practice, we begin by testing all relevant variables for unit roots. Using the Augmented Dickey Fuller (ADF) method, most of the variables except GDP growth, G, and real interest rate, R_d, are found to be integrated of order 1 (see Table A1 in Appendix A). Thus, the estimations must be carried out using co-integration procedures.

For more reliable results we have used two separate estimation procedures: (1) The ECM co-integration procedure recently proposed by Banerjee, Dolado and Mestre, 1998, and the Dynamic OLS (DOLS) procedure of Stock and Watson, 1993. Banerjee *et al.*, show that the ECM procedure provides a more reliable test of co-integration as well as an unbiased estimate of the long run relation when the explanatory variables are weakly exogenous for the parameters of interest. (2) The Dynamic OLS procedure has been shown to provide unbiased and asymptotically efficient estimates of the long run relation, even in the presence of endogenous regressors. Further, comparing the estimates obtained by the above two procedures would provide some information about whether any explanatory variables are actually endogenous or not.

The ECM procedure involves testing for stability of the parameters, which *revealed no evidence of instability in the parameters*. Further, in most cases, we have clear evidence of

co-integration, which again corroborates the above evidence in favour of a *stable long-run relationship*. Thus, while the policies of financial liberalization, may have affected the level of investment, they did not seem to materially change the long run investment function itself.

We also considered using the vector autoregression procedure of Johanson which allows for endogeneous explanatory variables. However, while the Johanson procedure is more appealing from a theoretical point of view, it is difficult to use with small samples (we only had about 25 to 35 annual observations available for each country) because use of several lags on each variable takes away too many degrees of freedom, often rendering most variables insignificant. Thus we believe that the use of above mentioned single equation procedures is appropriate here.

Further, there is a possibility that some of the explanatory variables could be potentially endogenous. In particular, for the arguments of this paper about the importance of credit availability and an appropriate interest rate policy to make sense, it is important that credit ratio determine investment rate, rather than being determined by it (or at least there should be bi-directional causality). To check this we shall test the direction of causality between investment rate and credit ratio[10] (and between credit ratio and interest rates). We describe below the two procedures we use in Section 3.1 for testing the direction of causality:

The Vector Auto-Regression (VAR) Procedure (for I(0) variables)
Following Granger (1969), an economic time series Υ_t is said to be 'Granger-caused' by another series X_t if the information in the past and present values of X_t helps to improve the forecasts of the Υ_t variable. The conventional Granger causality test involves specifying a bi-variate pth order VAR as follows:

$$\Upsilon_t = \mu + \sum_{i=1}^{p} a_i \Upsilon_{t-i} + \sum_{j=1}^{p} b_j X_{t-j} + U_t \tag{6}$$

$$X_t = \mu' + \sum_{i=1}^{p} c_i \Upsilon_{t-i} + \sum_{j=1}^{p} d_t X_{t-j} + U_t' \tag{7}$$

where μ and μ' are constant drifts, U_t and U_t' are error terms, and more generally, the equation may include any number of additional relevant variables. Then, the null hypothesis that X_t does not Granger cause Υ_t amounts to testing,

$$b_1 = b_2 = \cdots = b_n = 0. \tag{8}$$

[10] Alternatively, we could test the direction of causality between investment rate and real interest rates R_d. However, INV/Y is I(1) while R_d is I(0) for all four countries and there is no well accepted procedure for testing causality between variables of different orders. However, INV/Y and CRDT/Y are both I(1) for all four countries and present no such difficulty.

This can be tested by standard methods, such as an F-test. Similarly, the null hypothesis that Υ_t does not Granger cause X_t amounts to testing,

$$c_1 = c_2 = \cdots = c_n = 0. \tag{9}$$

The Vector Error Correction (VECM) Procedure (for I(1) variables)
The procedure for testing Granger causality becomes more complex when the variables X_t and Υ_t have unit roots. In such cases, it is useful to re-parameterise the model in the equivalent error correction (ECM) form as follows (see Engle and Granger, 1987; Johansen, 1988):

$$\Delta\Upsilon_t = \eta + \sum_{i=1}^{p-1} \alpha_i \Delta\Upsilon_{t-i} + \sum_{j=1}^{p-1} \beta_j \Delta X_{t-j} + \Theta(\Upsilon - \kappa X)_{t-1} + U_t \tag{10}$$

$$\Delta X_t = \eta' + \sum_{i=1}^{p-1} \gamma_i \Delta\Upsilon_{t-i} + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \Phi(\Upsilon - \kappa X)_{t-1} + U'_t \tag{11}$$

where the lagged ECM term $(\Upsilon - \kappa X)_{t-1}$ are the lagged residuals from the co-integrating relation between Υ and X. There are now two sources of causation of Υ_t by X_t, either the short run causality through the lagged dynamic terms ΔX_t if all the β_i are not equal to zero, or the long term granger causality through the lagged ECM term if θ is non-zero.

3. Empirical Results

In this section we describe the empirical results from our estimations. First we address the issue of the direction of causality between investment rate and credit ratio and between changes in credit ratio and the interest rates. These are found to be in the direction suggested by the proponents of financial liberalization (Section 3.1). Then we proceed to estimating the investment relations and testing various financial liberalization hypotheses. The more standard investment relation (equation 1) with credit ratio was estimated and found to give results along expected lines.[11] Since this is not of direct relevance in testing the financial liberalization hypotheses, the results are not reported here for brevity (but are available from the author on request). Here we report on the tests of McKinnon-Shaw versus neo-structuralist hypotheses in Section 3.2 and the test of Stiglitz (1994) versus McKinnon (1993) in Section 3.3.

All estimations in Sections 3.2 and 3.3 were carried out using the ECM and/or DOLS procedures (see Section 2.3) — the ECM procedure involved up to second order lags of the

[11] For example, credit ratio was found to be significant at 1 per cent level for all four countries, private foreign capital inflows, RER and TOT were found important for at least some of the countries, while the cost of capital (COC) was found insignificant for all countries.

dynamic terms and first order in leads of dynamic terms — a higher order was usually not feasible given that we usually had 25 to 35 annual observations available for each country. Similarly, the dynamic OLS was carried out with up to second order of lags and leads in dynamic terms. The insignificant terms were dropped in both procedures.

3.1 Causality Issues: Do More Credit/Higher Interest Rates Cause More Investment?

In the literature, the credit ratio in equation (1) is often suspected to be potentially endogeneous, i.e. it is not clear whether increases in the credit ratio cause investment to increase or are merely the result of a high demand when more investment is taking place due to other factors. Before we proceed with detailed estimation and evaluation of the impact of different levels of interest rates on the investment rates, it is important to ensure that it is indeed the changes in credit ratio and/or interest rates that are causing the changes in the investment rates and not the other way around. In our case, we found that the investment rate (INV/Y) and credit ratio (CRDT/Y) are I(1) variables for all four countries being studied here while the real interest rates on deposits was found to be stationary or I(0) for all four countries. Thus, a direct test of causality between investment rate and interest rate is not possible as existing causality tests are applicable only when both variables between which the direction of causality is being considered, are integrated of same order. Thus, we carried out a causality test between investment rate and credit/GDP ratio using the well-known vector ECM procedure (Engle and Granger, 1987) since both variables are I(1) variables for all four countries studied here. The variables co-integrated for each of the four countries.

The results of the causality tests are briefly summarized in Table 1. It is seen that the increased credit causes increased investment rate in three of the countries (through the dis-equilibrium term in the case of Indonesia and through the short run dynamics in the case of Malaysia and South Korea), while in the case of Thailand the results were inconclusive either way.

TABLE 1
Test of Causality between Investment Rate (INV/Y) and Credit Ratio (CRDT/Y) Using VECM Approach

	H_0: Credit Ratio Does Not Cause Investment Rate		*H_0: Credit Ratio Does Not Cause Investment Rate*	
Country	*$\beta_i = 0$: F-stat (p-value)*	*$\Theta = 0$: t-stat (p-value)*	*$\gamma_i = 0$: F-stat (p-value)*	*$\Phi = 0$: t-stat (p-value)*
Indonesia	–1.165 (.256)	2.889**(.008)	–.036 (.972)	–.414 (.682)
Thailand	–1.181 (.246)	–0.575 (.569)	–.947 (.351)	1.311 (.199)
Malaysia	–.299**(.028)	–.412 (.683)	.934 (.357)	.727 (.472)
Korea	–1.734*(.092)	–1.220 (.231)	.586 (.562)	–.130 (.898)

Note: See equations (10) and (11) in Section 2.3.

As a further check, we also tested the direction of causality between interest rates and changes in the credit ratio ΔCRDT/Y. We considered the changes in credit ratio, rather than credit ratio in levels as this variable is I(0), the same as the real interest rate variable. In this case the VAR procedure is applicable (see Section 2.3). Upto 3 lags were considered and using the Schwartz Baysian criterion, the lag length of 1 was found to be optimal for all four countries. The results for this case are shown in Table 2. It is seen that the null of non-causality of credit ratio changes by interest rates is rejected for all countries while the opposite null of non-causality of interest rates by credit ratio changes is not rejected for any of the countries. These results show that in the East Asian countries being studied here, increases in real interest rates on deposits did indeed cause increased credit to become available.

TABLE 2
Test of Granger Causality between Changes in Credit Ratio (ΔCRDT/Y) and the Interest Rate Using Vector Auto Regression (VAR)

		H_o: Interest Rate Doesn't Cause ΔCRDT/Y	*H_o: ΔCRDT/Y Doesn't Cause Interest Rate*
Country	*No. of Lags*	*$\Sigma b_i = 0$: F-Stat (p-Value)*	*$\Sigma c_i = 0$: F-Stat (p-Value)*
South Korea	1	5.046** (.032)	0.185 (.670)
Malaysia	1	8.490** (.006)	0.049 (.826)
Thailand	1	3.136* (.090)	0.305 (.586)
Indonesia	1	6.795** (.016)	2.151 (.156)

Note: See equations (6), (7), (8) and (9) in Section 2.3.

Thus, together tables 1 and 2 imply that (=> stands for "causes"):

Increase in Real Deposit Rate, R_d => Increased Credit Availability
=> Increased Investment.

This is precisely as argued by the proponents of financial liberalization (e.g., see Shaw, 1973). However, we still need to evaluate the impact of different levels of interest rates on the investment rates and check whether this association turns negative beyond a certain level of interest rates. This is done in the next two sub-sections.

3.2 Inter-sectoral Flows of Funds: McKinnon-Shaw versus the Neo-structuralists

As discussed in Section 2.2, the McKinnon-Shaw and neo-structuralist hypotheses can be tested empirically by estimating the investment relation (4):

$$\text{INV/Y} = b_0 + b_1\, G + b_2\, R_d + b_3\, \text{FCIpvt/Y} + b_4\, \text{TOT} + b_5\, \text{RER} + b_6 \text{COC} + b_7 \text{GW} \qquad (4)$$

A positive co-efficient of R_d will support the McKinnon-Shaw hypothesis while a negative co-efficient would support the neo-structuralist hypothesis.

When estimating (4), the cost of capital (COC) was found to be insignificant for all the four countries and thus dropped from estimations. For the growth of real wages (GW) variable, the data on wages or worker earnings was available only for South Korea (for other countries, the data was available for only a few years, so that an econometric analysis was not feasible). For South Korea, the variable was found to be insignificant. Thus GW was also dropped from estimations.[12] The remaining variables were found to be significant for at least some of the countries. Thus, our estimations suggest that investment of most firms in the East Asian countries were primarily constrained by credit and/or foreign exchange availability. The results of estimation for Korea, Malaysia, Thailand and Indonesia using both the ECM and DOLS procedures are shown in Table 3. It is seen that the ECM test for co-integration rejects the null of non-cointegration at 5 per cent significance level[13] for all countries (except Malaysia, for which the null of non-cointegration can be rejected with a probability of about 50 per cent only). The ECM estimations satisfy various diagnostic tests of the Hendry approach including Ramsey's Reset test of functional form specification, normality of residuals and chow test of parameter constancy.

It is seen that the long run impact of the real interest rate on bank deposits, R_d, on the investment rate is positive and significant at 5 per cent level for **all** four countries using the DOLS procedure while using the ECM procedure, it is positive for all four countries being significant at the 5 per cent level for Thailand and Indonesia, at about 7 per cent level for Malaysia, and statistically not significant for South Korea. The magnitude of co-efficient of R_d is also quite large in the case of Thailand and Malaysia, where an increase in interest rates by 1 per cent will increase the investment rate by 0.01 to 0.033, i.e., increase the investment by 1 to 3.3 per cent of GDP (recall that INV/Y is a fraction while R_d is measured in per cent). The coefficients are smaller for Korea and Indonesia.

This evidence supports the McKinnon-Shaw hypothesis while rejecting the neo-structuralist hypothesis. Thus, at least part of the additional funds coming to the formal financial sector following an increase in interest rates are likely to come from non-financial assets (McKinnon, 1973) or foreign assets (Agrawal, 2001). It also supports the arguments of Bencivenga & Smith (1992) and Kapur (1992).

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[12] As discussed earlier in section 2.1, for S. Korea, we also considered using the growth rate of cost of capital divided by the real wage rate G(COC/W), but it was also found to be insignificant.

[13] We have a mixture of I(1) and I(0) variables. Banerjee et al. (1998) only analysed the case of all I(1) variables. However, in a private communication with this author, Banerjee suggests that estimating mixed equations is fine and that addition of exogeneous I(0) regressors might have the same effect on the critical values as the addition of deterministic components. We have taken appropriate critical values for the ECM cointegration test from Ericsson and MacKinnon (2002) who provide them for any number of I(1) and deterministic variables.

TABLE 3
The Relation between Investment Rate and Interest Rates: Test of McKinnon-Shaw versus Neo-structuralist Hypothesis

	Korea		*Malaysia*		*Thailand*		*Indonesia*	
Variable	*ECM*	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*	*ECM*	*DOLS*
Constant	0.564	0.542	–1.056	–0.685	–0.197	0.090	0.251	0.216
	(25.75)**	(22.88)**	(–2.07)*	(–4.99)**	(–5.85)**	(8.20)**	(12.49)**	(17.91)**
G(Growth)	1.813	0.00815	13.555	6.093	5.787	1.549	–0.152	0.307
	(3.93)**	(0.07)	(2.27)*	(5.99)**	(11.57)**	(9.87)**	(–0.54)	(1.92)
R_d	0.00025	0.00037	0.0328	0.01810	0.0117	0.00727	0.0010	0.00173
	(0.33)	(5.02)**	(1.89)	(4.22)**	(13.88)**	(13.19)**	(2.13)*	(4.82)**
FCIpvt/Y	–	–	–	–	1.042	1,551	0.354	–
					(9.36)**	(11.55)**	(1.42)	
RER	–0.00053	–0.00031	–	–	–	–	–	–
	(–10.03)**	(–11.48)**						
TOT	–	–	0.0031	0.00458	–	–	–	–
			(1.81)	(6.34)**				
R^2	0.936	0.89	0.645	0.78	0.959	0.99	0.689	0.74
SE of Reg.	0.0068	0.0181	0.0163	0.0407	0.0062	0.0071	0.01049	0.0130
Durbin-Watson Stats.	2.371	1.120	1.522	0.541	2.559	2.169	2.127	1.237
ECM Test of Cointegration	–5.281**	–	–2.251	–	–7.841**	–	–5.263*	–
Sample (Annual)	1969–1996	1967–1994	1962–1994	1963–1993	1973–1995	1973–1994	1971–1995	1973–1993

Notes: 1. R_d denotes real interest rate on bank deposits, FCIpvt/Y denotes ratio of net foreign capital inflows to GDP, RER denotes real exchange rate (see eq. 6) and TOT denotes an index of term of trade.

2. DOLS refers to estimation by the dynamic OLS procedure and ECM refers to estimation by error correction mechanism procedure. The long-term coefficients for explanatory variables in the ECM procedure are obtained from solving full ECM estimations using eq. (B5). The t-statistics for these are provided by the Microfit program using a non-linear procedure.

3. t-statistics of coefficients are given in parentheses.

4. ** Denotes significant 1 per cent level and * denotes significance at 5 per cent level. Critical Values are 2.57 and 1.96 respectively for the t-statistics and 4.71 and 3.97 respectively for the ECM test (values for the case of 2 I(1) variables and 2 deterministic or I(0) variables from Ericsson and MacKinnon, 2002).

3.3 'Mild Financial Repression' or 'Restrained Financial Liberalization': Stiglitz versus McKinnon

As discussed in Section 2.2, we can evaluate the Stiglitz argument that real interest rates beyond a certain level, $\underline{R}$, may be deleterious to the investment process by estimating the following long run relation:[14]

$$\text{INV/Y} = b_0 + b_1\, G + b_2\, R_d + b_2'\, R_d\, D(\underline{R}) + b_3\, \text{FCIpvt/Y} + b_4\, \text{TOT} + b_5\, \text{RER} \qquad (5)$$

If Stiglitz's argument were correct, we would expect b_2 to be positive and b_2' as well as $b_2 + b_2'$ to be negative for some $\underline{R}$ close to about zero per cent.

We estimated relation (5) for various values of $\underline{R}$ between 0 and 12 per cent (still higher values of $\underline{R}$, had too few observations left for most countries), *at intervals of 1 per cent*. In view of the fact that the coefficient of R_d (and most other variables) in Table 3 are not very different using the ECM and DOLS procedures, any feedback effects seem to be minor. In view of this and the fact that several regressions needed to be carried out for each country, we carried out these estimations using only the ECM procedure (which, unlike the DOLS procedure, also provides a simultaneous test of co-integration). The same full equation structure (including the dynamic terms) was used as in the regressions of Table 3 because we found that it usually remained optimal even when the $R_dD(\underline{R})$ term was included. Further, the estimations continued to satisfy the various diagnostic tests, including Ramsey's Reset test of functional form specification, normality of residuals and Chow test of parameter constancy. In fact, most diagnostic tests showed improvement, when the $R_dD(\underline{R})$ term was included, with best results often appearing for $\underline{R}$ = 6 per cent if the ECM test of co-integration is taken as a indication of the goodness of fit (see Table 4). Similarly, if maximum of the adjusted R^2 or the minimum of the standard error of regression is taken as an indication of the goodness of fit, the optimum value of $\underline{R}$ is again seen to be 6 per cent (except in the case of Korea where it is seen to be 9 per cent by a small margin). This suggests that (5) is a better specification of the investment relation than (4), with about 6 per cent as the best fit for $\underline{R}$.

In Table 4 we report the results of estimation of equation (5) for Korea, Malaysia, Thailand and Indonesia using the ECM procedure for some representative values of $\underline{R}$, namely $\underline{R}$ = 3, 6 and 9 per cent (results varied essentially continuously as $\underline{R}$ was increased from 0 to 12 in steps of 1 per cent). It is seen that the ECM test for co-integration rejects the null of non-cointegration at the 5 per cent confidence level for all values of $\underline{R}$ and for all countries (except Malaysia, in whose case, the null hypotheses can only be rejected at about 50 per cent confidence level).

It is also seen from Table 4 that the coefficient b_2' on the $R_dD(\underline{R})$ terms are negative for all values of $\underline{R}$ for all countries except Malaysia, in which case they are positive but statistically insignificant. However, for the Stiglitz argument to hold strictly, we require the sum

[14] As discussed in the previous sub-section, the variables COC and GW were found to be insignificant and thus dropped from the estimated equation.

TABLE 4

Relation between Investment Rate and Interest Rates on Bank Deposits: Test of Stiglitz versus McKinnon Hypothesis

	Korea			*Malaysia*			*Thailand*			*Indonesia*		
Variables	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
Constant	0.561 (24.341)**	0.542 (24.945)**	0.527 (17.67**)	–1.135 (–2.177)*	–1.155 (–2.119)*	–1.097 (2.36)*	–0.209 (–5.619)**	–0.237 (–6.500)**	–0.196 (4.90)**	0.209 (16.737)**	0.238 (16.688)**	0.253 (16.01)**
G (GDP Growth)	1.887 (3.716)**	1.701 (4.161)**	2.287 (3.68)**	14.340 (2.371)*	14.925 (2.294)*	13.889 (2.58)**	5.999 (10.566)**	6.401 (11.635)**	5.761 (9.62)**	–0.0472 (–0.219)	–0.0186 (–0.0862)	–0.0336 (–0.14)
R_d	0.000608 (0.644)	0.000913 (1.254)	0.000776 (0.94)	0.0261 (2.371)*	0.0288 (1.813)	0.0314 (2.12)*	0.0125 (9.767)**	0.0137 (10.520)**	0.0116 (10.41)**	0.00200 (3.845)**	0.00201 (3.895)**	0.00192 (3.419)**
$R_d.D(3)$	–0.00113 (–0.655)	–	–	0.0155 (1.119)	–	–	–0.00077 (–0.949)	–	–	–0.00286 (–3.041)**	–	–
$R_d.D(6)$	–	–0.00348 (–1.903)	–	–	0.0143 (1.241)	–	–	–0.0015 (–1.961)*	–	–	–0.00269 (–3.136)**	–
$R_d.D(9)$	–	–	–0.00483 (–1.7)	–	–	0.0107 (1.14)	–	–	–0.000053 (–0.095)	–	–	–0.00263 (–2.78)**
FCIpvt/Y	–	–	–	–	–	–	0.979 (7.299)**	0.927 (7.986)**	1.048 (7.78)**	0.412 (2.170)*	0.342 (1.285)	0.354 (1.71)
RER	–0.000527 (–10.381)**	–0.000484 (–9.353)**	–0.000527 (9.41)**	–	–	–	–	–	–	–	–	–
TOT	–	–	–	0.00298 (1.820)	0.00287 (1.709)	0.00312 (2.06)*	–	–	–	–	–	–
Adj R^2	0.880	0.903	0.906	0.554	0.566	0.550	0.888	0.921	0.872	0.718	0.730	0.720
SE of Reg.	0.00693	0.00621	0.00610	0.0162	0.0159	0.0162	0.00621	0.00521	0.00662	0.00864	0.00845	0.00860
Durbin-Watson Stats.	2.312	2.767	2.969	1.656	1.755	1.514	2.761	2.579	2.548	2.082	2.099	2.408
ECM Test of Cointegration	–4.900*	–5.821**	–4.555*	–2.350	–2.286	–2.475	–7.475**	–8.937**	–7.309**	–6.862**	–6.929**	–6.357**
Year	1966–1995	1966–1995	1966–1995	1962–1994	1962–1994	1962–1994	1973–1995	1973–1995	1973–1995	1971–1995	1971–1995	1971–1995

Notes: 1. R_d denotes real interest rate on bank deposits, FCIpvt/Y denotes ratio of net foreign capital inflows to GDP, RER denotes real exchange rate (see eq. 6) and TOT denotes an index of term of trade, $D(\underline{R})$ for $\underline{R} = 3, 6, 9$ is a dummy variable with a value of 0 for $R_d < \underline{R}$ and 1 for $R_d \geq \underline{R}$.

2. DOLS refers to estimation by the dynamic OLS procedure and ECM refers to estimation by error correction mechanism procedure. The long-term coefficients for explanatory variables in the ECM procedure are obtained from solving full ECM estimations using eq. (B5).
3. t-statistics of coefficients are given in parentheses.
4. ** Denotes significant 1 per cent level and * denotes significance at 5 per cent level. Critical Values are 2.57 and 1.96 respectively for the t-statistics and 5.04 and 4.30 respectively for the ECM test (critical values for the case of 2 I(1) and 3 deterministic or I(0) variables from Ericsson and MacKinnon, 2002).

of coefficients, $b_2 + b_2'$ (see Section 2.2), to be negative for an $\underline{R}$ close to zero. The results on this count are as follows. In the case of Thailand and Malaysia, $b_2 + b_2'$ is positive for all three values of $\underline{R}$ (although b_2' is negative for Thailand). In the case of Korea, $b_2 + b_2'$, is seen to be negative for Korea for $\underline{R}$ = 3, 6 and 9 per cent, although the coefficient b_2' (and $b_2 + b_2'$) is significantly different from zero only for the case $\underline{R}$ = 6 and 9 per cent. In the case of Indonesia, $b_2 + b_2'$ is small but negative for all three values of $\underline{R}$.

Thus Indonesia and Korea provide results consistent with the Stiglitz hypothesis. However, the coefficients b_2' (and $b_2 + b_2'$) for these countries are found to be negative for all values of $\underline{R}$. Just as the positive co-efficients of R_d in Table 3 were driven by the episodes of negative real interest rates, it is possible that the negative coefficients b_2' (and $b_2 + b_2'$) for Korea and Indonesia are primarily driven by the episodes of real interest rates in excess of some fairly high value, say R^*. But since those points are included with $R_dD(\underline{R})$ term for all values of $\underline{R}$ below R^*, its coefficient turns out to be negative (this suggests that R^* may well be at 9 per cent or above). To examine this possibility, we estimated the following long run relation for Indonesia and Korea:

$$\text{INV/Y} = b_0 + b_1 G + b_2 R_d + b_2' R_d D(R^*) + b_2'' R_d D(0 < R_d < R^*) + b_3 \text{FCIpvt/Y} + b_4 \text{TOT} + b_5 \text{RER} \quad (5a)$$

where $D(0 < R_d < R^*)$ is a dummy variable which takes the value 1 in the range $0 < R_d < R^*$ and zero outside this range and $D(R^*)$ takes value 1 for $R_d > R^*$ and zero otherwise. Thus the coefficient of R_d is b_2 for $R_d < 0$, $b_2 + b_2''$ for R_d between 0 and R^* and $b_2 + b_2'$ for $R_d > R^*$. We estimated relation (5a) for all values of R^* between 0 and 12 at intervals of 1 per cent — the primary interest being in the highest value of R^* for which $b_2 + b_2'$ is negative but $b_2 + b_2''$ is non-negative. This value was found as high as 9 per cent for Indonesia and 12 per cent for Korea. The estimated long run relations for these two cases are presented below (the full equation structure is same as in estimations of Tables 3 and 4):

Indonesia:

$$INV/Y = .253 - .0068\ G + .0021 R_d - .0031\ R_dD(9) - .0019\ R_dD(0 < R_d < 9) + .364\ FCIpvt/Y$$
$$(15.78)\quad (.030)\quad (3.58)\quad (2.83)\quad (.85)\quad (1.83)$$

ECM test of cointegration = –6.09, R^2 = .81, SE = .00869, DW = 2.24, LM1–F(1, 15)= .263.*

Korea:

$$INV/Y = .543 + 2.11G + .00031 R_d - .0034\ R_dD(R^* = 12) + .0001\ R_dD(0 < R_d < 12) - .00034\ RER$$
$$(21.98)\quad (3.98)\quad (.28)\quad (1.40)\quad (.042)\quad (9.99)$$

ECM test of cointegration = –5.06, R^2 =.95, SE = .00646, DW = 2.53, LM1–F(1, 12)=1.73*

It is seen that the coefficient b_2'' of the term $R_dD(0 < R_d < R^*)$ is negative but small and insignificant (so that $b_2 + b_2''$ remains positive) while the coefficient b_2' of the term $R_dD(R^* = 9)$

or $R_dD(R^* = 12)$ is negative and larger and statistically more significant (so that $b_2 + b_2'$ is negative). These results show that in the case of Indonesia, interest rates up to 9 per cent in real terms have a positive association with the investment rate (since b_2 as well as $b_2 + b_2''$ remains positive), which turns negative beyond interest rates of 9 per cent in real terms (since $b_2 + b_2'$ becomes negative). In the case of Korea, the association between the real interest rate and investment rate is insignificant for real interest rate up to 12 per cent and turns negative thereafter.

To summarize, the evidence from Korea and Indonesia suggests that the association between real interest rates and the investment rate remains positive for real interest rates (on intermediate-term bank deposits) up to about 9 per cent but turns negative shortly thereafter.[15] Recall that the estimations for Thailand and Malaysia suggested that the positive association between higher real interest rates and the investment rate continues even for positive real interest rates in excess of 9 per cent. Thus while two of the four countries investigated here do provide some evidence in support of the Stiglitz hypothesis, the real interest rates at which the association between real interest rate and investment rate turns negative is found to be around 9 per cent or above, rather than about zero per cent conjectured by Stiglitz (1994, p. 41).

The second part of Stiglitz's argument against high real interest rates is that such rates can lead to excessively risky loan portfolios for banks and thereby to banking crises. In the absence of time series data on the risk exposure of the banks' asset portfolios, econometric analysis of this issue was not feasible for us. However, there does exist some data on banking crises (primarily due to excessive accumulation of non-performing assets) in the countries under consideration. This is summarized below:

In Thailand (1983–87), 50 finance companies failed beginning in 1983, necessitating a government bail out at an estimated cost of US$190 million (0.48 per cent of GNP). Five commercial banks accounting for 24 per cent of commercial bank deposits were in financial difficulties due to huge accumulation of non-performing assets (World Bank, 1993, p. 250).

In Malaysia (1985–88), failure of one deposit taking co-operative caused runs on 32 (out of 35) others. In addition, 4 (of 38) banks and 4 (of 47) finance companies were in financial distress. Non-performing assets were estimated at 30 per cent of total bank loans (Williamson and Mahar, 1998; World Bank, 1993, p. 249).

In Indonesia financial system faced serious problems of non-performing loans due to exceedingly high real interest rates in 1983–85 following financial liberalization in 1983

[15] As we had few data points beyond 12 per cent, we cannot rule out the possibility of multiple equilibriums, i.e., that the sign of the relation between investment rate and interest rate may change again beyond this level. However, since few countries have managed high growth economies in the medium to long run with interest rate in excess of 9 per cent and the real controversy is whether real interest rate should be around zero (Stiglitz) or around 5–9 per cent (McKinnon, 1993), such possibilities do not have much practical relevance.

(Cho and Khatkhate, 1989, pp. 61–62). These problems became more severe over 1990–96. Bank Duta failed in September 1990, followed by PT Bank Summa in 1992. PT Bapindo in 1993. Two private banks failed and had to be taken over in 1995. Non-performing assets (primarily from state-owned banks) were 25 per cent of total loans in 1993, declining to about 12 per cent of total loans by late 1995 (Williamson and Mahar, 1998; Nasution, 1998, p. 273).

Finally, in Korea also, following financial reforms in 1981, the banking system suffered from the problem of non-performing assets, which accounted for 10.5 per cent of the total loans in mid 1980s (Williamson and Mahar, 1998). However, there were no banking failures. The cause of these non-performing assets is generally believed to be rooted in the directed credit program over the 1970s and the increase in real interest rates over the 1980s. The problem was eased by the central bank's assistance (Cho and Khatkhate, 1989, p. 60; Gokarn, 1995).

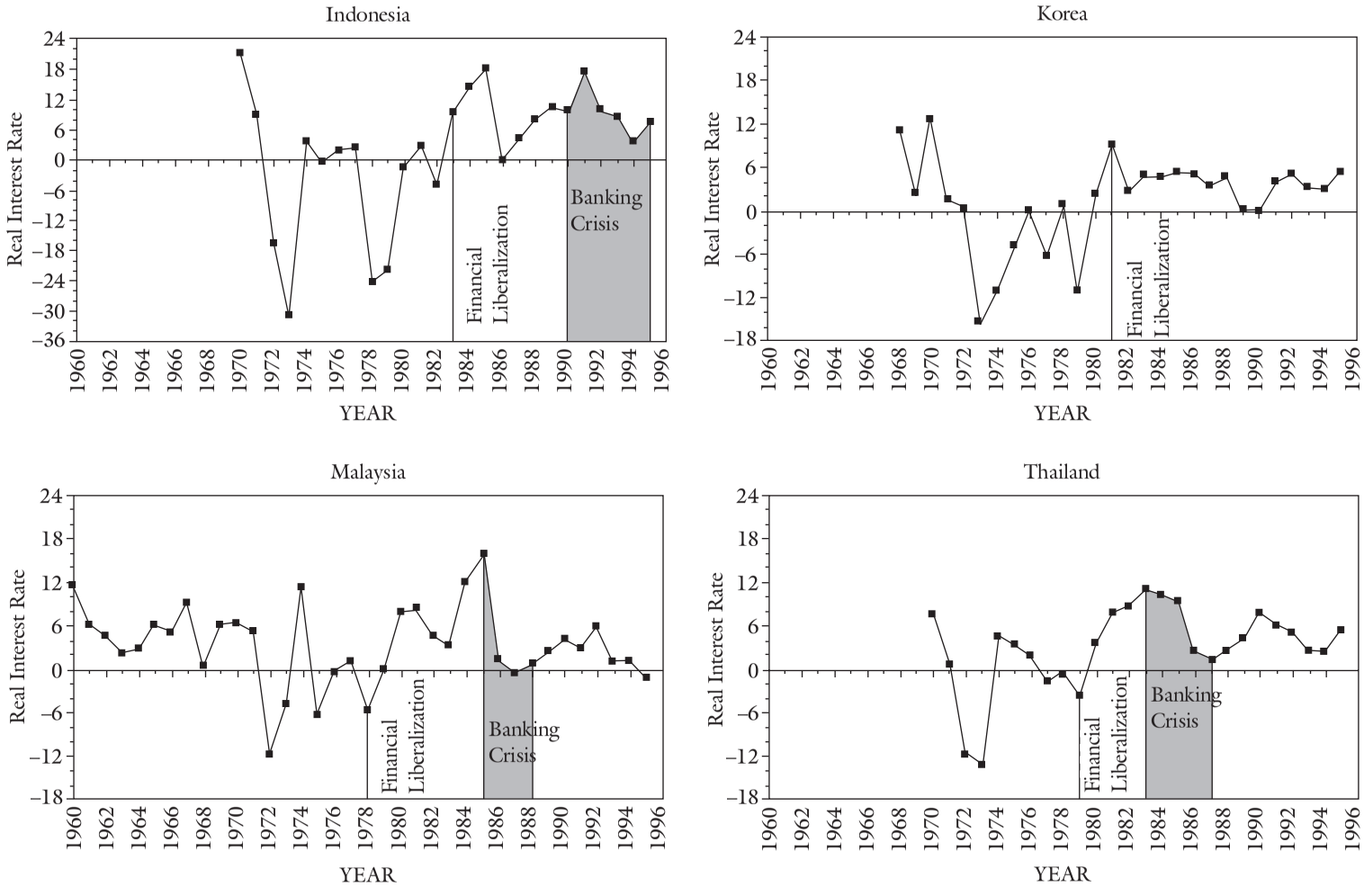
Figure 1 shows the plot of real interest rates for the four East Asian countries, along with the years of financial liberalization and banking crisis, with serious accumulation of non-performing assets or bank failures. It is seen that in Indonesia, Malaysia and Thailand, banking failures have occurred following an episode of high real interest rates that exceeded 9 per cent for more than a year or two.[16] Similar evidence is also available from other countries as well.[17] Further, high real interest rates can also generate the potential for financial crisis by attracting large inflows of foreign capital which undermine disinflationary strategies and which do not necessarily go into productive uses (see for example, Agrawal, 2000). This is not to claim that there exists a magic line at real interest rate of 9 per cent, crossing which results in a banking crisis (indeed, the critical interest rate could vary to some extent from country to country). Nevertheless, the existing evidence suggests that the probability of accumulating non-performing loans increases with increasing real interest rates and probably begins to assume serious proportions for real interest rates exceeding about 9 per cent (at least for the countries studied here). In fact, it seems plausible that problems begin in a less severe form at lower real interest rates, perhaps even at about 6 or 7 per cent, as the Korean case suggests.

Thus, while higher real interest rates up to 9 per cent are associated with higher investment rates for all countries considered here, the upper limit is uncomfortably close to the rates at which serious banking crisis can get triggered. Thus, about 6 per cent might be the optimal real interest rate on intermediate-term bank deposits. Recall that previously in Table 4, the diagnostic tests also suggested best fit for $R = 6$ per cent. These results suggest that interest rates above 6 per cent may require careful watching by the central bank to avoid excessive accumulation of non-performing assets by banks. It may be worth noting that even 6 per cent

[16] The longer the interest rates last above 9 per cent, the more likely and severe would be the financial crisis. Also, see Stiglitz and Weiss (1981) for a detailed analysis of how high interest rates can lead to large accumulations of non-performing assets.

[17] Agrawal (2000) also provides evidence on 11 countries that experienced banking crises. In each of these cases, the banking crises were preceded by high real interest rates in excess of 8 per cent.

FIGURE 1
Real Interest Rate and the Incidence of Banking Crisis in Indonesia, Korea, Malaysia and Thailand



is a reasonably high level of real interest rate. For comparison, the free market real interest rates averaged about 3 per cent in the USA over the last 100 years and similar levels have prevailed in most other developed countries. And even in developing countries (including East Asian countries) the free market interest rates exceeding 6 or 7 per cent in real terms have rarely been sustained for more than a few years without resulting in a banking crisis.[18] Thus, higher real interest rates are unlikely to represent stable long run equilibrium.

Overall, this evidence does not support the unbridled financial liberalization that was suggested by McKinnon (1973) and Shaw (1973). It provides some support for Stiglitz's hypothesis that high positive real interest rates may not enhance investment (and growth), but may significantly increase the risk of banking crises through a build-up of non-performing assets. However, the real interest rate level above which these effects take place is considerably higher than Stiglitz's conjecture of close to zero per cent. The optimum financial markets policy seems to be 'restrained financial liberalization' with a moderate upper limit on the real interest rates. Real interest rates above about 7 per cent may demand careful supervision from the central banks and rates above 9 per cent are probably best avoided.

4. Concluding Remarks

In this paper we have undertaken an empirical evaluation of the impact that interest rates (on intermediate term bank deposits) have on investment rates, which is then used to evaluate the arguments underlying various financial liberalization hypotheses.

Using causality tests, we found that the higher interest rates caused greater availability of bank credit, which in turn, caused higher investment rate in the four East Asian countries studied here. Further, the cost of capital was found to have an insignificant effect on investment rates. This suggests that the availability of bank finance, rather than its cost was important in increasing the investment rate in the East Asian countries.

Next, we tested the overall impact on the investment rate of raising real interest rates on bank deposits. We found that for all four countries studied here, higher real interest rates up to 9 per cent were associated with higher investment ratios. However, as interest rates increased above 9 per cent, this positive association vanished in two of the four countries. Furthermore, each of the three countries where interest rates exceeded 9 per cent for more than two years, experienced serious problems of accumulation of non-performing loans by banks leading to a banking crisis. However, the real interest rates above which banking crises can be triggered could vary somewhat across countries and a large, though non-critical, build-up of non-performing assets could occur at real interest rates somewhat lower than 9 per cent.

[18] In fact, we are not aware of any country that has successfully managed a high growth economy in the medium to long run with real interest rates significantly above 6 or 7 per cent.

Therefore, we feel that optimum real interest rates might be about 6 or 7 per cent and that higher interest rates may demand careful supervision from the central banks. Furthermore, interest rates above 9 per cent are probably best avoided.

Thus, our empirical findings reject the neo-structuralist argument that higher interest rates on bank deposits would lower investment at all interest rates. Nor do they support unbridled financial liberalization. At the same time, they provide only limited support to Stiglitz's arguments for mild financial repression. While interest rates beyond a certain level may not increase investment and probably contribute to banking crises, the level at which it happens is found to be around 9 per cent—considerably higher than about zero per cent conjectured by Stiglitz. Thus, reducing real interest rates from say, 6 per cent to 3 or 0 per cent would not be advisable and would have actually reduced the investment and growth rates in the East Asian countries. Thus, Stiglitz's argument that lowering interest rates may boost investment by transferring income from savers to investors is not supported for real deposit rates below 6 or 7 per cent and is also in-egalitarian since investors (corporations, firms) are often much wealthier than the savers (mostly individuals). The optimum financial markets policy suggested by our analysis seems to be closest to the recent position of McKinnon (1993), i.e., 'restrained financial liberalization' or liberalization with a moderate upper limit (about 6 or 7 per cent) on the real interest rates beyond which the central bank must watch banks carefully. As long as interest rates do not exceed this level, they should be allowed to be determined by the markets as attempts to lower them further is likely to lower investment, growth and equity in the economy.

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Appendix A

A.1 Data Sources

The data on net inflows of foreign direct investment, foreign portfolio investment, private debt inflows and the exchange rates are taken from IMF, International Financial Statistics (CD version, 1998). Data on gross domestic fixed investment and gross domestic product (GDP) in current and constant prices are taken from World Development Indicators (CD version, 1998). Data on terms of trade are taken from World Tables (CD version 1995) and World Development Indicators (CD version 1998; ratio of index of export prices to index of import prices). Data on interest rates on bank deposits (one year fixed deposits) for most

countries are taken from SEACEN Research and Training Centre, Malaysia, SEACEN Financial Statistics, 1991 and 1993. In the case of Korea, these are supplemented by data from Yearbooks of Statistics, for various years and for Malaysia from Money and Banking in Malaysia, 35th edition, published by Bank Negara, Malaysia.

A.2 Results of the Unit Root Tests

TABLE A1
Results of the Augmented Dickey Fuller (ADF) Tests for Unit Roots in Various Variables of Interest

	Korea			*Malaysia*			*Thailand*			*Indonesia*		
Variables	*Level*	*First Diff.*	*0 – I*[3]	*Level*	*First Diff.*	*0 – I*[3]	*Level*	*First Diff.*	*0 – I*[3]	*Level*	*First Diff.*	*0 – I*[3]
INV/Y	–0.94	–4.73*	I (1)[3]	–1.18	–3.32*	I (1)	–0.68	–4.16*	I (1)	–0.96	–5.54*	I (1)
G	–5.83*	–	I (0)[3]	–4.52*	–	I (0)	–3.73*	–	I (0)	–4.38*	–	I (0)
CRDT/Y	–1.11	–4.23*	I (1)	0.99	–4.79*	I (1)	0.73	–3.63*	I (1)	0.73	–4.27*	I (1)
FCIpvt/Y	–3.85*	–7.75*	I (0)	–3.09*	–3.84*	I (0)	–1.56	–4.57*	I (1)	–2.49	–6.57*	I (1)
RER	–1.58	–3.72*	I (1)	–1.13	–4.29*	I (1)	–2.14	–3.93*	I (1)	–1.72	–3.12*	I (1)
TOT	–2.82	–3.89*	I (1)	–2.14	5.37*	I (1)	–0.60	–5.92*	I (1)	–1.38	–4.46*	I (1)
R_d	–3.11*	–7.77*	I (0)	–4.53*	–7.48*	I (0)	–4.65*	–6.75*	I (0)	–3.86*	–6.13*	I (0)

Notes: 1. G denotes GDP growth rate, CRDT/Y the ratio of total domestic credit to GDP, FCIpvt/Y the ratio of net foreign private capital inflows to GDP, RER the real exchange rate, TOT the term of trade and R_d denotes real interest rate on bank deposits.

2. * denotes that the null hypotheses that the variable concerned is non-stationary can be rejected at 5 per cent significance level. Asymptotic cut off values for 5 per cent significance level are –2.86 when the trend term is not included and –3.41 when the trend term is included (see Davidson and Mackinnon, 1993, p. 708).

3. O – I denotes the "Order of Integration" of the variable, on the basis of the ADF tests.

Chapter 4

Macroeconomic Fundamentals and Exchange Rate Dynamics in India: Some Survey Results

N.R. BHANUMURTHY

Introduction

After the collapse of the Bretton Woods system in 1973 the exchange rates have shown much volatility. Since then a lot of research has been undertaken to understand the behaviour of exchange rate movements. Some of the perennial questions that were raised are for example: what are the determinants of exchange rate? do exchange rates follow a specific pattern? is there any theory that help in predicting the rate movements near-accurately? Many approaches developed in the area of open economy macroeconomics have tried to address these questions. However, these approaches have had some success in explaining currency movements only in the medium and the long-term. But these macro fundamental theories however, could offer no explanation for the short run exchange rate movements in the market (Evans & Lyons, 1999). Particularly after the finding of Meese & Rogoff (1983) that forecasts based on the monetary approach to exchange rate determination could not out-perform the random walk forecasts; the macro models lost their allure subsequently. In fact even after two decades of this finding, there is no unanimity that theories based on fundamentals can provide best forecasts for the exchange rate movement (see Mark, 1995; Mark & Sul, 2001; Cheung, Chinn & Pascual, 2002; and Chinn & Meese, 1995). A recent study by Neely & Sarno (2002) raises an important query: why should fundamentals forecast exchange rate movement? There is a need to address this basic issue so as to strengthen the research in exchange rate economics and also to chart the future direction for this. As exchange rate forecast is a necessary datum for policy makers to determine the output and inflation in the economy as also for fund managers to

plan their asset allocation, Neely & Sarno (2002) argue that instead of forecasting exchange rates through fundamentals, the agents can directly predict output, inflation and uncovered interest rate parity (UIP).

The above two views only question the relevance of existing macro approaches in the exchange rates economics. But both the views ignore the role of the time horizon in judging the efficacy of macro theories. As exchange rate is an output derived out of market behaviour, merely concluding that the exchange rate follows a random walk would mean that the market forces behind this rate are erratic irrespective of the time horizon. This is a conclusion to be contested and it needs to deliver answers both at theoretical and the empirical level. On the other hand, an over dependence in macro theories to explain and forecast exchange rates fairly accurately at all time horizons is also not completely acceptable. From the literature, one may find that there are some mixed results regarding the macro fundamental theories' ability to explain exchange rate behaviour in the long-run. But in the short-run, recent studies, particularly after the introduction of on-line trading systems that make the tick-by-tick (high frequency) data available, have shown that macroeconomic fundamentals are hardly useful in predicting the rate movement (see Sarno & Taylor, 2001, for the survey). Hence, there is a need to search for some factors that can explain the exchange rate movement based on the time horizon. In this study we try to investigate the factors that determine the exchange rate in different time horizons with the help of primary information collected from the Indian foreign exchange dealers. (The present author also examined this issue with the help of secondary data, which is available in Bhanumurthy (2004).)

This study is organised as follows. In Section II, we discuss briefly one of the alternative theories on asset price determination in the finance literature (namely market microstructure theory). Section III contains a review of the empirical literature. In Section IV are laid down the specific objectives and database used in this study. Sections V discuss the empirical findings based primary data. Accordingly the conclusions are drawn in the last section. (All the graphs and table have been provided in the Appendix.)

Section II

The present study questions the relevance of macro theories in explaining and predicting day-to-day movements in the foreign exchange market. It is implicitly acknowledged that fads and/or speculation are the most important aspects of intra day/day-to-day transactions in the foreign exchange markets rather than fundamentals. This is because the speculative agents' role may be an important factor on influencing the short-term behaviour of the market. Further, it was found that the role of fundamentals is either insignificant or is tending to be so in recent years. The problems of policy inconsistency and the so-called 'good news' and

'bad news' effects seem to be playing a more dynamic role in the exchange market behaviour today. From the current macro approaches it is seen that these consider only fundamentals such as relative income, relative prices, interest rate differentials, relative cumulated current account balances etc. But in practice, do the market participants (dealers) consider only macro economic fundamentals such as these or do any other variables (that are micro in nature) become relevant to these movements? Particularly in the short run, where transactions tend to occur in a very short time span, it may be easily understandable that practitioners do not consider these macro variables at the moment of forming their expectations; "... market participants do not in fact all use a common agreed-upon model for thinking about the foreign exchange market and do not all share the same expectations at any point of time" (Frankel & Froot, 1996). Also the frequency of changes in macro fundamentals is very low.

Now the question that remains is that, in the short run, what are the factors that affect the dealers' decision-making? In the literature it was found that more than macroeconomic fundamentals, the dealers consider other variables that are micro in nature (Lyons, 1995). The micro variables are bid-ask spreads, trading volume, own volatility, nonsynchronous trading, information (both private and public), inventory cost, etc. In the financial economics literature, to study the behaviour of asset prices and the market participants the researchers mostly use the *market microstructure theory,* which considers all the micro variables. In the following sub-section we discuss this theory in brief.

Market Microstructure Theory

Market microstructure theory is defined as "the study of the process and outcomes of exchanging assets (i.e., currency, stock, etc.) under explicit trading rules" (O'Hara, 1995). While much of economics abstracts from the mechanics of trading, the microstructure theory analyses the way in which specific trading mechanisms affect the price formation process in the financial markets. These trading mechanisms may differ from one market to the other. For example, in the stock market, trading is centralised and synchronous but in the foreign exchange market trading is decentralised and nonsynchronous. However, irrespective of the type of trading mechanism, prices emerge for the assets when buyers and sellers interact. But the question is whether the equilibrium price that emerges is based purely on the interaction of only demand and supply factors that emanate from the desires of the trading agents, as our microeconomic theory explains? This enquiry forms the beginning of the study of microstructure theory.

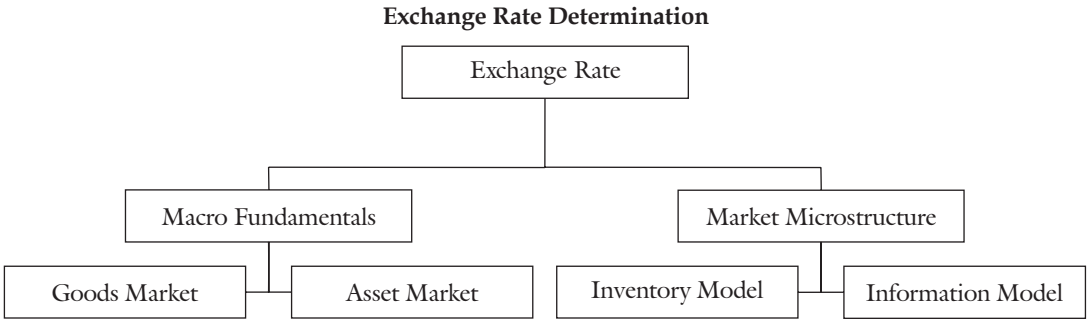
Microstructure theory consists of two models namely the inventory model and the information model. The crux of the inventory model is the problem of optimisation as the dealers' objective is to maximise expected profit per unit of time. The model emphasises control of the inventory fluctuations through price adjustments to avoid bankruptcy and failure at the end of dealing. This model also explains the relationship between the transaction cost and the bid-ask spreads. Information models, which are based on the adverse selection problems,

explain the behaviour of market prices through the information contents of the traders. Since there exist asymmetries of information between the dealers, their behaviour in making the quote will be different. These information models also explain how the equilibrium market price emerges in the presence of asymmetric information.

In microstructure theory there are two variables that occupy the centre stage, neither of which had any role in the macro approach. These variables are: (a) Order flow, (b) Bid-ask spread. Both these variables are synonymous with the 'quantity' and 'price' in traditional microeconomics. Order flow, as used in microstructure theory, is a variant of a key term in microeconomics, namely, "effective demand". It measures the net buyer-initiated orders and seller-initiated orders.

Micro-Macro Divide

The core distinction between the microstructure approach and the macro approach is the role of trades. Under the macro approach, trades play no role, whereas in microstructure models they are the driving force. We frame this distinction by considering structural models within these two approaches with the help of the flowchart that is presented below.



Source: Evans & Lyons (1999).

The exchange rate determination within the macro approach are typically estimated at the monthly frequency, or lower, as the adjustment between the variables would take a time lag of one month or more and also due to the availability of some of the exogenous variables in this approach. The driving variables in this approach include current and past values of home and foreign interest rates, money supply, and other macro determinants like trade balance, fiscal deficits, etc. Exchange rate determination within the microstructure approach is derived from the optimisation problem faced by the actual price setters in the market, namely the dealers. The driving variables in this approach include order flow, a measure of dealer net positions, or inventory, and other micro determinants like information (both public and private).

Section III

Review of Literature

Until recently the application of market microstructure theory was limited to the security markets. Its application to the foreign exchange market has begun only in the early 90s, particularly after the introduction of trading systems like the Reuters and Telerates through which the market participants, mostly banks, can complete their transactions electronically in a short time span. These systems made the transactions very easy and reduced the time and transaction costs in the market. This also made available the high frequency data on exchange rates, which helped the researchers in this area to study the market behaviour in the short run and also in its forecasting in the short-run.

One of the basic studies in this area is that of Goodhart & Figliuoli (1991). In this study, for the first time, high frequency data on exchange rates has been analysed and many issues have been raised for further research. However, the application of microstructure theory to exchange rates was initiated by a pioneering study by Lyons (1995). As mentioned in the preceding section, the models based on microstructure theory (particularly the information models) are very useful in explaining changes in the exchange rate movements. Under information models there are two types of studies that exist in the literature: one that concentrates on the public information, which is uniformly available to all participants in the market and its impact on the exchange rates in the short-run; second, the presence of private (and/or asymmetric) information, which is available to individual participants, and its impact on the volume and the rate changes. Researchers explored both the cases with the help of high frequency data and with advanced econometric tools. But there are not many studies that applied the inventory models and this is due to an unavailability of information relating to the order book of the dealers in the foreign exchange market. For a detailed survey of empirical studies purely on microstructure theory can be found in Sarno & Taylor (2001).

From a review of the studies on microstructures in the foreign exchange market, it may be found that most of them are fairly recent. This indicates that the study of micro issues in exchange rate behaviour is a recent phenomenon. We also find that most of the studies have concentrated on the leading currencies like Deutsche Mark/US dollar, Yen/Dollar and Pound/Dollar. This may be because of high market activism in these currencies and also due to availability of data at high frequency.

Only Evans & Lyons (1999) develop a model by including both micro and macro variables to test their comparative efficiency in tracking the changes in exchange rate. For this purpose, the study considered the daily data of deutsche mark/dollar and yen/dollar exchange rates. Order flow, which is defined as net of buyer initiated trades to seller initiated trades, is taken to represent as micro variable and interest rate is taken as macro variable. It is found that order flow and nominal exchange rates are strongly positively correlated. The study tests a portfolio shift model, where order flow was considered as the main microstructure variable

and interest rate differentials were considered as macro variable, and concludes that order flows are better predicators of the exchange rate changes. The model was robust and also produces better out-of-sample forecasts than a random walk model.

In India, with the introduction of economic reforms, particularly in the financial sector, and growing foreign investments, the volatility in exchange rates has been more intense. Now that there is talk of full convertibility on capital account also, it is very important to understand the exchange rate dynamics. (In the Indian foreign exchange market, the daily transactions amount to more than one billion US dollars.) Further, until recently the transactions were completed only with telephone contacts while the Reuters screen helped to identify the dealing party. But the Reserve Bank of India (RBI) has recently allowed the transactions to be undertaken directly through the Reuters' system. This may lead to more activism in the market and would lead to an increase in both volume and the number of transactions. This situation would force the market players to understand the trends in the market properly. For this purpose, it is necessary to study the behaviour of high frequency data in the Indian foreign exchange market. Bhanumurthy (2000) does try to examine the role of information on the behaviour of INR/USD in the short term. But this kind of analysis would be incomplete if the perceptions of traders, who are the real decision makers in the market, about the importance of macro fundamentals in determining the exchange rates in the short-run are not taken into account. Cheung & Chinn (1999) recognised this issue and undertook a survey on foreign exchange dealers in the United States. This study probes the causes and determinants of bid-ask spreads and the predictability of exchange rates in the short-run. It was found that majority of the traders responded that the predictability of exchange rate changes is very low in the intra-day. And in the medium and long run more than two-thirds of the traders view that exchange rates cannot be predicted. Though this study did not focus on the factors that determine exchange rates over the time horizon, it has marked a beginning in the survey-based studies on the foreign exchange market.

In continuation with the above study, Cheung, Chinn & Marsh (2000) have done a survey on the UK-based foreign exchange dealers in 1998. This study focuses on three aspects: (1) the microeconomic operation of the foreign exchange market; (2) the beliefs of dealers regarding the importance of macroeconomic fundamentals in understanding exchange rate movements; and (3) microstructure variables in the foreign exchange market. The study found that a majority of the dealers held the view that non-fundamental factors dominate the short-term exchange rate movements. Alternatively, it was found that speculation is an important factor in the short-term market. Further, the dealers believe that fundamentals have significant effects on exchange rates in a much shorter time frame than is expected by the macro theorists. Regarding the concept of purchasing power parity, the study concludes that though the dealers accept it as representative of the exchange rate's fundamental value, however the trading would not be based on this. Lastly, market convention has been found as an important determinant of bid-ask spread. (Cheung & Wong (2000) has further extended this survey to Hong Kong, Tokyo and the Singapore foreign exchange markets.)

Taking the cue from the above empirical and survey-based studies, the present study, which is the first of its kind on the developing country's foreign exchange market, attempts a similar exercise in the Indian context. In the next section, we specify the objectives of the present study.

Section IV

Objectives of the Study

It is significant that in the RBI's *Report on Currency & Finance, 1999–2000* (page IV-18–19), it has raised the issue of studying the foreign exchange behaviour in a market microstructure framework. The apex bank has indicated that the movements in the macro fundamentals may not back exchange rate movement in India in all time horizons. In this context, the present study would try to analyse the factors behind changes in the exchange rate in the short run. An attempt has been made to discern dealers' perception regarding the market movement and the forces behind it in the case of Indian foreign exchange market.

The specific objectives of the paper are as follows: (1) to test the importance of macro economic fundamentals in different time horizons by using primary information; (2) to examine the importance of microstructural factors in the short-term rate movement; (3) to find out the predictability of exchange rates in different time horizons; and (4) to analyse the effects of speculation and Central Bank intervention on the rate movement.

Section V

Empirical Results

A structured questionnaire has been prepared and mailed to the foreign exchange dealers, who are registered with the Foreign Exchange Dealers' Association of India (FEDAI).[1] In India, foreign exchange dealing rooms are located in seven cities (Ahmedabad, Bangalore, Chennai, Delhi, Kolkatta, Kochi, and Mumbai). (The information on number of banks in each city can be found in Table 1.) But it has been observed that most of the operations have been undertaken by the banks in Mumbai, Chennai, and Bangalore. Some of the dealing rooms in Mumbai, Chennai, Bangalore and Delhi were visited and discussions were held with dealers and the

[1] Though there are some private primary dealers in the market, in this study we have covered dealers from the banks only.

questionnaires were filled. For the remaining dealers, questionnaires have been mailed. A total 91 dealers (around 23.3% of registered dealers) have responded to our questionnaire. For a study of this kind, 23% would be a very good response. One of the problems that the researcher faced was that from most of the dealing rooms, where there are many dealers, the response was one or limited to a maximum of two. The reason for this poor response is due to the dealer's assumption that all the dealers in a dealing room would have the same perception and make the same decisions. But to the surprise of the researcher, it has been found that, wherever the responses are more than one from a single dealing room, no two dealers from same bank have same perception and possess same decision-making principle.

Distribution of the Sample (Spatial and Dealers' Profile)

It may be noted from Table 1 that in India, in 2001, there were 144 dealing rooms and 391 dealers. These dealing rooms are spread over seven cities specified earlier. For this study, we could collect information from 91 dealers. The spread of the sample can be seen in Chart 1. About two-thirds (61.5%) of the sample is from Mumbai. Chennai and Delhi consists of 17.6% and 9.9%, respectively. From other cities like Bangalore and Kochi, we could get only 9 samples. The unspecified slice of the chart is one sample from Kolkatta. We could not get any response from Ahmedabad.

The profile of the sample includes Managers, Treasurers, Chief/Senior dealers, and dealers/junior dealers. It may be noted from Chart 2 that a large portion of the sample (about 49.5%) are dealers/junior dealers. Chief/Senior dealers are about 40.7%. We got only 9 responses from the Managers/Treasurers. In terms of experience, around 57% of people are having less than five years of experience and around 37% people have between 6 to 10 years and the remaining 6% (exploded slice in Chart 3) have more than 10 years of experience. We have adopted this distribution basically to capture the changes in the trading systems and strategies over a five-year period.

Daily Dealing and Bid-ask Spread

We have also collected the information regarding volume of transaction of the bank so as to determine the size of the bank. Given the sensitivity of this information we could get responses only from 69 dealers (about 75%). It is also observed that most of the deals are in Indian rupee/US dollar market and other foreign currencies like Euro are traded in crosses with US dollar. The range of dealing is found to be very large (minimum is US$ 0.5 million and maximum US$ 500 million). From Chart 4 it may be noted that around 45% of the responded banks have a daily dealing between 10 to 50 million US dollars. An interesting aspect is that about 19% banks have a daily dealing of more than 50 millions. This shows how important it is to study the India foreign exchange market behaviour.

The study tries to examine the basis of foreign exchange trading in India. In doing so the data on current trading and the trading five years ago has been collected from the banks. It has been found that five years ago, foreign exchange was traded mostly to adjust the changes in fundamentals and complete the customer orders. But presently there seems to be a significant shift from these trades to the trading based on technical factors (see Chart 6). (Over the last five years technical trading has increased substantially from 33% to 62%, whereas trading based on customer orders have declined significantly from 42% to 25%.)

Another important objective of this study is to know what are the determinants of the bid-ask spread of the quotations. It has been found that a majority of the respondents (around 70%, see Chart 5) determine their spreads based on the market convention and around 21% determine this based on their potential costs of making the quote. But the information on spreads in INR/USD market shows a different picture. About 60% dealers quote the spread of half a paise and about 23% of dealers quote a one paise spread. Also the discussions with the dealers found that though the spreads are quoted on the basis of market convention, the conventional spread is not the same across the banks.

Market Convention and Spreads

For a smooth functioning of the market, it is necessary that the bid-ask spreads quoted should follow the market convention. If both differ, then it may lead to or be led by some factors that are exogenous to the market, like unexpected changes in the fundamentals, political news, etc. In this study we find mixed results (see Chart 7). There are 30% of dealers who have less than 5% of their quotes as larger than conventional spread. In the same way there are 22% dealers who have less than 30% of their quotes smaller than conventional spread.

But why should the dealers quote their spreads differently from the conventional one? Or, why should the dealers quote the conventional spread? For the first question, more than 30% of the dealers answered that the presence of increased market volatility, holding position against the market trend, and unexpected change in the market activity due to various reasons are the prime factors (see Chart 8). For the second question, more than 45% of the dealers felt that securing a good market image of the bank and maintaining reciprocal relationship with other banks are the main reasons (see Chart 9).

Determination of Exchange Rates

One of the important questions this study addresses is what are the factors that determine the exchange rates in any economy? In the area of international money and finance, there are many theories that explain the exchange rates. But are these theories helpful in practical trading?

To answer this, we have asked the dealers what are the important factors that determine exchange rates over time horizon (like intra day, medium run, and the long run). It is interesting to note that in the intra day trade factors like news[2] (68.1%), bandwagon effect (50.5%), speculation (50.5%), and order flow (55.5%) are important (see Chart 10). One striking thing is that nobody expressed that economic fundamentals are important in the intra day trades. But in the medium run and long run economic fundamentals seems to be a major factor in determining the rate movement. In other words, over the time horizon the importance of economic fundamentals is increasing. From this it can be concluded that macroeconomic theory may be useful only in the medium and long run. But to study the market behaviour in the short run one would need to consider non-macro fundamentals like news, order flow, etc. These are the major elements of market microstructure theory.

Macroeconomic fundamentals indeed have a role in the exchange rate determination. But it is not in the intra day. It may be noted from Chart 12, more than 80% of dealers feel that in intra day trading, fundamentals play an insignificant role. Over the time horizon the importance of fundamentals is increasing. If the intra day changes in exchange rate does not reflect changes in economic fundamentals, what are the other variables responsible? The response was loud and clear that both speculation and the central bank intervention are the major determinants (see Chart 11). This vindicates the impression that in India the central bank plays a 'spoil sport'[3] in the foreign exchange market activity and the rates move accordingly. But one may be interested to know what would be the exact impact of speculation and central bank intervention on the market.

Speculation, Central Bank Intervention, and the Foreign Exchange Market

In the intra day trading, we found that there are two factors that affect the exchange rate movement, i.e., speculation and central bank intervention. But what is the exact effect of these factors on the market behaviour (like on market volatility, liquidity and market efficiency)? Though it is known that both speculation and central bank intervention could either increase or decrease volatility, liquidity and efficiency, this question was asked basically to bring out the dealers' general perception about the effect of these two factors on the market movement. The dealers were asked the same question separately and these are presented in Charts 13 and 14.

It was found that a majority of the dealers (more than 50%) feel speculation leads to an increase in market volatility, liquidity and efficiency. Contrary to this, more than half of the dealers feel that central bank intervention would reduce both volatility and efficiency in

[2] Here the news could be any thing. It can be either political, economical, or some thing else which distorts the dealers expectations.

[3] Some of the dealers have used this word at the time of discussions.

the market. One of the arguments given for the central bank intervention is that to "bring orderly movement" by removing speculation in the market. But the dealers perceive this in the other way. They feel that without speculation there is no 'charm' in the market and the central bank's intervention is very 'depressing'.[4]

Macroeconomic Announcements and Exchange Rate

In the intra day, it may be concluded from our survey results that exchange rates do not follow macroeconomic fundamentals. This is true only when the new economic data coincides with the expectations already formed and which are already discounted in the market. But if the new macroeconomic data deviates from the market expectations, the market tries to adjust this new information. Now the question is how fast does the market assimilate the news. This depends on the kind of macroeconomic news. To analyse this, we have taken interest rate, trade deficit, money supply, GDP, and inflation. It was found that among all these variables, interest rate announcements assimilate within ten seconds (see Chart 15). The remaining variables take more than a minute. Further, for the question of which economic announcement has a bigger impact on the market movement now and five years ago, it was found that the importance of interest rate changes has increased substantially over the period (response was 50% five years back and now it is 73%) (see Chart 16). This may be due to a substantial increase in the capital mobility and also the gradual integration of financial markets (both domestic and foreign), which has an immediate impact on the market. But the importance of money supply, GDP and inflation has declined over the period. One reason for this could be that these variables are behavioural and predictable (unlike interest rate, which is still a policy variable).

Purchasing Power Parity and the Exchange Rate

The macroeconomic researchers believe that market practitioners strongly believe in purchasing power parity theory (PPP). It is assumed that the dealers hold their position based on this theory. The dealers' views are in contradiction to the macroeconomic researchers' belief that PPP condition would be helpful in tracking the exchange rate movement (see Charts 17 and 18). Almost 45% of the dealers were of the view that this is basically an academic jargon. Further, more than 60% of dealers felt that the PPP condition couldn't help in predicting the rate change in the short run. But it can help predict only in the long run.

[4] From the discussions with the dealers it was found that most of the big players in the foreign exchange market have shifted to other markets. Also it was viewed by these big players that there is no foreign exchange market in India.

Conclusion

In the present study we tried to discern the factors that affect the exchange rate movements in different time horizons by using survey data. It was found that the dealers perceive, compared to fundamentals, order flow has a more significant impact on the exchange rates in the intra day. But it was found that fundamentals are more useful in predicting the rates in the long run. This is a significant finding for any developing countries' foreign exchange market. These results might differ between the countries as it depends on the specific country's market regulations, 'maturity' and the economy itself.

Given these conclusions, it can be inferred that the studies on exchange rate determination models should concentrate on the short-term forecasting with the help of micro variables like bid-ask spreads, volume of transaction, order flows, and public & private information. A study of this kind may be greatly useful not only in predicting the exchange rates near-accurately but also in maintaining orderly movement that helps the risk managers in the market. One of the criticisms to this conclusion could be that a greater emphasis has been given to the views of the dealers whose objective may be fairly different from that of the market regulator. Though this may be true to some extent, however one cannot completely ignore the dealers' perception about the established theories in the area of international macroeconomics, as they are the major players in the market and the rate (or price) is an outcome of these people's behaviour. The RBI has been intervening, both directly and indirectly, in the market to achieve its goal of orderly movement in the market. Though the intervention is necessary to minimize speculative attacks on the currency, the excessive intervention would only lead to market inefficiency. Besides having the objective of maintaining orderly movement, the RBI should also develop more efficient and more vibrant foreign exchange market. This is necessary particularly when the financial markets are highly integrated both domestically and at international level.

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Appendix

TABLE 1
Total Number of Dealing Rooms and Dealers in India (Location Wise and Only Banks)

Location	*Number of Dealing Rooms*	*Number of Dealers*
Ahmedabad	2	4
Bangalore	4	11
Chennai	17	37
Delhi	25	57
Kolkatta	12	16
Kochi	5	14
Mumbai	79	252
Total	144	391

Source: The Indian Dealing Rooms Directory, 2001, Forex Association of India.

CHART 1
Distribution of Sample (Area, Total 91)

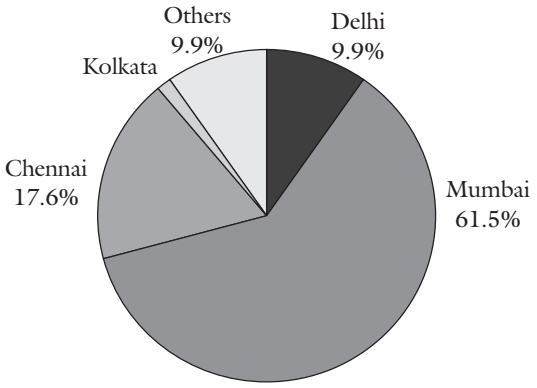


CHART 2
Distribution of Sample (Position)

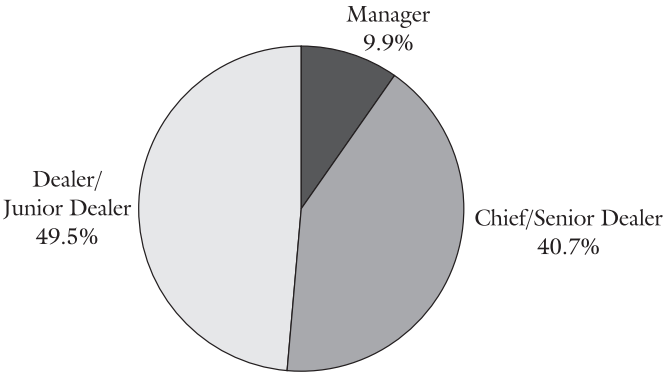


CHART 3
Distribution of Sample (Work Experience)

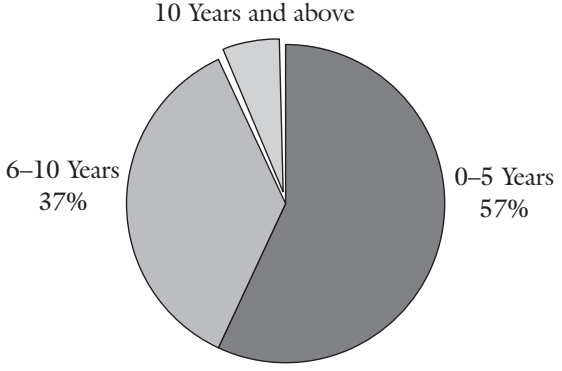


CHART 4
Average Daily Dealing (in $ millions)

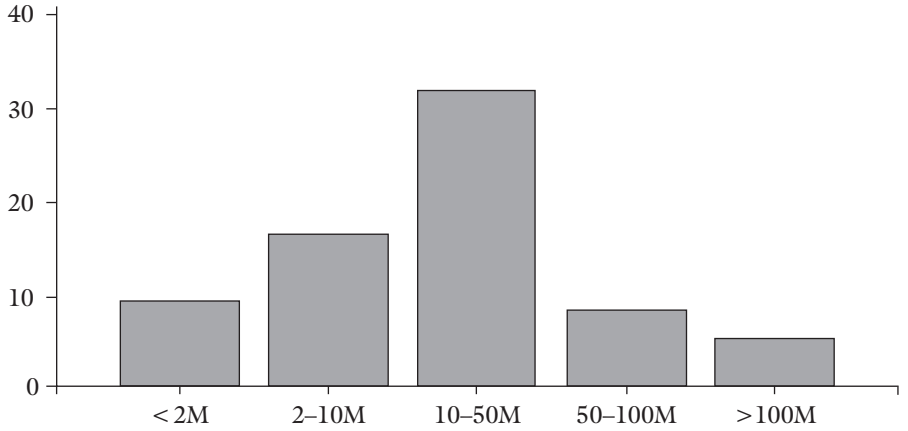


CHART 5
Determinants of Bid-ask Spread

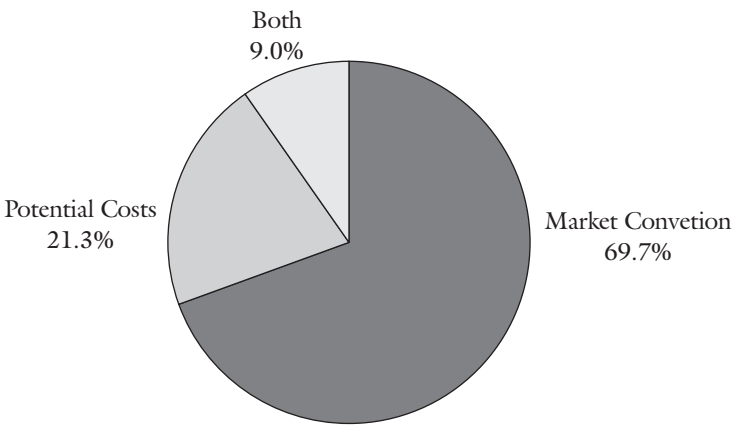


CHART 6
Trading

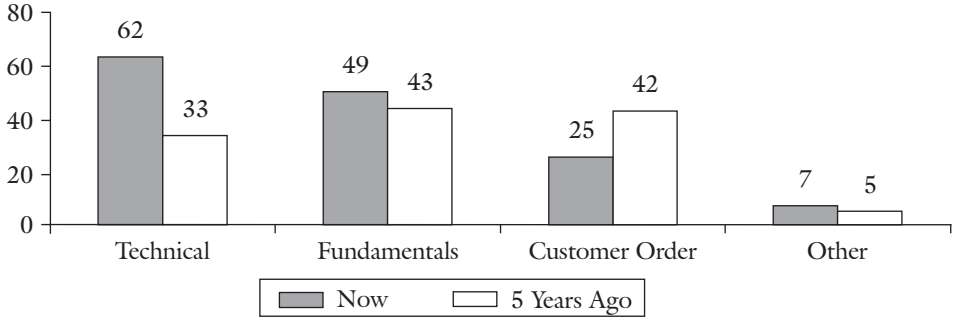


CHART 7
Quotes

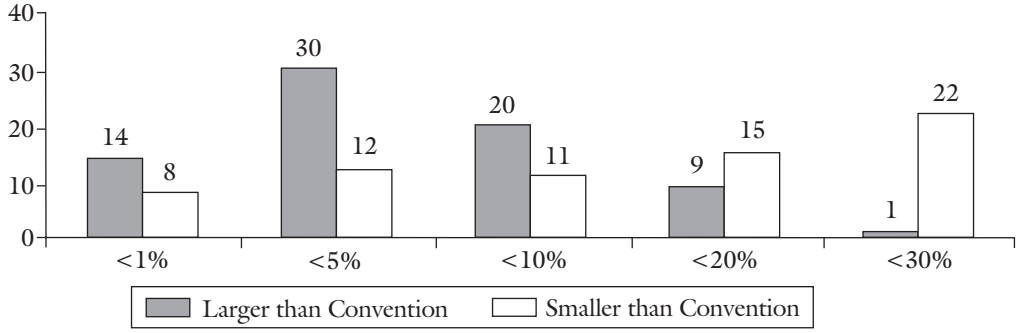


CHART 8
Reasons for Spreads Different from Market Convention (%)

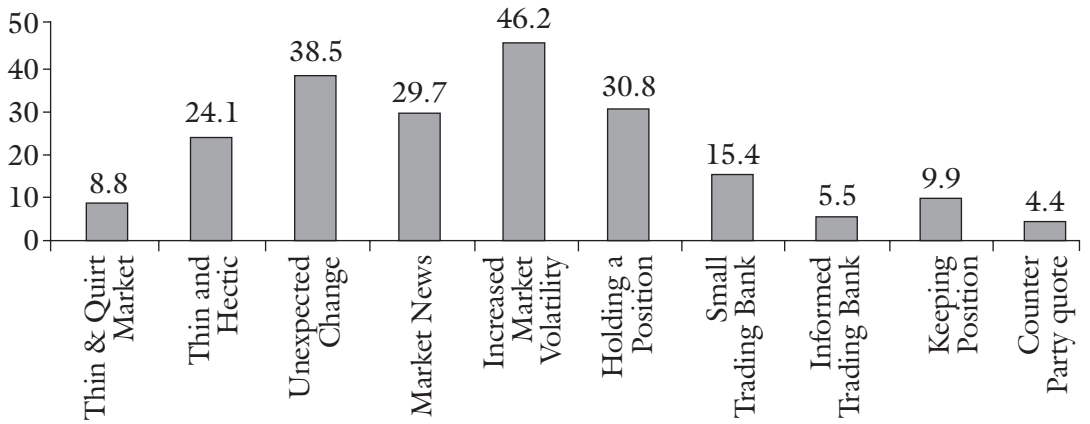


CHART 9
Reasons for Spreads Confirming to Market Convention (%)

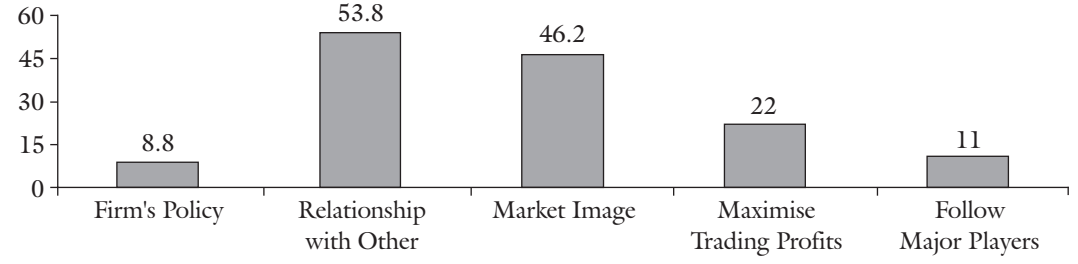


CHART 10
Important Factors that Determine Exchange Rates Over Time Horizon

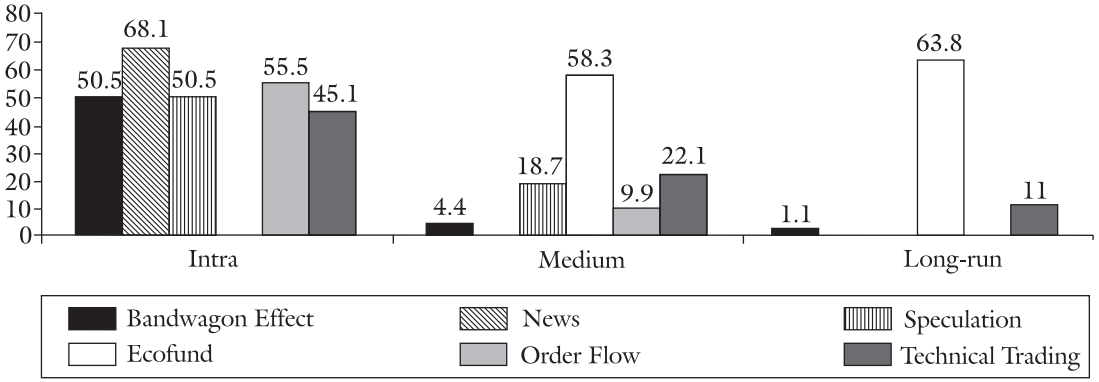


CHART 11
If Exchange Rate does not Reflect Changes in Economic Fundamentals, what are the Factors Responsible? (%)

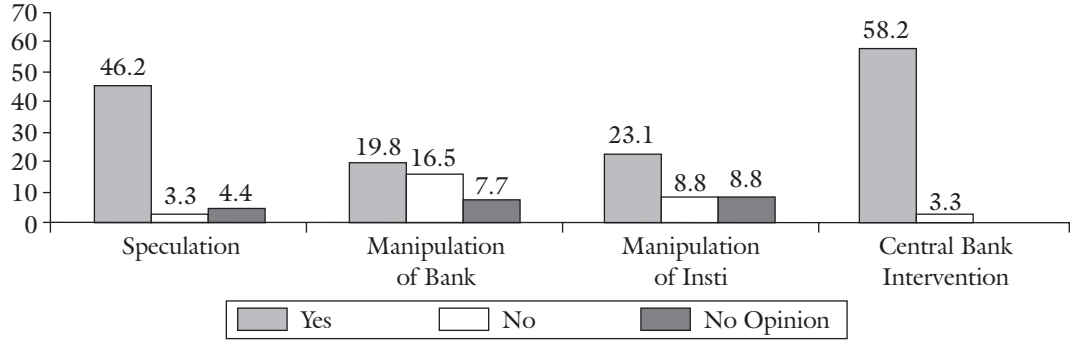


CHART 12
Do You Believe Exchange Rate Changes Accurately Reflect Changes in the Fundamentals?

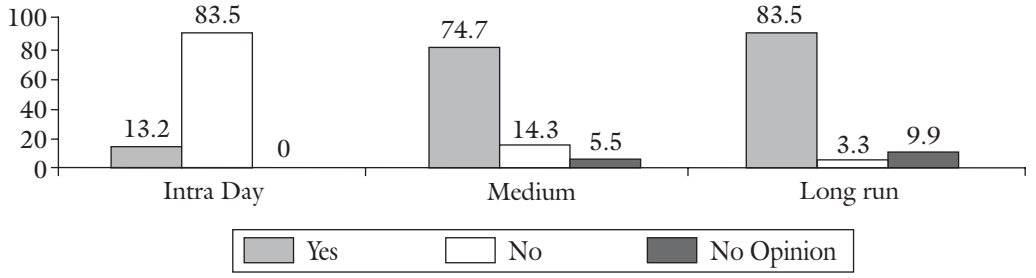


CHART 13
Effects of Speculation on the Market

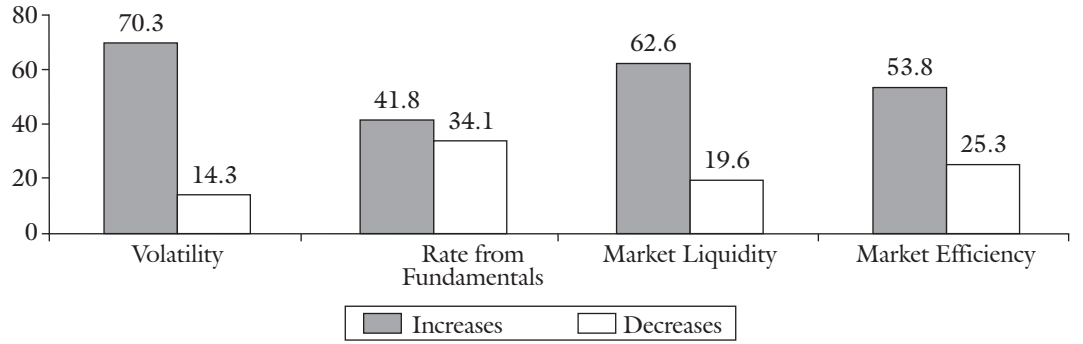


CHART 14
Effects of Central Bank Intervention on the Market

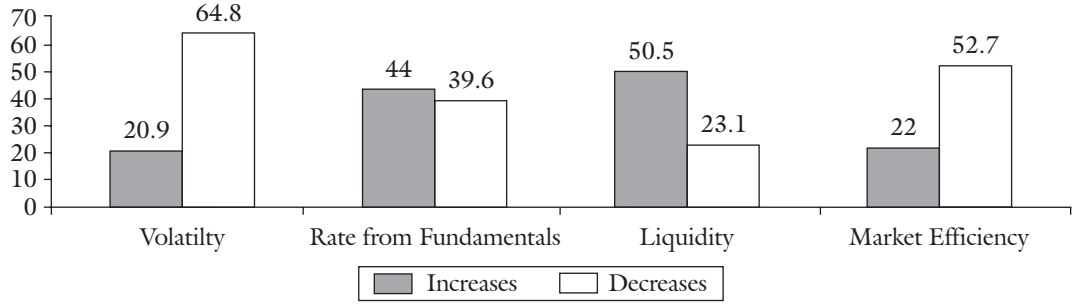


CHART 15
Assimilation of Economic Announcements when they are Different from Market Expectations

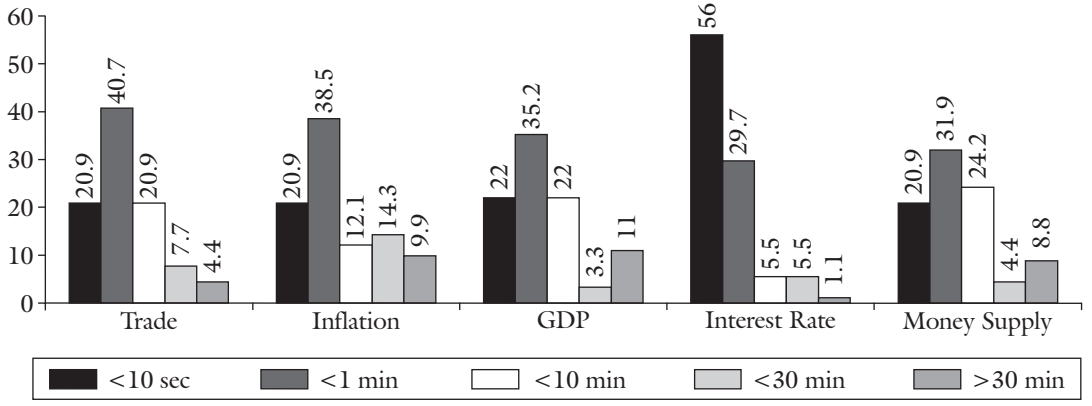


CHART 16
Which Economic Announcement has Bigger Impact on Market Movement

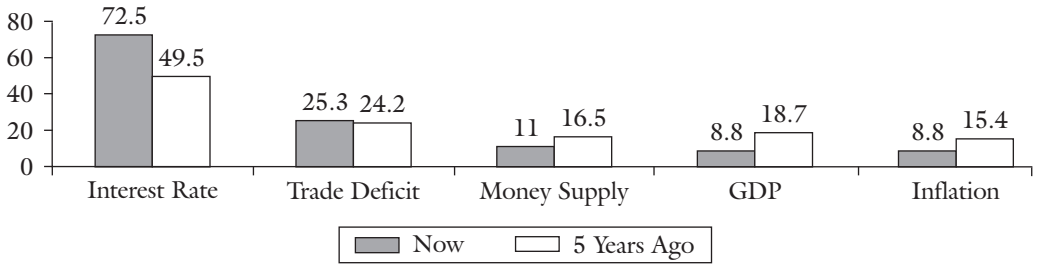


CHART 17
Use of Purchasing Power Parity Condition

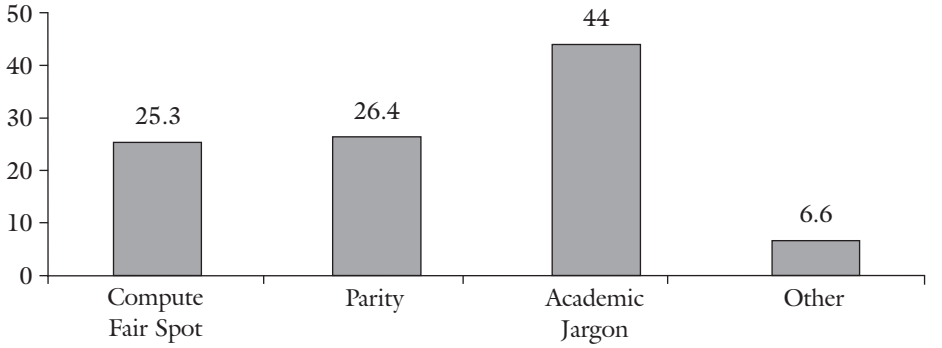
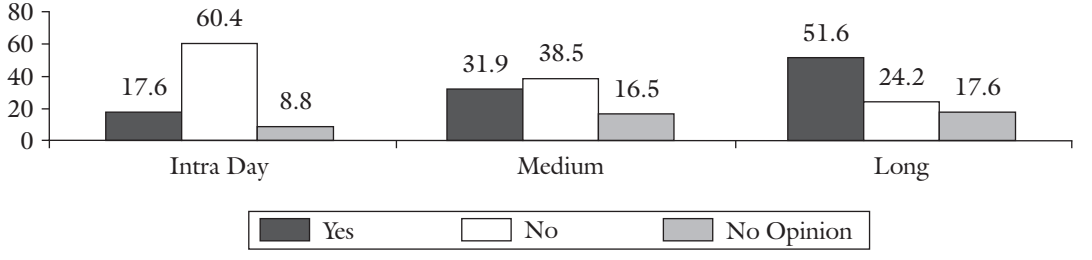


CHART 18
Do You Think PPP Condition Can be Used to Predict Rate? (%)



Section I

Growth

(b) Industry

Chapter 5

MNE Affiliation, Firm Size and Exports Revisited: A Study of Information Technology Firms in India

N.S. Siddharthan and Stanley Nollen

In this study we argue that the export performance of affiliates of multinational enterprises (MNEs) in developing countries is determined differently from that of licensees of foreign firms or of domestic firms. Our empirical results for the information technology sector in India show that exports of MNE affiliates are greater when they have larger foreign equity stakes that bring more tacit knowledge transfer and complementary FDI advantages and when they import more explicit technology from the purchase of licences. Standard export determinants such as firm size and capital intensity do not matter for MNE affiliates, but they do for licensees and domestic firms.

I. Introduction

In recent years several papers have appeared linking the export performance of firms with firm size and multinational enterprise (MNE) affiliation [*Aggarwal, 2002; Buck, Filatotchev, Demina and Wright, 2000; Kumar and Siddharthan, 1994; Patibandla, 1995; Willmore; 1992, Athukorala, Javasuriya and Oczkowski, 1995; Bonaccorsi, 1992; Katsikeas, Leondidou and Morgan, 2000; and Wagner, 2001*]. However, the results of these firm level studies are not unambiguous. Empirical explanations are 'inconsistent and contradictory' [*Aulach, Kotabe and Teegen 2000, 343*], especially for developing countries for whom exports are especially important. Our lack of understanding, we suggest, is due in part to a failure to recognise the key role played by the firm's relationship to MNEs.

In this study we suggest that the export behaviour of affiliates of MNEs is determined differently from that of other companies in high-technology industries in developing countries. We focus on the contribution to the firm's export competitiveness of knowledge that it

sources internationally, following Nelson [*1995*], who emphasised that inter-firm differences in performance in high technology industries depend on the core resources and capabilities of firms as well as on the market conditions they face. We argue that critical differences in firms' resources derive from their modes of foreign collaboration, resulting in strategic differences in their bases for competing [*Caves, 1996*].

Earlier studies analysing inter-firm differences in export intensities of developing countries have, by and large, considered firm size, technology acquisition variables like payments made for technology imports and capital goods imports, and other firm specific variables as determinants. In addition, they also introduced foreign equity participation as an additional explanatory variable. In doing so the earlier studies implicitly assume that the export performance of MNE affiliates and other firms is explained in the same way. In this paper, we argue that MNE affiliates behave differently from other firms and that the magnitude and sign of the coefficients of some determinants of exports will differ between the MNEs and other firms. Therefore, in order to obtain more meaningful and interpretable results, we advocate fitting separate equations for different groups of firms, or using slope and intercept dummies in a single equation.

We empirically analyse firms in the information technology sector in India, which is an important industry in an increasingly open economy. We explain the exports of three different groups of firms: affiliates of MNEs, licensees of foreign technology, and domestic firms with no foreign collaborations. Our findings show that their export behaviours are different and must be analysed separately.

In analysing the determinants of inter-firm differences in export intensities, we consider the standard determinants—firm size, technology and collaborations. Nevertheless, we argue that the same determinants would behave differently for different groups of firms. In other words, the main contribution of this paper is not in the choice of variables or in the estimation techniques, but in the development of hypotheses that predicts the differential behaviour of the variables between different groups of firms.

II. Technology and Exports

Evolutionary growth theory and neo-technology trade theory stress knowledge that is valuable, inimitable, rare and non-substitutable as one of the firm's critical resources that explains its growth and performance [*Nelson, 1995*]. While some of the firm's knowledge resources can be obtained locally (for example, skilled labour), other knowledge resources can be obtained from foreign sources. Some of these knowledge resources can be purchased directly from the external market (for example, buying a licence to use a patented production process), but others (for example, knowing how to operate quality control systems), can only be acquired through foreign equity or non-equity alliances. We suggest that a firm's foreign collaborations will affect

its knowledge resources and therefore its export competitiveness. In particular, we argue that some of the variables that determine the export performance of MNE affiliates are different from those that apply to licensees and domestic firms, and that the direction and magnitude of other export determinants differ across these firms.

The Contribution of Knowledge to Export Performance

Previous empirical research conducted in developing countries or transition economies does not permit us to draw conclusions about the contribution of knowledge to export performance. Studies that considered knowledge or technology (we do not distinguish between the terms and use them interchangeably) reported mixed effects [*Filatotchev et al., 2001; Aggarwal, 2002; Kumar and Siddharthan, 1994; Harrison, 1996; Lall, 1986*], no effects [*Filatotchev et al., 1999; Willmore, 1992*], or negative effects [*Lall and Kumar, 1981*]. Technology was measured in various ways in these studies, including value of R&D spending, number of patents, payment of royalties or licence fees abroad, imports of components, or new product development. Positive links between technology and exports were more often found in industrialised countries [*Basile, 2001; Nassimbeni, 2001; Wagner, 2001; Sterlacchini, 1999; Dosi, Pavitt and Soete, 1990; Van Hulst, 1991; Hughes, 1986; Hirsch and Bijaou, 1985; Cavusgil, 1984*], but here also some studies found mixed effects [*Katsikeas et al., 2000; Lefebvre et al., 1998; Wakelin 1998, 1997; Cooper and Kleinschmidt, 1985*], or no effects [*Ito and Pucik, 1993, Kirpalani and Macintosh, 1989; Reid, 1986*].

Technology Development

Technology is developed by firms as a cumulative, endogenous process influenced by past innovation experience [*Wakelin, 1997; Dosi, 1988*]. It occurs increasingly inside networks of strategic alliances among multinational enterprises in which creation and diffusion interact. The development of technology requires an array of complementary resources (such as highly trained people and specialised equipment and facilities), and its exploitation requires additional capabilities (such as manufacturing processes, distribution channels and technical service). In industrialised countries, firms invest in R&D that produces innovations in products, production processes, or marketing techniques. These innovations lead to competitiveness in export markets [*Nelson and Winter, 1977; Krugman, 1990; see Wakelin, 1997 for a survey of these neo-technology trade theory-based studies*].

However, firms in developing countries are unlikely to be innovators of new technologies because they are unlikely to have the organisational resources or R&D networks with firms abroad that are needed to follow the developmental trajectories [*Ostry and Gestrin, 1993*]. We expect firms in developing countries to obtain innovative technology via collaborations with

foreign firms. Although many firms in developing countries do conduct R&D in-house, this R&D is adaptive rather than innovative [*Lall, 1983; Katrak 1985, 1997; Siddharthan, 1992*]. In-house R&D aims to adapt production processes of foreign origin to different domestic input availabilities, and to adapt foreign products to different needs of domestic markets. In some cases the adaptations can be accomplished at the factory floor and do not need a formal R&D unit. This technology effort is usually insufficient to become competitive in export markets. With rare exceptions, empirical studies in developing countries have found in-house R&D to have no effect on exports, whereas imported technology (measured variously) was positively related to exports of firms in some industries, particularly high technology industries [*Aggarwal, 2002 and Kumar and Siddharthan, 1994 for India; Harrison, 1996 for Côte d'Ivoire, Morocco and Venezuela; and Braga and Willmore, 1991 for Brazil*].

Technology Transfer

A defining characteristic of technology is the extent to which it is explicit—codified, articulated, tangible—or tacit—not fully expressed, only partly conscious, partly intuitive. To explain the export performance of firms, we are concerned with international technology transfer into the firm from abroad. Explicit technology can be purchased directly in the form of licences for which the firm pays royalties or lump sum payments, or it can be embodied in capital equipment or components and imported. On the other hand, transfer of tacit technology incurs high transaction costs and also entails the movement of people. Therefore, tacit technology is transferred mainly intra-firm through direct investment.

To appropriate the benefits of innovative R&D and achieve competitive advantage for exporting, local firms in developing countries acquire tacit technology via inward foreign direct investment (FDI), and they acquire explicit technology from FDI or from licensing. Therefore, the type and extent of a firm's foreign collaboration should influence its knowledge resources and its export competitiveness.

III. The Role of Foreign Collaboration

Several previous empirical studies have found the effect of foreign direct investment on the export performance of firms in developing countries to be positive [*Filatotchev et al., 2001, 1999; Bigsten et al., 1999; Haddad et al., 1996; Willmore 1992; Lall and Mohammed, 1983*]. Some studies in developing countries found that firms with foreign equity stakes exported more if they were in high technology industries, but not otherwise [*Aggarwal, 2002; Harrison, 1996; Kumar and Siddharthan, 1994; Lall, 1986*]. In only one study was no effect found [*Athukorala et al., 1995*]. In these studies, FDI was used as a separate variable in addition to the other determinants of exports implicitly assuming that the coefficients of the main determinants of

exports do not differ between MNEs and non-MNEs. The FDI variable has not been used in export studies among developed countries.

MNE Affiliation and Export Performance

An MNE invests in operations abroad when its firm-specific advantage is transferred at lower transaction costs via internal organisational hierarchy rather than the external market. Explicit technology, especially mature technology, is likely to be transferred by licensing or export of capital goods, but tacit technology, especially newer technology, is mainly transferred by equity participation [*Siddharthan and Safarian, 1997, Mowery and Oxley, 1995*], and it is largely unrecorded [*Kokko and Blomstrom, 1995*]. Recent evidence shows that MNEs do transfer technology to their subsidiaries or joint ventures [*Wright, 2002*], and that the performance of the subsidiaries is thereby improved, especially in industries that lag behind best practices [*Chung, 2001*] and when the technology is tacit and embedded [*Andersson, Forsgren and Pedersen, 2001*]. The larger the foreign equity stake, the greater the amount of technology transferred [*Grosse, 1996; Ramachandran, 1993*]. This advantage of foreign ownership adds to the local firm's competitiveness, which can be realised as superior export performance.

MNE affiliates gain competitive advantage for exporting because of their foreign parents' innovation capabilities, marketing and supplier networks, managerial skill, and financial resources. MNEs have complementary assets such as globally dispersed R&D [*Kuemmerle, 1999*], global brand names and differentiated products, and networks with their international alliance partners. These resources give MNE affiliates an advantage in accessing innovations not otherwise achieved from in-house R&D, exploiting the size advantages of their global organisation, and finding export markets. Compared to licensees or domestic firms, they are likely to depend less on their own size and exposure to foreign markets to achieve export success, and the explanation of their export behaviour is different.

We suggest an additional effect of MNE affiliation on exports: an interaction between foreign equity stake and technology imports. The relationship between FDI and purchased technology can be one of either substitution or complementarity. Following transaction costs analysis, FDI will dominate as the mode of foreign market entry when transaction costs through the external market are high and internalisation is preferred, whereas licensing will be the preferred mode in cases where transaction costs through the market are low. In this view, FDI and licensing are alternatives or substitutes. A local firm will have either one or the other; more FDI means less licensing. According to this argument, while FDI and licensing variables individually will each have a positive impact on exports, the interaction between FDI stake and licensing payments will be negative.

On the other hand, a broad view of internalisation embraces all foreign transactions and considers direct purchase of technology and import of capital goods as complementary parts of the technology transfer process. The larger the FDI stake, the more technology the MNE

is willing to transfer via intra-firm hierarchy, and the more useful the technology obtained via external market transactions because a more complete package of production and marketing knowledge is obtained. Under this approach, FDI and technology imports go together, and the export performance of local firms is increased by the combination of the two modes. In this case the interaction term will be positive.[1]

IV. Standard Export Determinants

Export functions that are empirically estimated typically include variables representing firm size and factor endowments, as well as technology indicators.

Firm Size

An important characteristic that enables a firm to achieve export competitiveness, especially in imperfect markets, is large size. Larger firms with market power can achieve scale economies and produce differentiated products. They may also have advantages of superior information, greater risk-bearing capacity, lower unit cost, brand names, and price-setting power [*Krugman, 1990; Glejser, Jacquemin and Petit, 1980; Bonaccorsi, 1992; Christensen et al., 1987*]. However, they have disincentives to export if profitability in the domestic market is high when they have high market share and the domestic market is not yet mature [*Patibandla, 1995*].

For MNE affiliates and foreign technology licensees, the collaboration itself should capture some of the advantages attributed to size, such as scope economies, information and risk bearing and brand name (though not all, such as scale economies and market power). Hence for these two groups of firms, size need not be important for exporting. Nevertheless, for domestic firms, size should still be important. Thus size could be significant for domestic firms, but need not be important for MNE affiliates. Under these conditions combining the two groups could distort the results.

Capital Intensity

For an inter-firm study such as this, the role of factor intensities must be interpreted differently than for an inter-industry study. In inter-industry analysis, a capital-poor country such

[1] The advantage of foreign ownership can also be realised in stronger domestic sales if the MNE affiliate's objective is to serve the local market, and imported technology via licensing can be used to improve domestic as well as export sales. We find examples in our firm profiles below.

as India does not have a comparative advantage in exporting capital intensive products. However, within an industry such as information technology, firms that use more capital intensive methods are likely to use newer vintages of machinery than less capital intensive firms and therefore to have product quality if not cost advantages for the export market. We therefore expect a generally positive relationship between capital intensity and exports for our inter-firm analysis in a high technology industry. For MNE affiliates, however, the effect may be weaker because some of the advantages of late-vintage capital can be supplied by the MNE parent.

In one previous study of high-technology industries, firms with greater capital intensity were found to have greater export propensity [*Kumar and Siddharthan, 1994*]. In most other studies in developing countries, capital intensity and skill intensity either had no effects or negative effects on the export intensity of firms, as should be the case in countries for which neither physical capital nor skilled labour is an abundant factor [*Haddad et al., 1996, Athukorala, 1995; Willmore, 1992; Lall, 1986; Lall and Mohammed, 1983*]. However, Roberts and Tybout [*1997*] found a positive effect of capital stock on export probability for manufacturers in Colombia.

V. Methodology and the Model

Our model to explain export performance depends on the resources of the firm that are obtained from foreign sources—foreign equity participation and purchase of technology imports—and resources identified from earlier studies—firm size, and capital intensity. Unlike the earlier studies, we consider separately three groups of firms for whom we expect different export behaviours: MNE affiliates with MNE equity participation, technology licensees that make lump sum or recurring licence or royalty payments abroad but do not have foreign equity stakes, and domestic enterprises that neither have foreign direct investments nor make technology payments abroad.

To analyse the determinants of inter-firm differences in exports, we follow the usual practice of taking the export intensity of the firm (export sales divided by total sales) as the dependent variable. In our sample some firms do not export and for them the value of the dependent variable is zero. Following the earlier studies we use a tobit estimation that allows both observations with zero values and continuous positive values in one equation. We prefer a tobit estimation because it is preferable to use all the continuous export sales information we have rather than give up valuable information by using dummy variables, and because there is no separate or different model for export probability versus export intensity. Recent studies have determined that a tobit estimation was statistically satisfactory [*Wagner, 2001*] and did not give different results from separate probit estimation of export probability and ordinary least squares estimation of export intensity where all values were greater than zero

[*Sterlacchini, 1999*].[2] During the sample period (1994–98) there was entry of new firms and some exit of existing firms.

The data for the study were obtained from *Capitaline,* a corporate database, produced by Capital Markets Ltd, an Indian information services firm. The database provides panel data for about 7,000 companies that are listed on the Indian stock exchange as well as some unlisted companies. In this study we include all firms in the *Capitaline* database in the information technology sector (computer hardware and software, telecommunication equipment and services, and electronic components). The sample consists of pooled data, that is, cross-sections of firms pooled over the years 1994–98. The total number of observations is 425 from 145 different firms. We chose the information technology sector for analysis rather than all manufacturing because it permits new insights into export behaviour that stem from its global character, substantial foreign involvement, reliance on advanced technology and freedom from some standard factor endowments.

In estimating the model we use three methods:

(a) Separate tobit estimates for the three groups of firms to show that the slope coefficients are different for the three groups of firms.
(b) Single equation tobit estimates combining the three groups of firms with slope and intercept dummies for MNE and licensee groups to establish statistical significance in the differences in the slope coefficient for the three group of firms.
(c) Fixed effects estimates using balanced panel techniques.

The results of the first two are presented in the text while the third is presented in the Appendix 1. In addition to these three estimations, we also attempt to account for any possible simultaneity problem by re-estimating each model with lagged independent variables.

The usual practice is either to present the results of the combined sample with slope and intercept dummies or to present the three separate equations. The practice of using slope dummies is normally followed when the independent variables are the same for all the three samples. In our case only four independent variables are common to all the three samples, namely, capital goods imports, raw material imports, capital output ratio and firm size. In the case of MNE affiliates we have three additional variables, namely, FDI, technology imports, and the FDI-technology imports interaction. Since FDI values are zero for the other two groups, this variable cannot be introduced in the analysis for licensees and domestic firms. Therefore, in the combined sample of all the three groups, it is not possible to introduce FDI and its related variables and also introduce MNE slope dummies for FDI and related variables.

[2] Our analysis is not able to determine causation, and it is not our objective to do so. However, other studies have tackled this issue and concluded that the direction of causation runs 'from good plants to export activity' [*Bernard and Jensen, 1999*], and that key independent variables such as foreign linkages contribute to the explanation of export performance even when the lagged dependent variable is used as a regressor [*Filatotchev et al., 2001, Roberts and Tybout, 1997*].

That would result in a near singular matrix and the equation cannot be estimated. Under these conditions, we could introduce slope dummies only to the four variables that are common to all the groups. Given these complications we present the separate results for the three groups of firms as well as for the single combined group using slope dummies for the variables that are common to all the groups.

There are two sets of problems in presenting fixed effect models for our sample. First, standard computer software packages like Eviews and Stata do not allow estimation of tobit models using balanced panels. Since some sample firms did not export, it is important to use tobit estimates rather than OLS. In our analysis the tobit estimates differed from the OLS estimates as expected. In particular, in the case of MNE affiliates, in the OLS estimates most variables and more importantly FDI related variables did not turn out to be important while they were significant in the tobit estimates. Furthermore, the results of the fixed effect models were similar to the OLS estimates, which we had rejected on econometric grounds.

Second, during the sample period there were many new entrants and some of the firms stopped their operations. A balanced panel would ignore the entry and exit of firms and give an unrepresentative picture. It is important to consider the entry and exit of firms, especially during the period of economic reforms in India. Due to these two reasons, we interpret the results of the tobit mode in the main text and present the balanced panel data fixed effect results in the Appendix.

Dependent Variable

EXPORT = export intensity measured as export revenue divided by sales revenue

Independent Variables

TECHIMP	=	Technology Import—royalties, licence fees, and lump-sum technology payments abroad divided by sales revenue
FDI	=	foreign equity stake in per cent
CAPIMP	=	imports of capital goods divided by sales revenue
MATIMP	=	imports of raw materials and components divided by sales revenue
CAPOUT	=	capital/output ratio, defined as fixed assets divided by sales revenue[3].
SIZE	=	sales revenue (Rs 10 million)
DMNE	=	Dummy variable for the MNE affiliates
DLIC	=	Dummy variable for the licensees.
DSOFT, DTELE	=	dummy variables for computer software and telecom industries.

We allow for industry-specific factors that influence export performance by using dummy variables for two industries: computer software, with an expected positive effect for firms in India; and telecommunications, with an expected negative effect because of telecom services

[3] Capital intensity can be measured by capital-labour ratio or by capital-output ratio (or capital productivity, which varies with capital-labour ratio); both indicators were used in previous studies. For Indian firms we use capital-output ratio because, employment data are not reported.

that are difficult to export. The estimating equation for licensees omits the FDI variable, and the equation for domestic companies omits also the indicator for direct purchases of technology imports, TECHIMP.[4] In the fixed effect panel results industry dummies are excluded, as firm dummies are included.

VI. Statistical Results

Table 1 provides descriptive statistics for all the variables to facilitate the interpretation of regression results. The average export intensity over the entire sample was 8.4 per cent of sales revenue (this includes firms with zero exports, which is about half the total number of firms). Counting only firms with exports, the average export intensity was 16.9 per cent, and MNE affiliates had the highest average export intensity (19.2 per cent) while domestic firms were lowest (15.1 per cent).

TABLE 1
Descriptive Statistics

Variable	*Measure*	*MNE Affiliates*	*Foreign Licensees*	*Domestic Firms*
Export intensity (% of sales)				
All firms	Mean	9.1	9.4	6.3
Firms with exports	Mean	19.2	16.7	15.1
Technology imports (% of sales)	Median	0.4	0.6	NA
FDI	Mean	23.1	NA	NA
Capital imports (% of sales)	Median	0.5	0.7	<0.1
Materials imports (% of sales)	Median	17.8	17.5	<0.1
Capital/output ratio (Rs/Rs)	Median	0.49	0.48	0.77
Size (Sales, Rs 10m)	Mean	294.2	232.3	49.0
DSOFT	Count	17	54	25
DTELE	Count	18	32	16
Number of observations	Count	104	204	117
Number of unique firms	Count	31	47	67

Notes: See the text for definitions of each variable.
Means and medians include observations whose value for the variable is 0, except for export intensity where values are given separately; 49.7 per cent of all firms had zero exports.
Medians are reported rather than means for variables whose values tend to fluctuate widely for any given year.
NA means not applicable.

[4] The interaction term between FDI and technology imports, and the firm size variable incorporate the firm's motives for exporting versus domestic sales. The Profiles of Key Firms section of the paper that follows the statistical findings comments on firms' objectives.

Method 1: Separate Regressions for the Three Groups of Firms

In Table 2 we present the tobit regression results for MNE affiliates, foreign licensees, and domestic companies in separate equations. The results suggest that technology plays an important though variable role in the explanation of export intensity, and that the exporting behaviour of MNE affiliates, foreign licensees, and domestic companies differs. Among MNE affiliates, firms that had larger foreign equity stakes had greater export intensities. Firms that made larger payments for technology imports also had greater export intensities. Both methods of obtaining technology from abroad are independently effective in raising export performance for this group of firms.

TABLE 2
Determinants of Exports of Indian Information Technology Firms

Explanatory Variable	*MNE Affiliates*	*Licensees*	*Domestic Firms*
FDI	0.007** (2.111)		
TECHIMP	1.253** (1.932)	–0.611*** (73.600)	
TECHIMP × FDI	–0.051** (–2.343)		
CAPIMP	–1.954** (–2.080)	0.121 (0.822)	–0.073 (–0.281)
MATIMP	–0.315 (–1.097)	–0.084 (–1.327)	0.576*** (2.765)
CAPOUT	–0.013 (–1.092)	0.0342*** (3.829)	0.015*** (5.034)
LOGSIZE	–0.196*** (–2.683)	0.015 (0.477)	0.226*** (3.934)
DSOFT	–0.093 (–0.606)	0.168*** (2.587)	0.210** (2.427)
DTELE	–0.191 (–1.358)	–0.141** (2.200)	–0.438*** (–3.040)
Constant	–0.278* (1.742)	0.015 (0.236)	–0.446*** (–3.094)
Log likelihood	–43.909	–72.878	–31.091
Number of observations	104	204	117

Notes: Dependent variable is exports as a percentage of total sales. Coefficients in the table are maximum likelihood estimates from a tobit model. Asterisks indicate statistical signficance at the *** 1 per cent, ** 5 per cent, and * 10 per cent levels, respectively, for two-tailed test; z-statistics are in parentheses beside estimated coefficients.

The coefficient on the TECHIMP × FDI interaction term for MNE affiliates is negative and significant (the simple correlation between these two variables is also slightly negative). This result does not support the hypothesis that intra-firm transfer of technology via internal hierarchy is complementary to arm's length purchase of technology from the market. Foreign direct investment and technology imports from licences and royalties do not work together to boost exports for the Indian information technology firms in this study. On the contrary, the alternative hypothesis is supported. This result suggests that the two methods of transferring technology are substitutes. It does not mean that tacit and explicit technology are substitutes (they might be complements but we do not measure the complementarity); rather, it means that technology transfer intra-firm and technology transfer via external market purchase are substitutes. The export-oriented MNE affiliates either have large imports of technology licences or they have high foreign ownership stakes, but not both at once.

Neither of the other methods for obtaining foreign technology that we measured—imports of raw materials and components and imports of capital goods—contributed positively to exporting by MNE affiliates. Moreover, imports of capital goods did not contribute to the exports either of licensees or domestic firms, and only for domestic firms was the import of raw materials and components a significant positive influence on export performance. (Although Kumar and Siddharthan [*1994*] found that technology imports in the form of payments abroad for licences aided exports in some high tech industries, as we find for MNE affiliates, total import intensity had no effect on exports in any of the industries they studied). (In the next section we look into key characteristics of selected companies that help us to understand their exporting behaviour and some of the statistical results obtained here.)

Among foreign licensees (that are not MNE affiliates), technology imports were negatively related to export intensity. This result, which is contrary to our hypothesis, suggests that firms in this industry in India that spend more on the direct purchase of foreign technology use it to improve domestic sales rather than to promote exports. In some cases, while transferring technology and rights to unaffiliated licensees, MNEs insist on export restrictions if not an export ban to safeguard their export markets. In other words, the MNEs license technology to unrelated third parties mainly to serve the host's domestic market. In our sample, licensees had higher median expenditures on technology imports than MNE affiliates.

Export determinants used in earlier studies are important by and large in the explanation of the export intensity of licensees and domestic firms, but they matter less for MNE affiliates. For example, greater capital intensity and larger firm size in this high-technology industry both contribute to the exports of domestic firms, and greater capital intensity contributes to the export intensity of licensees. However, none of these variables assist the exporting of MNE affiliates. In fact larger MNE affiliates exported less, given other export determinants, than smaller MNE affiliates. Thus we find both negative and positive effects of firm size on exports. The hypotheses that foreign collaborations confer advantages for exporting by local firms that render other export determinants less important were supported.

The industry dummy variable for software, DSOFT is positive and significant for licensees and domestic companies, reflecting the emergence of highly export competitive Indian firms in the software industry. For all three groups, firms in the telecom industry had fewer exports than firms in other information technology industries; some of these firms are service providers rather than equipment manufacturers for whom exports are not possible.

Method 2: Combined Sample and the Use of Intercept and Slope Dummies for MNEs and Licensees

The tobit estimates for the combined sample with slope and intercept dummies for MNEs and licensees are presented below. The results are consistent with the results presented in Table 2. Therefore, we will not repeat the discussion presented in the previous subsection (Method 1) but will merely indicate the statistical significance of the slope dummies.

Regression Equation for the Combined Sample (Tobit Estimates)

EXPORT = –0.336*** + 0.007 FDI*** –0.382 TECHIMP**
(–4.532) (2.877) (–2.528)
–0.042 TECHIMP × FDI** –0.009 CAPIMP + 0.011 CAPOUT***
(–2.515) (–.029) (3.653)
+ 0.147 LOGSIZE*** + 0.550 MATIMP**
(2.778) (2.473)
+ 0.533 DMNE*** + 0.456 DLIC***
(3.907) (4.214)
+ 1.439 TECHIMP × DMNE** – 1.621 CAPIMP × DMNE*
(2.485) (–1.915)
–0.728 MATIMP × DMNE** – 0.019 CAPOUT × DMNE
(–2.310) (–1.232)
–0.335 LOGSIZE × DMNE*** + 0.211 CAPIMP × DLIC
(–4.193) (0.615)
–0.613 MATIMP × DLIC*** – 0.056 CAPOUT × DLIC
(–2.625) (–1.596)
–0.187 LOGSIZE × DLIC***
(–2.969)

Log likelihood = –161.6005

The results show that all the MNE slope dummies are significant indicating that with regard to all the four variables, the MNE affiliates behaved differently from domestic firms and licensees. In addition the three MNE specific variables, namely, FDI, TECHIMP × FDI and TECHIMP were also significant and the values of the coefficients were comparable to those that were presented in Table 2. In addition, the coefficient of DMNE is also positive and significant indicating higher export intensity among MNEs compared to the domestic firms. In other words, MNE affiliates export more and their export intensity increases with an increase in foreign equity participation. The substitution nature of foreign equity participation and technology imports is also confirmed by this result. Furthermore, as argued earlier for the MNEs, size is not an advantage for exports. In the case of licensees also, the slope coefficient of SIZE and MATIMP variables are significant indicating that their export behaviour is different from those of the domestic firms. For the licensees also, size is not an advantage for exports.

Method 3: Fixed Effect Estimates

The fixed effect estimates are presented in the Appendix, Table A1. The results support the main hypothesis, namely, that the determinants of export intensities of the three groups of firms are different. However, we will not be interpreting the individual coefficients as these

are not tobit estimates. For samples with a large number of zero observations OLS estimates are biased towards the zero observations and consequently could show the coefficients of several variables as insignificant. As expected, the fixed effect estimates are close to the OLS estimates of the unbalanced panel with some minor differences. The minor differences could be because of the characteristics of the balanced panel data that ignores the entry and exit of firms. In this industry many firms entered after 1994 and they had to be ignored in the balanced panel data analysis. Thus for the fixed effect estimates, the sample consisted solely of firms that existed and reported for the entire sample period.

Model with the Lagged Values of the Determinants

In estimating export functions, it could be argued, that some of the determinants like size and technology imports, while influencing exports could also be influenced by exports. Thus there could be simultaneity in the relationship. Under these conditions, some studies advocate the use of lagged values of the determinants. While the problem of simultaneity could be a serious problem in samples with high average levels of export intensities, it need not exist in samples with low levels of export intensities. In our sample the mean value of export intensities was less than 10 per cent. Given the low level of average export intensities, exports might not influence size or technology imports. Large firms might enjoy some advantage in exports, but exports might not contribute to large size as they constitute less than 10 per cent of sales. Similar arguments could be advanced in the case of other determinants. Further, it could also be argued that the use of the lagged values of some of the independent variables might not be appropriate in our case. For example, the use of the current values of the import of materials and components should be more relevant in explaining current exports than the use of the last year's values of materials imports. Nor is it clear why the previous year's foreign equity stake should influence the current year's exports. Nevertheless, we estimated the model with lagged values of the determinants and the results are presented in the Appendix, Tables A2–A4.

The results of the model with lagged values of the determinants are presented in Table A2. This table, along with the results of the model with intercept and slope dummies, supports the hypothesis that the coefficients (both intercept and slope) are different for the three groups of firms. As discussed in the earlier sections, several firms entered the industry during the later years of the sample period, and consequently the use of lagged variables reduced the sample size. In the case of the MNE affiliates, in the lagged variables model, TECHIMP × FDI was not significant and in its presence TECHIMP was also not significant. Hence, this variable was dropped. In the lagged model also the FDI variable was significant and the value of its coefficient remained the same as reported in Table 2 in the text. TECHIMP has a negative sign, indicating substitution relationship between FDI and technology imports at arm's length. As in the main results in Table 2, firm size is negative and significant when lagged. For the licensees also the results are similar with TECHIMP having a negative sign, DSOFT with a positive sign and DTELE with a negative sign. In Table 2, capital imports were not important,

but when lagged in Table A2 it is important. It is reasonable that capital imports influence exports with a lag. The lagged model does not work well with regard to the domestic firms, only MATIMP is important, while in Table 2 most of the variables were important.

The combined model with slope and intercept dummies reinforces the conclusions arrived from Table A2. In addition to FDI and TECHIMP variables turning out to be important, both the intercept dummies—DMNE and DLIC—are important with positive values. For MNEs, slope dummies of TECHIMP, MATIMP and LOGSIZE are important and for the licensees, MATIMP was important. In the fixed effect model also the value of the coefficients of the three groups of firms are different.

VII. Profiles of Key Firms

The determinants of export intensity can be understood further by examining the characteristics of some of the firms in our sample, not all of which could be measured in the statistical analysis.[5] Ace Software Exports, as its name implies, is an MNE affiliate that exports more than 90 per cent of its output, which is software products for data processing and web services. This small company purchased technology from abroad in 1996, but has not imported either capital goods or materials. Its export success apparently depends on its technically skilled computer professionals, which India has in abundance.

Kalyani Sharp had high exports (mainly video cassette recorders) in 1997 and 1998, amounting to 52 and 35 per cent of total sales of about $70 million in those years, respectively, because of sales to its Japanese majority owner, the Sharp Corporation. Kalyani Sharp's capital imports into its assembly operation were only at the median of the MNE affiliates in our sample, but its foreign collaboration was decisive in its export success. This company illustrates the complementary resources that foreign collaboration brings, which diminishes the influence of other export determinants for MNE affiliates.

Two MNE affiliates that have very small or zero exports are Tata Honeywell and Yokogawa Bluestar. These companies are joint ventures whose foreign parents hold 40 per cent stakes. Both joint venture companies have substantial imports of capital goods and materials, but they do not export their finished electronics products because they were established instead to serve the domestic Indian market.

Among licensees of foreign technology that do not have foreign direct ownership stakes, perhaps the best known major exporter is Infosys Technologies, about 85 per cent of whose revenue ($104 million in 1998) is earned from exports. Infosys Technologies is also a large

[5] These company sketches were obtained from news reports located by Lexis-Nexis and internet search engines, from company websites, descriptions in Indian trade publications such as *Voice & Data* and *DataQuest,* and the *Capitaline* corporate database.

importer of foreign technology, spending about one-quarter of its revenue on purchases of licences and payment of royalties.

However, other licensees achieved considerable export success without importing substantial amounts of foreign technology, as the statistical analysis showed. An example is DSQ Software Ltd, whose businesses are client server applications, re-engineering and mainframe maintenance. DSQ Software had an export intensity exceeding 75 per cent of its revenue of $28 million in 1997 despite small technology imports (a few thousand dollars only) because almost all of its employees were software engineers (educated to a high technical standard in India), it had two niche markets—Y2K and Enterprise Resource Planning—that were not at the peak of new technology, and it had its own subsidiaries abroad (the result of outward FDI) who obtained contracts and from whom it could obtain technology transfer by movement of employees in addition to or instead of purchase of licences.

Another licensee that achieved export success in the last two years, with about half of its revenue ($13 million) accounted for by exports in 1998, was VXL Instruments Ltd, which supplied computer monitors and components to resellers or as an original equipment manufacturer for companies such as IBM, Hewlett Packard, and ICL. The company had only a median level of technology imports, but it also had established a European sales and distribution centre. VXL Instruments was established quite a long time ago (for this industry) in 1986 by a team of Indian scientists. This company illustrates a frequent characteristic of Indian information technology companies that is difficult to measure in a statistical analysis: start-up and management by professional technologists. It also suggests the growing importance of outward FDI from this increasingly competitive and profitable Indian industry. Our data set does not permit us to introduce these two variables, namely, outward FDI by Indian firms, and professional qualifications of the chief executive.

VIII. Summary and Conclusions

This study demonstrates that for the information technology firms in India, the explanation of export performance depends in part on the firm's foreign collaboration and on the amount and type of technology that it acquires from abroad. For affiliates of MNEs, both explicit technology transfer from purchases of licences and payments of royalties, and tacit technology transfer received from foreign ownership contribute to greater export intensity. They do so independently, without a complementary interaction to further boost export performance.

In contrast, the explanation of export performance for strictly domestic firms that have neither a foreign equity stake nor foreign licences is different. For these firms, more imports of raw materials and components as a source of product quality improvement contribute to more exports of products, as does larger size of firm and greater capital intensity. These export determinants for domestic firms are unimportant for MNE affiliates, we argue, because the foreign ownership influence in the MNE affiliates makes them less necessary.

These results clear up some of the mixed findings from previous empirical studies and add insights to otherwise unexplored questions. We show that a better understanding of export performance can be achieved by disaggregating firms into groups based on their foreign collaboration, and by breaking down technology resources acquired internationally into different types. We show that the roles of firm size and capital intensity in determining export performance, for which previous empirical results were in conflict, depend on the type of firm.

By investigating the characteristics of particular firms in the sample, we discover other behaviours of firms influencing their export intensities that are not captured by the statistical analysis and which suggest further study. The firm's objectives, in addition to its resources, surely affect its export performance. For example, MNE affiliates that exist to produce offshore for their foreign parent are intensive exporters whether or not they import capital goods or components. To the contrary, MNE affiliates that exist to serve the local market are not major exporters even if they do import large amounts of capital goods and components. Licensees with imported technology resources that are devoted to strengthening their domestic sales will not necessarily be large exporters. Industry features are also important. Even though India is a capital-poor developing country, it possesses abundant low-wage, highly technically skilled labour, and the software industry is an intensive user of this factor. The export behaviour of software firms is not the same as firms in other industries. These conclusions suggest that future studies of exporting need to measure the firm's objective as well as its foreign collaboration and knowledge management, and to conduct analyses specific to industry.

Appendix

TABLE 3
Determinants of Exports of Indian Information Technology Firms Balanced Panel Data: Fixed Effect Results

Explanatory Variable	*MNE Affiliates*	*Licensees*	*Domestic Firms*
FDI	– 4.49E –05 (–0.038)		
TechImp	–0.454 (–0.967)	–0.059 (–0.438)	
TechImp × FDI	0.011 (0.779)		
CapImp	0.015 (0.090)	1.867*** (3.585)	–0.060 (–0.263)
MatImp	0.084 (0.786)	–0.165*** (–3.527)	0.186 (1.595)
Cap/Out	–0.0002 (–0.049)	0.036 (0.797)	0.0015 (1.482)
Log Size	0.031 (0.873)	–0.020 (–0.741)	0.052** (2.286)
Number of observations	65	101	40

Notes: Dependent variable is exports as a percentage of total sales; asterisks indicate statistical signficance at the *** 1 per cent, ** 5 per cent, and * 10 per cent levels, respectively, for two-tailed test; z-statistics are in parentheses below estimated coefficients.

TABLE 4
Determinants of Exports of Indian Information Technology Firms

Explanatory Variable	*MNE Affiliates*	*Licensees*	*Domestic Firms*
FDI	0.007** (2.253)		
TECHIMP	–1.648** (–2.513)	–0.699*** (–3.067)	
CAPIMP	–0.372 (–0.661)	0.408** (2.396)	0.108 (0.734)
MATIMP	–0.470 (–1.516)	–0.081 (–1.368)	0.311** (2.057)
CAPOUT	0.005 (0.281)	–0.075 (–1.286)	–0.024 (–0.994)
LOGSIZE	–0.211** (–2.666)	–0.059 (–1.264)	0.022 (0.401)
DSOFT	–0.043 (–0.227)	0.187** (2.159)	–0.222 (–0.250)
DTELE	–0.038 (–0.265)	–0.148* (1.699)	–0.144 (–1.581)
Constant	–0.325* (1.784)	0.191* (1.720)	–0.068 (–0.087)
Log likelihood	–30.188	–55.86	–3.761
Number of observations	76	138	69

Notes: Dependent variable is exports as a percent of total sales; all independent variables are lagged by one year. Coefficients in the table are maximum likelihood estimates from a tobit model; asterisks indicate statistical significance at the *** 1 per cent, ** 5 per cent, and * 10 per cent levels, respectively, for two-tailed test; z-statistics are in parentheses below estimated coefficients.

TABLE 5
Determinants of Exports of Indian Information Technology Firms Balanced Panel Data: Fixed Effect Results

Explanatory Variable	*MNE Affiliates*	*Licensees*	*Domestic Firms*
FDI	0.000663 (0.654)		
TechImp	–0.385* (–1.688)	–0.254 (–1.360)	
CapImp	0.113 (0.703)	1.486** (2.208)	0.157 (0.626)
MatImp	0.062 (0.467)	–0.141** (–2.429)	0.360*** (2.951)
Cap/Out	0.003 (–0.061)	0.035 (0.499)	0.034 (1.490)
Log Size	0.055 (1.622)	–0.071** (–0.2.118)	0.048 (0.944)
Number of observations	52	80	28

Notes: Dependent variable is exports as a percentage of total sales; all the independent variables are lagged by one year; asterisks indicate statistical significance at the *** 1 per cent, ** 5 per cent, and * 10 per cent levels, respectively, for two-tailed test; z-statistics are in parentheses below estimated coefficients.

TABLE 6
Regression Equation for the Combined Sample (Tobit Estimates)

EXPORT = –0.253* + 0.007 FDI** –0.365 TECHIMP** + 0.219 CAPIMP
(–1.717) (2.564) (–2.086) (0.687)
–0.045 CAPOUT + 0.577 MATIMP* + 0.072 LOGSIZE
(–0.850) (1.906) (0.671)
+ 0.564 DNME*** + 0.501 DLIC***
(2.821) (2.795)
–1.267 TECHIMP × DMNE** – 0.610 CAPIMP × DMNE
(–2.102) (–1.039)

(*Table 6 continued*)

(*Table 6 continued*)

+ 0.050 CAPOUT × DMNE	–1.009 MATIMP × DMNE**
(0.912)	(–2.523)
–0.0279 LOGSIZE × DMNE**	+ 0.190 CAPIMP × DLIC
(2.91)	(0.529)
–0.039 CAPOUT × DLIC	–0.652 MATIMP × DLIC**
(–0.522)	(–2.099)
–0.163 LOFSIZE × DLIC	
(–1.408)	

Notes: All the independent variables are lagged by one year. Log likelihood = –104.0732.

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Chapter 6

Import Liberalization and Productivity Growth in Indian Manufacturing Industries in the 1990s

BISHWANATH GOLDAR AND ANITA KUMARI

1. Introduction

Since 1991, India has undertaken a major economic reforms program. Under the program, significant and far-reaching changes have been made in industrial and trade policy. Import liberalization has been a principal component of the economic reforms undertaken. Tariff rates have been brought down considerably and quantitative restrictions on imports have been by and large removed. These reforms in import policy, along with complementary changes in industrial policy, technology import policy and foreign direct investment policy, were aimed at making the Indian industry more efficient, technologically up-to-date and competitive, with the expectation that efficiency improvement, technological up-gradation, and enhancement of competitiveness would enable Indian industry achieve rapid growth. Given that the main object of import liberalization was to improve industrial productivity, it is appropriate to ask how far has import liberalization contributed to the better productivity performance of Indian industry in the post-reform period. The present paper addresses this issue.

In the paper, estimates of total factor productivity (TFP) growth are presented for Indian manufacturing and major industry groups for the period 1981–82 to 1997–98. The object is to compare the growth rate in TFP in Indian manufacturing industries in the 1990s, i.e. the post-reform period, with that in the 1980s. This is followed by an econometric analysis of inter-temporal and inter-industry variations in productivity growth rates, aimed at assessing the effect of import liberalization on productivity growth in Indian manufacturing industries in the 1990s. Another aspect that receives specific attention in the econometric analysis is the effect of capacity utilization on measured productivity growth.

2. Effect of Import Liberalization on Industrial Productivity

There are reasons to expect a favorable effect of import liberalization on industrial productivity. This is expected to occur through several channels: (a) import liberalization will provide to industrial firms greater and cheaper access to imported capital goods and intermediate goods (embodying advanced technology), which will enable the firms improve their productivity performance; (b) greater availability of imported intermediate goods will enable the firms to exploit better the productivity enhancing potential of imported technology; (c) the increased competitive pressure on industrial units in a liberalized import regime will force them to be more efficient in the use of resources (which can be achieved through better organization of production, improved managerial efficiency, more effective utilization of labor, better capacity utilization, etc.); (d) the increased competitive pressure coupled with expanded opportunities for importing technology and capital goods will bring greater technological dynamism in industrial firms; (e) as the competitive business environment forces inefficient firms to close down, the average level of efficiency of various industries should improve; and (f) greater access to imported inputs and a more realistic exchange rate associated with a liberalized trade regime would enable industrial firms compete more effectively in export markets. This would allow them to increase their sales and reap economies of scale with concomitant gains in productivity.

Evidently, there are persuasive theoretical arguments for contemplating a positive effect of import liberalization on industrial productivity. However, this view or hypothesis does not have a strong empirical support. There have been a number of empirical studies for developing countries, including the countries of Asia, in which econometric models have been estimated to assess the effect of import liberalization on industrial productivity.[1] Some of them have found a significant favorable effect of import liberalization on industrial productivity. But, some have found no significant effect, while some others have found an adverse effect of import liberalization on industrial productivity. Thus, on the whole, the empirical evidence on the relationship between import liberalization and industrial productivity in developing countries is mixed and no definite conclusion can be drawn.

As regards Indian industry, there are two recent studies, which have examined the effect of economic reforms on industrial productivity. These are by Krishna and Mitra (1998) and Balakrishnan, Pushpangadan and Suresh Babu (2000). Both studies have used firm-level data taken from Centre for Monitoring Indian Economy (CMIE) database. Also, there is similarity in the method of econometric analysis applied in the two studies. But, the studies come up with conflicting results. Krishna and Mitra find evidence of a significant favorable effect of reforms on industrial productivity. Balakrishanan *et al*., on the other hand, find an adverse effect of economic reforms on industrial productivity. One serious limitation of both studies

[1] For a review of this literature, see Das (2002).

is that they have not used explicit trade liberalization variables in the econometric model estimated. Rather, a dummy variable approach has been taken to distinguish between the pre- and post-reform periods.

This study differs from the above two studies in several respects. The analysis of productivity is undertaken at the industry level rather than at the firm level. The source of data is also different. More important, an attempt is made here to incorporate explicitly, variables representing trade liberalization in the econometric model estimated.

3. Productivity Growth in Indian Manufacturing

This section presents estimates of total factor productivity growth in Indian manufacturing and 17 two-digit industry groups in the period 1981–82 to 1997–98. Two other studies in which estimates of productivity growth in Indian manufacturing have been presented for the 1990s are Trivedi, Prakash and Sinate (2000) and Srivastava (2000). Srivastava has carried out a careful and detailed econometric analysis of productivity growth and technical efficiency in manufacturing firms in India for the period 1980–81 to 1996–97, using data for about 3,000 companies. Trivedi *et al*. have presented estimates of productivity growth for aggregate manufacturing and five major industry groups for the period 1973–74 to 1997–98. They have used industry-level data taken from the *Annual Survey of Industries* published by the Central Statistical Organization (CSO), Government of India.

The basic data source used for the present estimates of industrial productivity is the same as used by Trivedi *et al*. (2000). Also, the methodology of productivity measurement adopted here is similar to the one used by them. However, greater care has been taken in the measurement of output and inputs, so as to obtain better estimates of productivity growth.

3.1 TFP Estimation Method

A three-input framework has been used for the TFP estimates presented in the paper, as done in several earlier studies including Trivedi *et al*. (2000). The translog index of TFP has been used for the measurement of TFP.

Under the three-input framework, the translog index of TFP growth is given by the following equation:

$$\Delta \ln TFP(t) = \Delta \ln Q(t) - \left[\frac{SL(t)+SL(t-1)}{2} \times \Delta \ln L(t)\right] - \left[\frac{SK(t)+SK(t-1)}{2} \times \Delta \ln K(t)\right] - \left[\frac{SM(t)+SM(t-1)}{2} \times \Delta \ln M(t)\right]. \quad (1)$$

In this equation, Q denotes gross output, L labor, K capital and M materials (including energy) input. $\Delta\ln Q(t) = \ln Q(t) - \ln Q(t-1)$. In the same way, $\Delta\ln L(t)$, $\Delta\ln K(t)$ and $\Delta\ln M(t)$ are defined. SL, SK and SM are respectively the income shares of labor, capital, and materials input. These add up to unity. $\Delta\ln TFP$ is the rate of technological change or the rate of growth of TFP.

Using the above equation, the growth rates of TFP have been computed for each year. These have then been used to obtain an index of TFP. Having obtained the TFP index for different years, estimates of TFP growth rate have been made for two sub-periods, 1981–82 to 1990–91 and 1990–91 to 1997–98, and for the entire period 1981–82 to 1997–98. The estimation of TFP growth rate for the entire period has been done by fitting an exponential (or semi-log) trend equation to the TFP index. To obtain the growth rates for the sub-periods, the kinked exponential model has been used.

3.2 Data Sources

The basic source of data used for the productivity estimates is the *Annual Survey of Industries*, which has been the principal data source in most earlier studies on industrial productivity in India. For making price corrections to the reported data on gross output and intermediate input, suitable deflators have been constructed with the help of the official series on wholesale price indices (*Index Number of Wholesale Prices in India*, prepared by the Office of the Economic Advisor, Ministry of Industry). These have been taken from the official publications and the publications of the Centre for Monitoring Indian Economy (CMIE). For a few specific items, other sources of data have been used to construct price indices for those items. The construction of deflator for intermediate input requires that the price indices for various categories of items be combined using appropriate weights (representing their shares in the intermediate input cost). For this purpose, the weights have been taken from an input-output table for 1989–90, prepared by the Central Statistical Organization (CSO). For constructing the capital input series for manufacturing industries, estimates of net fixed capital stock (for the benchmark year) and gross fixed capital formation (for different years) made by the CSO have been used. These have been taken from the *National Accounts Statistics* (NAS).

3.3 Measurement of Output and Inputs

Details of the methods employed for the measurement of output and inputs are given in the Appendix of the longer version of the paper published in the *Developing Economies* (December 2003). Suffice it to note here that deflated gross output is taken as the measure of output. Number of persons employed is taken as the measure of labor input. Deflated fixed capital stock is taken as the measure of capital input. To obtain a measure of materials input, the time series on value of materials (including energy) consumed has been deflated by a price index formed by taking into account the cost structure as given in the input-output matrix

for 1989–90. The estimates of deflated gross output and deflated material input have been worked out for the individual two-digit industries. These have then been added to obtain the estimate for aggregate manufacturing.

3.4 TFP Estimates

Estimates of TFP growth in the aggregate manufacturing sector are shown in Table 1. Growth rates are presented for the periods 1981–82 to 1990–91 and 1990–91 to 1997–98, and for the entire period 1981–82 to 1997–98. The table also shows, for comparison, TFP growth rates for these periods computed from the TFP indices presented in the study of Trivedi *et al*. (2000). It would be noticed that the two sets of estimates are quite similar.

TABLE 1
TFP Growth in Indian Manufacturing, 1981–82 to 1997–98

	TFP Growth Rate (per cent per annum)	
Period	*This Study*	*Trivedi* et al. *(2000)*
1981–82 to 1990–91	1.89	1.26
1990–91 to 1997–98	0.69	0.63
1981–82 to 1997–98	1.40	1.00

Note: The growth rates for sub-periods are estimated by fitting a kinked exponential model.

The estimated growth rate of TFP for the period 1981–82 to 1990–91 is 1.89 per cent per annum, which indicates a significant growth in TFP in Indian manufacturing in the 1980s. Also, there is a clear indication of a fall in the rate of growth of TFP in the 1990s as compared to the growth rate in the 1980s. The estimated growth rate of TFP in Indian manufacturing for the 1990s is 0.69 per cent per annum as against 1.89 per cent per annum for the 1980s. This finding of a decline in TFP growth in Indian manufacturing in the 1990s is in concurrence with the TFP estimates of Trivedi *et al*. (2000).

For the entire period 1981–82 to 1997–98, the growth rate of TFP in Indian manufacturing is estimated at 1.4 per cent per annum. This estimate of TFP growth rate is by and large in line with the estimates of Trivedi *et al*. (2000).

TFP estimates for two-digit industries are shown in Table 2. The estimated growth rate of TFP for the period 1981–82 to 1990–91 is positive for twelve out of the seventeen groups. For the period 1990–91 to 1997–98, the growth rate of TFP is positive for eleven groups out of seventeen. In most cases, the growth rate for the latter period is relatively lower (11 out of 17 groups). This is consistent with the finding of a decrease in the growth rate of TFP in the 1990s as compared to the 1980s at the aggregate manufacturing level.

Why did TFP growth in Indian manufacturing decelerate in the 1990s? Was this due to a negative effect of import liberalization on productivity of domestic industry, as a few studies for other developing countries have found? Or, were there other reasons for a slowdown in

TABLE 2
Estimates of TFP Growth Rates, Two-digit Industries, 1981–82 to 1997–98

		Growth Rate of TFP (% per annum)		
NIC Code	*Description*	*1981–90*	*1990–97*	*1981–97*
20–21	Food products	1.04	0.03	0.62
22	Beverage & tobacco	–0.61	–1.66	–1.04
23	Cotton textiles	2.44	–1.09	0.99
24	Wool, silk and manmade fibre textiles	3.04	1.86	2.55
25	Jute textiles	–0.24	0.81	0.19
26	Textile products	1.45	–1.15	0.38
27	Wood, wood products, furniture	2.81	–9.86	–2.41
28	Paper, paper products, printing and publishing	–0.91	0.92	–0.16
29	Leather, leather products	–0.87	1.54	0.12
30	Chemicals, chemical products	3.14	1.15	2.32
31	Rubber, plastic, petroleum and coal products	3.58	–2.01	1.28
32	Non-metallic mineral products	3.18	–0.41	1.70
33	Basic metals and alloys	0.59	2.57	1.41
34	Metal products	–0.07	1.07	0.40
35+36+39	Machinery	2.06	1.22	1.72
37	Transport equipment	1.37	2.64	1.89
38	Other manufacturing	6.55	3.32	5.22
All	Manufacturing sector	1.89	0.69	1.40

Notes: 1. The TFP estimates are based on the three-input framework.
2. NIC = National Industrial Classification.

productivity growth? One possible explanation, at least a partial one, may lie in gestation lags. There was a spurt in investment activity in the 1990s in response to economic reforms. This step-up in investment activity in manufacturing might have had an immediate adverse effect on productivity due to gestation lags.[2] A more detailed analysis of these issues is taken up in the next section.

4. Econometric Analysis of Productivity Growth Rates

This section presents the results of a multiple regression analysis applied to study the effect of import liberalization and gestation lags on industrial productivity. The analysis is based on

[2] Uchikawa (2001) has discussed about the investment boom in Indian industries in the first half of the 1990s and drawn attention to the adverse effect it had on productivity. He notes (p. 3253) that as a result of the reforms the Indian manufacturing sector had an investment boom in the first half of the 1990s. The boom was over by the mid-1990s. Although lumpy investment raised output sharply, demand did not expand as much as capacity. This led to underutilization of capacity and thus had an adverse effect on productivity. See also Uchikawa (2002, p. 48).

pooled cross-section and time-series data. Growth rates of TFP computed for the 17 two-digit industries for different years during the period 1981–82 to 1997–98 are pooled for the regression analysis. The regression equation is specified as:

$$TFPG_{it} = \alpha + \beta_1 GO_{it} + \beta_2 ERP_{it} + \beta_3 NTB_{it} + \beta_4 (ERP_{it} \cdot NTB_{it}) + \beta_5 IKR_{it} + \beta_6 REER_{t} + \beta_7 GAGR_{t} + \gamma DUMLIB + u. \quad (2)$$

In this equation, $TFPG_{it}$ is the growth rate of TFP in industry i in year t, GO_{it} is the growth rate of output (deflated gross value of production) in industry i in year t, ERP_{it} is the effective rate of protection accorded by tariff to industry i in year t, NTB_{it} is the extent of non-tariff barriers on imports in respect of industry i in year t, IKR_{it} is the ratio of recently made investments to existing capital stock in industry i in year t, $REER_{t}$ is the real effective exchange rate in year t, and $GAGR_{t}$ is the growth rate of agricultural output in year t. *DUMLIB* is a dummy variable for the post-liberalization period (taking value one for 1991–92 onwards and zero for earlier years) and u is the error term.

In the cross-sectional regression analysis of productivity growth, output growth is commonly used as an explanatory variable (see, for example, Goldar 1986, and Ahluwalia, 1991).[3] This is the reason for including output growth in the regression equation specified.

Since agriculture is an important source of demand for industrial products (both as intermediate inputs and as final consumer goods), agricultural growth is expected to have a demand-side effect on industrial productivity. Agricultural growth has therefore been included as an explanatory variable in the regression analysis.

The ratio of recent investment to capital stock has been taken as an explanatory variable with a view to capturing the effects of gestation lags in investment projects on productivity. Other explanatory variables used in the model include effective rate of protection (*ERP*), non-tariff barriers on imports (*NTB*) and real effective exchange rate (*REER*). These variables are expected to capture the effect of trade policy reforms and changes in exchange rate on industrial productivity performance. It should be pointed out that while lowering of tariff and non-tariff barriers exposes domestic industry to greater import competition, a depreciation of exchange rate would to some extent, neutralize the effects of reduced imports barriers. This has indeed been the case with Indian manufacturing in the 1990s. To assess the effect of trade reforms on productivity, it is important therefore that the real effective exchange rate be included in the regression equation as an explanatory variable.

In the regression equation specified, an interaction term involving *ERP* and *NTB* has been included. The purpose is to allow the effect of tariff reduction on productivity growth to be different for different industries or different periods of time depending on the extent of quantitative restrictions on imports. It may be argued that if the extent of quantitative restrictions on imports is low (high), then the effect of tariff reduction on productivity will be larger (smaller).

[3] This captures the effect of output growth on productivity through technological advance and scale economies.

The regression equation given above has been estimated by the Ordinary Least Squares (OLS) method. However, to take into account industry-specific factors, intercept dummy variables, one for each industry, have been used, which amounts to applying the fixed-effects model.[4]

4.1 Data Sources on Explanatory Variables

Goldar and Saleem (1992) presented estimates of the effective rate of protection (ERP) for various input-output sectors (manufacturing industries) for the years 1980–81, 1983–84 and 1989–90. In a recent study, Nouroz (2001) has presented estimates of ERP for various input-output sectors (manufacturing industries) for the years 1987–88, 1992–93, 1994–95 and 1997–98, using a methodology similar to that used by Goldar and Saleem (1992). To get a complete series on ERP for the period 1980–81 to 1997–98, the ERP estimates made by Goldar and Saleem for 1980–81, 1983–84 and 1989–90 have been combined with the estimates of Nouroz for 1992–93, 1994–95 and 1997–98, and then these have been interpolated. Next, the input-output sectors have been mapped into the two-digit industry groups. For each two-digit industry group, an estimate of ERP for different years have been formed by taking a weighted average of the estimates for the constituent input-output sectors (value added weights).[5]

As regards non-tariff barriers on imports (NTB), the estimates presented in a report of the National Council of Applied Economic Research have been used for the analysis (NCAER, 2000). These are estimates of the import coverage ratio, that is the percentage of imports covered by non-tariff barriers. The estimates of the import coverage ratio could be obtained for various input-output sectors for the years 1988–89, 1995–96 and 1997–98. The estimates for the input-output sectors were aggregated to yield estimates for the two-digit industry groups in the same way as done for ERP. The estimates for 1988–89 were used for all the years from 1981–82 to 1990–91, assuming thereby that the extent of non-tariff barriers changed very little in this period. The estimates for 1990–91 (same as 1988–89) and 1995–96 have been interpolated to obtain estimates for the in-between years. Similarly, the estimates for 1995–96 and 1997–98 have been interpolated to obtain the estimate for 1996–97.

The real effective exchange rate (REER) has been taken from a publication of the Reserve Bank of India (*Handbook of Statistics on Indian Economy*). The index is based on 36 country bilateral trade weights, base 1985 = 100.

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[4] The random-effects model was also tried. But, the results were found poor as compared to the results of the fixed-effects model—the coefficients of several explanatory variables turned out to be statistically insignificant. Therefore, for presentation in the paper and for drawing inferences from the econometric analysis, the results of the fixed-effects model were chosen.

[5] The ERP estimates used in the paper have been measured by taking the tariff-based approach. This methodology assumes that tariffs are the only source of distortion, implying that there are no quantitative restrictions (QRs) or other non-tariff barriers. For details, see Goldar and Saleem (1992) and Nouroz (2001).

Agricultural growth has been measured as the rate of change in gross domestic product of the agriculture and allied sectors at constant prices of 1980–81. The data have been taken from Reserve Bank of India, *Handbook of Statistics on Indian Economy, 1999*.

To capture the effect of gestation lags on productivity, the ratio of investment in fixed assets made in the previous two years to the existing fixed capital stock has been taken as an explanatory variable. Here, the assumption is that investments in plant and machinery need about two years' time to be able to achieve fully their potential output. This does not seem to be an unrealistic assumption to make.

The investment ratio variable described above has, however, a shortcoming. The construction of the variable is such that it should be highly correlated with the growth rate of capital input. Since in the computation of TFP growth, a weighted combination of the growth rate of capital input and growth rates of other inputs get subtracted from the growth rate of output, a spurious negative relationship may arise between the investment ratio variable and the rate of TFP growth. In view of this possibility, in some regressions, a different variable has also been tried for capturing the adverse effects of gestation lags on productivity. This is constructed as the ratio of investments made in two previous years to the investments made in the previous five years, and denoted by I2/I5. If there is a spurt in investment, this ratio should go up.

4.2 Regression Results

Table 3 presents the results of regression analysis. Regressions (1), (2) and (3) differ in regard to the investment ratio variable. In regression (1), the effect of the gestation lag is captured by the ratio of recent investment in fixed assets to existing fixed capital stock (*IKR*). In regression (2), *IKR* is replaced by *I2/I5* (for reasons given earlier). In regression (3), neither of the two investment-ratio variables is included in the equation. The specifications used in regressions (4), (5) and (6) are similar to those in regressions (1), (2) and (3), except that in these regression equations *NTB* and dummy variable for the post-liberalization period (*DUMLIB*) have been dropped (since the coefficients of these variables are found to be statistically insignificant).

The regression results presented in Table 3 clearly show a significant positive relationship between output growth and TFP growth. The coefficient of the output growth is positive and statistically significant at the one per cent level in all the equations estimated. Such a relationship between output growth and productivity growth has been found in a large number of earlier studies, including studies for Indian industries (Goldar, 1986; Ahluwalia, 1991).

The coefficient of agricultural growth is positive and significant at the five per cent or one per cent level in all the regression equations estimated. This may be interpreted as showing the effect of agricultural growth on industrial demand and hence on industrial productivity.

The coefficients of the variables representing the pace of investment activity, *IKR* or *I2/I5*, are found to be negative and statistically significant at the five per cent or higher level. These variables have been used in the regression to capture the effect of gestation lags on productivity, and a negative relationship is expected.

TABLE 3
Determinants of Productivity Growth
(Dependent Variable: TFP Growth Rate)

	Regressions					
Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
GO	0.360***	0.357***	0.345***	0.354***	0.350***	0.339***
	(10.91)	(10.62)	(10.29)	(10.93)	(10.60)	(10.30)
GAGR	0.195***	0.196***	0.160**	0.182***	0.181***	0.151**
	(2.96)	(2.89)	(2.39)	(2.84)	(2.75)	(2.32)
IKR	–25.718***			–25.52***		
	(–3.65)			(–3.68)		
I2/I5		–7.980**			–7.609**	
		(–2.35)			(–2.27)	
ERP	–0.109**	–0.083*	–0.095**	–0.109***	–0.090**	–0.103**
	(–2.56)	(–1.92)	(–2.19)	(–2.74)	(–2.19)	(–2.53)
NTB	0.012	0.028	0.030			
	(0.30)	(0.73)	(0.78)			
ERP· NTB	0.0008*	0.0007	0.0008*	0.0008**	0.0007*	0.0009**
	(1.80)	(1.42)	(1.70)	(2.10)	(1.89)	(2.39)
REER	0.088**	0.108**	0.090**	0.058**	0.076***	0.068**
	(2.05)	(2.45)	(2.05)	(2.03)	(2.60)	(2.33)
DUMLIB	1.699	1.917	1.367			
	(0.95)	(1.05)	(0.75)			
Adjusted R^2	0.357	0.337	0.325	0.360	0.339	0.328
No. of Observations	272	272	272	272	272	272

***Notes*:** 1. Figures in the parentheses are t-ratios.

2. *GO* = growth rate of output; *GAGR* = growth rate of output of agriculture and allied activities; *IKR* = ratio of recent investment in fixed assets to existing fixed capital stock; *I2/I5* = ratio of investments made in two previous years to the investments made in the previous five years; *ERP* = effective rate of protection; *NTB* = non-tariff barriers on imports; *REER* = real effective exchange rate; *DUMLIB* = dummy variable for the post-liberalization period.
3. The estimated equations include a constant term and 16 industry dummies.
   * Significant at 10 per cent; ** Significant at 5 per cent; *** Significant at 1 per cent.

Turning to the variables representing import liberalization, the coefficient of *ERP* is found to be consistently negative and it is statistically significant at ten per cent or higher level in the estimated regressions. In some equations, the coefficient is statistically significant at the one per cent level. This may be interpreted as showing the productivity enhancing effect of tariff reform (through increased competitive pressure on domestic industry).

The coefficient of *REER* is found to be positive. It is statistically significant at the five per cent or higher level in the regressions. Since there is a negative relationship between *ERP* and TFP growth, a positive relationship should arise between *REER* and TFP growth. This is so because a depreciation of exchange rate (a decline in *REER*) will counter the effects of tariff reduction.

The coefficient of the *NTB* variable is found to be positive. This is contrary to the expected relationship. However, in none of the regressions shown in the table, is the coefficient statistically significant. The coefficient of the interaction term involving *ERP* and *NTB* (i.e. the product of these two variables) is found to be positive. It is statistically significant in most equations. This may be interpreted as showing that the effect of tariff reform on productivity is stronger if there is less quantitative restriction on imports.

The coefficient of the dummy variable for the post-liberalization period (*DUMLIB*) is found to be positive, but statistically insignificant. This variable is expected to capture the net effect of all factors connected with economic reforms other than those directly included in the equation. Any differences between the pre- and post-reform periods unconnected with the reforms also get reflected in the coefficient of *DUMLIB*. Since a statistically insignificant coefficient is found, it may be inferred that this group of factors did not on balance have an adverse effect on productivity growth in Indian manufacturing.

Interestingly, when the investment ratio variable and all the trade liberalization related variables (*ERP*, *NTB* and *REER*) are dropped from the equation, the coefficient of *DUMLIB* becomes significantly negative. This shows that in order to obtain a proper assessment of the effect of reforms one should include in the econometric model, variables reflecting the reforms process, rather than use of a dummy variable for the post-reform period and expect that this will capture the effect of reforms as some earlier studies for Indian industries have done.

To sum up, the results of the regression analysis do not indicate any significant adverse effect of import liberalization on productivity growth in Indian manufacturing industries. Rather, there are indications that a lowering of tariff may have contributed positively to productivity growth. Also, it seems that the explanation for lower industrial productivity growth in the 1990s may partly lie in gestation lags in investment projects.

It should be pointed out here that the average growth rate of agricultural output was lower in the post-reform period (2.3 per cent per annum during 1990–91 to 1997–98) as compared to the pre-reform period (3.4 per cent per annum during 1981–82 to 1990–91). The slower agricultural growth may have led to a slow growth in demand for industrial product, which in turn may have caused under-utilization with an adverse effect on productivity. Thus, the deceleration in productivity growth in Indian industry in the 1990s may in part be attributed to a slowdown in the growth of agriculture in this period.

5. Capacity Utilization and Productivity

Regression analysis presented above suggested that gestation lags in investment projects was one of the factors that caused slowdown in TFP growth in Indian manufacturing in the 1990s. This, however, needs to be qualified because if gestation lags had seriously constrained industrial production in the mid-1990s, output growth should have picked up after 1997–98 because of accelerated investment during 1994–95 to 1996–97, which did not happen. Rather, the growth rate of real gross value added in registered manufacturing came down from

9.5 per cent per annum during 1990–91 to 1996–97 to 4.3 per cent per annum during 1997–98 to 2000–01.[6] Thus, gestation lags cannot provide an adequate explanation of the fall in the growth rate of TFP in manufacturing in the 1990s, though on the basis of the results obtained it seems this factor did make a contribution.

Uchikawa (2001, 2002) has pointed out that while the investment boom of the mid-1990s raised production capacities substantially, demand did not rise which led to capacity under-utilization. He notes that under-utilization of capacity manifested itself first in consumer durable and non-durable goods industries and then in capital goods and intermediate goods industries (Uchikawa, 2002: 40).

In consideration of the above points, there is clearly a need to incorporate capacity utilization into the regression analysis. It should be taken as an explanatory variable in the regression equations estimated to explain variations in productivity growth. Another variable that should be included in the regression equations is man-days worked per employee since it reflects effective utilization of the manpower available.

Table 4 presents the regression results obtained by including rates of change in capacity utilization and man-days worked per employee as explanatory variables. Data on employment and man-days worked are available in the *Annual Survey of Industries*, which were used to compute man-days per employee.[7] Capacity utilization rates were estimated for each two-digit industry for the period 1981–82 to 1997–98 using the minimum capital-output ratio method, applied earlier by Sastry (1984) and Uchikawa (2001, 2002), and several other studies. The estimates of capacity utilization obtained by this method are rather crude, but these had to be employed for the analysis as no better estimates of capacity utilization were readily available.

A strong positive relationship is found between the rate of change in capacity utilization and the rate of growth in productivity. This is obviously expected. On the other hand, the coefficient of the rate of change in man-days per employee is not statistically significant. The explanation for not finding a significant relationship between productivity growth and changes in man-days per employee probably lies in the fact that there has not been much change in man-days worked per employee in most industries, especially in the 1990s.[8]

The average rate of change in capacity utilization (across industries and years) was 2.37 per cent per annum in the pre-reform period and –1.39 per cent per annum in the post-reform period. Since the coefficient of the variable is about 0.25, changes in capacity utilization would account for about one percentage point difference in the growth rate of TFP between the pre- and post-reform period. Thus, the fact that capacity utilization in industries was growing in the 1980s and falling in the 1990s can explain most the observed difference in the growth rate of TFP between the two periods.

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[6] Growth rates based on gross domestic product of registered manufacturing at 1993–94 prices given in the *National Accounts Statistics*.

[7] Data on man-days are not available for 1997–98. The figures for 1996–97 were therefore repeated for 1997–98.

[8] Average growth rate in man-days per employee was 1.03 per cent per annum in the 1980s and 0.16 per cent per annum in the 1990s.

TABLE 4
Determinants of Productivity Growth, Additional Regression Results
(Dependent Variable: TFP Growth Rate)

	Regressions					
Explanatory Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
GO	0.206***	0.161**	0.135**	0.212***	0.160**	0.136**
	(2.69)	(2.38)	(2.18)	(2.78)	(2.36)	(2.20)
GAGR	0.209***	0.215***	0.203***	0.193***	0.195***	0.186***
	(3.18)	(3.20)	(3.08)	(3.00)	(2.99)	(2.89)
IKR	–13.900			–14.67*		
	(–1.58)			(–1.69)		
I2/I5		–3.446			–3.132	
		(–0.96)			(–0.87)	
ERP	–0.104**	–0.091**	–0.097**	–0.106***	–0.096**	–0.102**
	(–2.44)	(–2.14)	(–2.28)	(–2.65)	(–2.38)	(–2.54)
NTB	0.018	0.026	0.026			
	(0.46)	(0.68)	(0.70)			
ERP·NTB	0.0008*	0.0007	0.0008*	0.0007**	0.0007*	0.0008**
	(1.73)	(1.55)	(1.68)	(2.03)	(1.92)	(2.11)
REER	0.096**	0.107**	0.100**	0.057**	0.064**	0.060**
	(2.20)	(2.42)	(2.30)	(1.98)	(2.20)	(2.09)
DUMLIB	2.212	2.461	2.334			
	(1.23)	(1.36)	(1.29)			
CCU	0.190**	0.244***	0.272***	0.173**	0.234***	0.260***
	(2.20)	(3.27)	(3.94)	(2.04)	(3.16)	(3.82)
CMD	0.007	0.010	0.005	0.024	0.026	0.021
	(0.08)	(0.11)	(0.06)	(0.26)	(0.29)	(0.24)
Adjusted R^2	0.365	0.361	0.361	0.366	0.361	0.361
No. of Observations	272	272	272	272	272	272

***Notes*:** 1. Figures in the parentheses are t-ratios.
2. *GO* = growth rate of output; *GAGR* = growth rate of output of agriculture and allied activities; *IKR* = ratio of recent investment in fixed assets to existing fixed capital stock; *I2/I5* = ratio of investments made in two previous years to the investments made in the previous five years; *ERP* = effective rate of protection; *NTB* = non-tariff barriers on imports; *REER* = real effective exchange rate; *DUMLIB* = dummy variable for the post-liberalization period; *CCU* = rate of change in capacity utilization; *CMD* = rate of change in man-days per employee.
3. The estimated equations include a constant term and 16 industry dummies.
* Significant at 10 per cent; ** Significant at 5 per cent; *** Significant at 1 per cent.

As regards the other explanatory variables, the results reported in Table 4 are by and large similar to those reported in Table 3. A significant negative relationship is found between *ERP* and TFP growth and a significant positive relationship between agricultural growth and industrial productivity growth. Two important differences that may be noted in the regression results after inclusion of capacity utilization among explanatory variables are: (a) the coefficient of the output growth variable decreases in numerical value (but remains statistically significant), and (b) the coefficients of variables representing gestation lags become statistically

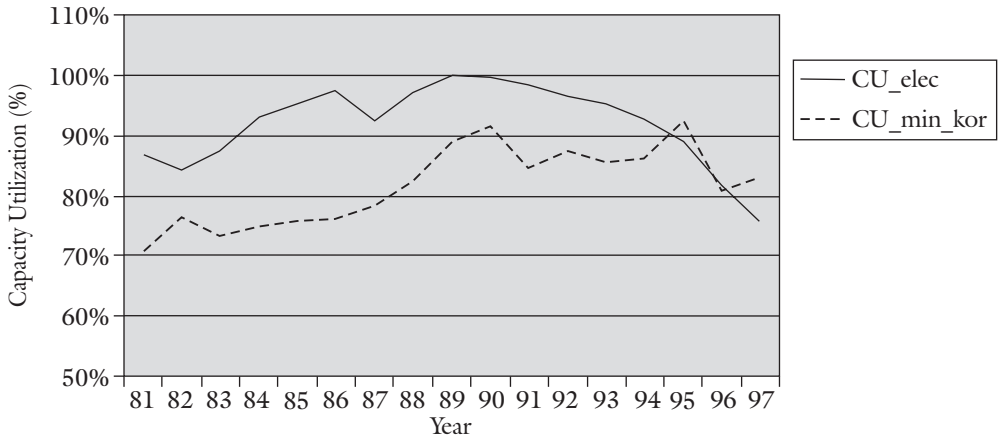
insignificant (barring one equation). It may be argued that the capacity utilization variable captures the effect of gestation lags (due to the manner of estimation of production capacity). Hence, after inclusion of capacity utilization variable in the regression equation, the variables representing gestation lags may become statistically insignificant in explaining TFP growth.

5.1 TFP Estimate for Manufacturing Adjusted for Capacity Utilization

Since the above analysis clearly shows that capacity utilization had a major effect on productivity growth in Indian manufacturing, it is important that an estimate of TFP be made corrected for changes in capacity utilization. This has been done and is discussed further below.

Estimation of capacity utilization in manufacturing has been done on the basis of electricity consumption, using a methodology applied earlier by Mulega and Weiss (1996).[9] The ratio of electricity consumption to capital stock is first computed for different years in the period under study. A trend line is fitted to the data, which is then shifted up so that it passes through the point having largest positive residual. The actual ratio of electricity to capital is then compared with the ratio indicated by the trend line (adjusted) to compute capacity utilization. The estimates of capacity utilization in Indian manufacturing obtained by this method are shown in Figure 1.

FIGURE 1
Capacity Utilization in Indian Manufacturing



CU_elec = capacity utilization estimated on the basis of electricity consumption;
CU_min_kor = capacity utilization estimated by the minimum capital-output ratio method.

[9] Data on electricity sold to industry by utilities have been used for this purpose. These data have been taken from *Energy*, Centre for Monitoring Indian Economy, Mumbai, April 2002. Since detailed industry-wise electricity consumption data are not available, this methodology could not be applied to the two-digit industries.

An alternate estimate based on the minimum capital-output ratio is also shown in the figure for comparison. This series on capacity utilization in manufacturing is obtained as a weighted average of the capacity utilization estimates for the various two-digit industries.

The capacity utilization series based on electricity consumption as well as that based on minimum capital-output ratio indicate an upward trend in capacity utilization in Indian manufacturing in the 1980s and a downward trend in the 1990s. For the 1990s, the estimates based on electricity consumption show a steeper fall in capacity utilization than the estimates based on minimum capital-output ratio.

The estimates of TFP growth in the manufacturing sector obtained after correcting for capacity utilization are shown in Table 5. The trend growth in TFP adjusted for capacity utilization was 1.3 per cent per annum in the period 1990–91 to 1997–98, only marginally lower than the growth rate of TFP of 1.6 per cent per annum in the period 1981–82 to 1990–91.

TABLE 5
TFP Growth in Indian Manufacturing, 1981–82 to 1997–98—Estimates Corrected for Capacity Utilization

	TFP Growth Rate (per cent per annum)	
Period	*Corrected for Capacity Utilization*	*Not Corrected*
1981–82 to 1990–91	1.6	1.9
1990–91 to 1997–98	1.3	0.7
1981–82 to 1997–98	1.5	1.4

Note: The growth rates for sub-periods are estimated by fitting a kinked exponential model.

Based on the results of regression analysis presented in Table 4 and the estimates of TFP presented in Table 5, it may be concluded that the deceleration in TFP growth in Indian manufacturing in the 1990s observed in several earlier studies was essentially a consequence of capacity under-utilization in Indian manufacturing in this period. Once that is corrected for, the growth rate of TFP in the 1990s was about the same as that in the 1980s.

6. Conclusion

The paper examined trends in total factor productivity in Indian manufacturing in the 1980s and the 1990s. The estimates obtained indicated that during the 1990s, a decade of major industrial and trade reforms, there was a deceleration in TFP growth in manufacturing, corroborating the findings of several earlier studies. However, a closer examination revealed that (a) capacity utilization was a significant factor influencing productivity growth in industries and (b) there was an increase in capacity utilization in manufacturing in the 1980s and a fall in the 1990s. After making corrections for changes in capacity utilization, the TFP growth estimates for the 1990s were found to be about the same as in the previous decade.

Multiple regression analysis was carried out to study the factors influencing TFP growth in manufacturing industries. The results showed a significant favorable effect of tariff reforms on industrial productivity. The analysis revealed that under-utilization of industrial capacity was an important cause of the observed productivity slowdown in the post-reform period. The regression results also indicated that slower growth of agriculture in the 1990s and gestation lags in investment project may have had an adverse effect on TFP growth in Indian manufacturing in this period.

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Chapter 7

Small-scale Units in the Era of Globalisation: Problems and Prospects

T.A. BHAVANI

1. Introduction

Small-scale units in India have assumed significance not only for their contribution to the economy especially in the creation of employment but also for the special patronage they enjoy from the government. Despite numerous policy measures for the past four decades, Indian small-scale units have remained mostly tiny, technologically backward and lacking in competitive strength.[1] Notwithstanding their lack of competitive strength, small-scale industrial units of India could survive so far due to product and geographical market segmentation, and policy protection.[2] The business environment has been changing drastically in the recent times reducing the importance of these three factors. For instance, economic policy reforms of the 1990s that have aimed at liberalisation of domestic economic transactions and opening of the economy, are slowly taking away the policy protection to the small-scale units. In this context, it is important to gauge the future scenario for these units and the ways of dealing with it. Accordingly, this paper analyses the on-going changes in the business environment, the consequent structural transformation of industries and their implications for the small-scale units. At the beginning itself, I would like to assert that protection (provided by an external agency like the government) can never be a viable alternative to the inherent competitive strength

[1] *Ninth Five Year Plan 1997–2002*, vol. 2, Planning Commission, Government of India, New Delhi, p. 609; Ayyar (1994: 39); *Report of the Expert Committee on Small-scale Enterprises* (Abid Hussain Committee) 1997, Ministry of Industry, Government of India, New Delhi, p. 151; and Tendulkar and Bhavani (1997: 50–51).

[2] Tendulkar and Bhavani (1997: 40).

of any economic organisation as it is neither possible nor feasible in the long run. Protection is a transitory measure and can be used only to give time to industrial units to improve their competitive strength.[3] All industrial units, small or large, have to sustain themselves on their own competitive strength by successfully facing competition in the market economies. Even to provide employment (an argument that has been widely articulated in favour of protection to the small-scale industries) in a sustainable way and at higher wages,[4] industrial units have to be competitive and commercially viable. Hence, we focus on the possible ways of improving the competitive strength and commercial viability of small-scale units keeping the requirements of the changing context in mind. Apart from the general purpose analysis meant for the small-scale sector at large, we examine the implications of the changing context with reference to the small-scale units in three industries, namely, garments, electronics and auto components.

The paper is organised in four sections. Section 2 analyses the changes in the business environment and its implications for the Indian small-scale sector at large. The next section summarises the important characteristics of the selected industries such as product composition, nature of the market served, technology used, industry structure and their likely future with a special emphasis on the position of small-scale units. The final section summarises the important findings and makes concluding remarks.

2. Changes in the Business Environment

Rapid economic development has been the primary objective of independent India. It has been pursued through industrialisation especially the development of basic and heavy industries within the ideological framework of a 'Socialist Pattern of Society' stressing equitable distribution.[5] In order to ensure equitable distribution, the State, as the principal agency acting on behalf of the society as a whole, assumed direct responsibility for the development of industry. The State's direct involvement in the development of industry resulted in the formation of a dominant public sector and heavily regulated private sector.[6] To enable the government to control the course of industrial development, public utilities and industries that were essential

[3] It was implicit in the Mahalanobis (1963: 72–73) that formed the basis for the development strategy of India and explicit in the famous Karve Committee (Committee on Village and Small Scale Industries, Second Five Year Plan, p. 30), which provided an immediate base to the policies on small-scale industries. Despite this, perpetual protection of small-scale industries had become a goal of the policies relating to small-scale industries overriding the primary objective, namely, improvement in the competitive strength of these industries. See Tendulkar and Bhavani (1997).

[4] The importance of employment generation flows from the fact that employment is the *only source of income* to a majority of the population. In order to raise the levels of living of the majority, the primary objective of our development strategy, it is essential to create high-wage employment.

[5] *Second Five Year Plan*, pp. 24–25.

[6] Tendulkar (1993: 282).

but required heavy investments were reserved for the public sector.[7] The private sector was subjected to controls and regulation through the Industries (Development and Regulation) Act 1951 and various policy instruments were used to guide the private sector industry into socially desired patterns. Some of the important policy instruments that have been in practice were industrial licensing, capital issues control, price controls and distribution controls.[8] Of these, industrial licensing has been the basic and the most comprehensive instrument that has acted as a big barrier to entry and thus given assured markets to the few existing industrial units.[9]

As regards external policies, these were guided by the principle of import substitution, which in turn had been prompted to some extent by the strategy of self-reliance but to a major extent by the scarcity of foreign exchange. The continuing and often acute shortage of foreign exchange involved the use of policy instruments like import licensing, quantitative restrictions on imports and high tariff rates.[10] In addition, there were restrictions on foreign direct investment, import of technology and foreign collaborations of industrial units.

All these policies together provided complete protection to Indian industry by eliminating the scope for foreign as well as internal competition.[11] Within this generally sheltered business environment, small-scale units have been protected further through measures such as reservation of certain products for exclusive production in the small-scale sector, reservation of some of the products produced in the sector for purchase preference by government agencies, supply of scarce materials, input price concessions like lower interest rates and numerous fiscal measures such as excise duty exemptions and other tax concessions.[12]

In addition, geographical and product market segmentation gave small-scale units isolated sheltered markets. For example, product differentiation in terms of quality coupled with the existing income inequalities segmented the product market into two parts: price-sensitive and quality-insensitive segment, and price-insensitive and quality-sensitive segment. Lower income households and government constitute the former segment while the higher income households constitute the latter market segment. Small-scale industrial units mostly being producers of lower quality but cheaper products cater mainly to the price-sensitive and quality-insensitive market segment. Product market segmentation exists in India for numerous consumer items such as water heaters, washing machines, pressure cookers, tape recorders, sewing machines,

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[7] *Industrial Policy Resolution 1956*. This does not mean that the public sector was confined only to the reserved areas of producion. During the course of time, the public sector has expanded indiscriminately to many areas. See Marathe (1989).

[8] For details of the controls one can refer to Bhagawati and Desai (1970: 120–24); Lucas (1988: 185); Marathe (1989: 36); and Srinivasan (2000: 3–4).

[9] See, for instance, Bhagawati and Desai (1970: 269); Ahluwalia (1988: 153); Tendulkar (1993: 287); and Srinivasan (2000: 3–4).

[10] Bhagawati and Desai (1970: 282–95); and Marathe (1989: 168).

[11] Bhagawati and Desai (1970: 272); and Tendulkar (1993: 289).

[12] See Tendulkar and Bhavani (1997).

garments and footwear. Underdevelopment of infrastructure like transport created sheltered local markets for small-scale units. The only competition these units have so far faced is the competition with each other due to the overcrowding.[13] The business environment has, however, changed drastically since 1990s due to new economic policies.

World over the business environment has been changing fast. Three features of this change are of critical importance to industrial units. First, there has been a shift, for the past two decades, in the economic policies of the nations especially developing nations from 'policy regulation' to 'market orientation' exposing their industrial units to market competition to a greater extent. Second, globalisation in the sense of increasing integration of world economies is taking place resulting in intensifying the market competition. Thirdly, past few decades have experienced rapid technological developments in numerous areas. All these developments have changed the methods of doing business drastically. We elaborate on these features in the Indian context and examine their implications for the small-scale units in the subsequent paragraphs.

Remarkable shift in the economic policies of many developing nations from the 'state intervention' towards 'market orientation' was apparent from the early 1980s.[14] In India, a major reform process has been under way since July 1991 to liberalise the regulations on domestic economic transactions. Some of these reforms are the abolition of licensing requirements for investments for majority of industries, opening of hitherto reserved areas of public sector to the private sector, reduction in price controls, reforms in capital markets, etc.[15] All these policy reforms are taking away the closed and assured markets of the Indian industry, exposing it more and more to market competition. Though the reforms are yet to touch the policies directly relating to the small-scale sector, new economic policies have already exposed this sector to market competition indirectly. For example, overall reduction in excise duties has automatically reduced the major benefit of the small-scale units, i.e., excise duty exemption. Feeling the pressure of competition, large-scale units are trying to expand their markets by getting into the lower end as well as rural segments of the product market for many consumer goods and thus opening the sheltered markets of small-scale units created by the product and geographical market segmentation.

Globalisation whether taken in a limited way in terms of 'multilateral trade liberalisation',[16] or in the broader sense of 'increasing internationalisation of production, distribution and marketing of goods and services',[17] has resulted in the opening of the markets and thus leading to intense competition. For example, the World Trade Organisation (WTO) that regulates multilateral trade enforcing its member countries to remove import quotas and other import restrictions, and to reduce import tariffs.

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[13] Overcrowding in the sector has been brought in Sandesara (1982: 112 & 121) and Tendulkar and Bhavani (1997).

[14] Biersteker (1995: 74).

[15] Ahluwalia, I.J (1996: 18–29); Ahluwalia, M.S. (1999); and Srinivasan (2000: 6).

[16] Bhalla (1996: 2).

[17] Harris (1993) cited in Bhalla (1996: 2).

India has to bring down its tariff rates, as per the GATT (General Agreement on Tariffs and Trade) agreement, to 40 per cent for finished products and 25 per cent for intermediate goods. In addition, India has been asked to remove quantitative restrictions on imports by 2001 and all export subsidies by 2003.[18] As a result, every single individual enterprise in India, small or large, whether exporting or serving the domestic market, has to face competition. The process has already been initiated for the small-scale units by placing 586 of the 812 reserved items on the OGL (open general license) list of imports. This opens up the possibility of direct competition in the domestic market with the imports of high quality goods from the developed countries and cheap products from the other less developed countries. A Business Today survey of consumers in two cities, i.e., Delhi and Chennai shows that toys and garments that have been reserved till recently are already hit by imports.[19]

Competition in the domestic market would further be intensified with the arrival of multinational companies as the restrictions on foreign direct investment have been removed. The 1990s have already witnessed the entry of many multinational companies in areas such as automobiles and electronics. In fact, in the electronics industry where numerous small-scale units are engaged in the manual assembly of imported kits/components of goods like tape recorders, have already been hit by the presence of multinational giants such as Sony.[20]

To be able to compete with imports or multinational corporations in the domestic market or to export successfully without any external support, Indian industrial units, small or large, need to improve their productivity and quality, to reduce costs, to go for higher performance products and better services, all to be delivered simultaneously.[21]

Equally important are the non-trade issues of WTO such as TRIMs, TRIPs, and the stringent sanitary, environment and labour standards. Some of the multilateral agreements on these issues like that of TRIMs (Trade Related Investment Measures) intensify the competition further and others either threaten to take away the comparative advantage of Indian industries or to enhance the competitive advantages of new technologies. With the implementation of the agreement on TRIMs, Indian input supplying units like that of auto component units (as a set) do not automatically get their market share. These units have to compete in the wide-open markets for their market shares. The agreement on TRIPs (Trade Related Intellectual Property Rights) takes care of the intellectual property rights by enforcing the patent rights, copyrights and related rights, and the protection of industrial designs, trademarks, geographical indications, layout designs of integrated circuits and undisclosed information. Accordingly, the member nations are asked

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[18] Kumar (2000: 33–35).

[19] "Life After QRs" in *Business Today*, 6 July 2001.

[20] During her discussions with the concerned industry associations and field survey of small-scale electronic units, the author was informed that many small-scale units in the electronics industry were closed in the past few years.

[21] Bhalla (1996: 9–12); Chandra and Sastry (1998: 26); Mashelkar (1998: 16); Islam (1996: 13); Ahmad (1996: 40); and Sharma (2000: 40–43).

to modify their existing laws.[22] Once these laws come into force, unauthorised usage of the patented innovations, trademarks, etc., becomes difficult. It is of critical significance for the Indian industrial units, as a majority of these units are involved in the unauthorised duplication of products without any formal technology transfers.[23] The magnitude of the possible impact of the TRIPs agreement on the small manufacturing sector can be gauged from the contribution of the food and chemical industries, the potential victims of the modified Patent Act, to this sector. Food processing units constitute 16.5 per cent of the total number of units, 14.42 per cent of the total fixed assets, 13.14 per cent of the total employment, 21.84 per cent of the total production and 11.40 per cent of the total value added of the small manufacturing sector and stands first in all these respects excepting the last one where it stands second as per the Second Census of Small-Scale Industries. And chemical units contribute 9.48 per cent of the total fixed assets (third position), 12.27 per cent of the total production (second position) and 15.09 per cent of the total value added (first position) of the small manufacturing sector in the year 1987–88.[24] Some estimates show that there are 9,000 registered and 7,000 unregistered small-scale units producing drugs alone.[25]

Similarly, SPMs (sanitary and photo-sanitary measures) empower countries to deny imports from certain regions for reasons like spread of diseases. While the environment standards enhance the importance of new technologies, labour standards, if agreed and implemented, remove totally the comparative advantage of having cheap labour for the Indian industry especially the small-scale sector.

Increasing internationalisation of production, distribution and marketing of goods and services has given rise to global commodity chains. The presence of global commodity chains makes it essential for the industrial units to be a part of the chain in order to access the markets and technology. So far, Indian industrial units especially small units are operating in isolation, which cannot be continued any more. However, to get into the international production and trade networks, individual units have to satisfy the buyers' standards in terms of price, quality and delivery schedules.[26]

Major changes in the past few decades both in the basic sciences and in applied fields like technology have altered the manufacturing processes as well as the nature of inputs and outputs. Mechanical devices have been replaced initially by electrical, later by electronic and very recently by computerised machines. Microelectronics-based technologies permit increased automation of a wide range of operations in many industries.[27]

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[22] WTO (1999: 321–56); and Braga (1996).

[23] See for instance, Desai (1984: 249), "But far more widespread than these formal technology transfers was unauthorised duplication of products. Unauthorised imitators have penetrated a wide range of engineering product markets on the basis of lower prices, arising largely from lower wages."

[24] Verma (1995: 8–9).

[25] Lanjouw (1998: 9).

[26] Gereffi (1995: 119–128).

[27] Mody, *et al*. (1992: 1797).

Simultaneously, there have been numerous organisational changes. The organisation of a production process involves plant layouts, materials management, work allocation, production schedules, quality management, inventory control, and so on. Some recent developments in the area of organisation include total quality management (TQM), Just-in-time (JIT), new standards for scrap management, machine reliability, inventory control and so on.[28] Also, an increasing consumer preference for variety has changed the ground rules of competition from the mass production of standardised products to flexible specialisation of manufacturing customised products and thus altered the ways of organising the production system. Accordingly, changes are required in production schedules and work organisation such as multi-skilling and multi-tasking.[29]

Exchange of information in business has traditionally been carried out through paper documents delivered by messengers or postal services and off late by fax. With the advent of computer and communication technologies, more efficient alternatives are available nowadays. These new technologies not only enable firms to acquire accurate and up-to-date information but also provide it faster. In addition, the new technologies can store, process and retrieve a variety of data forms, ranging from simple numbers to video images.[30]

These developments in various dimensions of technology while enabling industrial units to supply high quality products at cheaper prices and in time at the same time, by being rapid, also make the existing technologies obsolete very easily and thus create the necessity for upgrading these often. Until and unless Indian industrial units continuously upgrade their technologies, it is difficult for these units to withstand the international competition that is due to liberalisation and globalisation, and to survive. This observation applies more particularly to the small-scale units as these lag far behind both in terms of technology and competitiveness.

3. Salient Features of the Selected Industries

In this section, we bring out some of the important characteristics of the structure of the selected industries, viz., garments, electronics and auto components and the requisite changes in their structure due to the changing business environments.

Garment Industry

The garment industry is one of the dynamic sectors of the Indian economy, which is growing at a rate of 20 per cent per annum for the past two decades.[31] It is also one of the major

[28] Mody, *et al*. (1992: 1797).

[29] Kaplinsky (1994), "Future Factory" in *The Economist*, 1989 and "Meet the Global Factory" in *The Economist,* June 20, 1998.

[30] Mody and Dahlman (1992: 1703).

[31] NIFT (1998: 2).

employment generating industries and larger earners of foreign exchange for the country. The direct employment of the industry was about 0.6 million persons in 1980 and has gone up to around 2.0 million persons in 1992.[32] The exports of garments were worth US$ 2.58 billion in 1990–91 and have risen to US$ 4.91 billion by 1997–98.[33] These exports accounted for about 9 per cent of total Indian exports in 1981–82. The share has almost doubled to 17 per cent by 1994–95.[34]

The Indian garment industry began in an unorganised way in the sense that scattered, small players entered the business to avail immediate gains that came in the form of external demand. This character was further enhanced by the seperable production stages and reservation of garments for exclusive production in the small-scale sector.[35] As a result, the garment industry in India is highly disintegrated and consists of disparate groups of small-scale units which are confined to a particular small activity.[36] According to the Textile Committee Report 1991, 80 per cent of the units in the industry are very small and tiny units. Tailoring, the basic production operation has, generally, been subcontracted to numerous fabricators located in residential, commercial and industrial areas of metropolitan cities.[37] Significant activities like processing of fabrics and value added activities like embroidery, applique and sequin work are carried out in several nondescript and tiny units.[38,39] As regards the physical technologies, the industry by and large employs older technologies. Pattern making and finishing operations are done, mostly, manually. Though cutting machines are present, a good number of units cut the fabric using hand shears and treadle machines. Manually operated sewing machines account for 83 per cent of the sewing machines.[40]

As regards the market, the Indian garment industry serves both the international and domestic market. However, the two segments of the market are independent of each other in terms

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[32] Koshy (1997: 72).

[33] Koshy (1997: 72).

[34] *Compendium of Textile Statistics 1995*.

[35] The production of garments has been reserved for small-scale units officially defined in terms of ceiling limit on the original value of investment in plant and machinery. This industry was opened for large-scale units in July 1993 subject to an export obligation and a limit on the investment in plant and machinery. Recently, Government of India has de-reserved the garments industry unconditionally. *Economic Survey* 2000–2001, p. 145.

[36] Koshy, (1997: 1); and Khanna (1991: 77).

[37] Khanna, (1991: 114).

[38] Koshy (1997: 1).

[39] Data relating to the various aspects of the industry are almost non-existent even with the government as it is highly unorganised. Whatever little information is available pertains to the export sector (Khanna 1991: 47–48). Most of the details are collected through primary surveys conducted by individuals. Accordingly, details presented in this section, mostly, relate to the export segment. Limited qualitative information presented about the domestic market is collected through the author's interaction with the industry associations and individual entrepreneurs.

[40] Koshy (1997: 72–73); and Khanna (1991: 127).

of the units serving and the nature of product. The exports of textiles have been subjected to quantitative restrictions in the importing developed countries under the Agreement on Textiles and Clothing (ATC) in 1995. A major proportion of the Indian garment exports have so far been to quota countries like USA, UK and Germany though the percentage share of these countries in the Indian garment exports has been declining over time.[41] Also, the Indian garment exports are confined to few product categories like men's shirts and women's tops.[42] Further, cotton-based apparel dominate the Indian garment exports and most of the fabric is obtained from the power loom sector.[43] The Indian garment exports are of relatively low value added, non-branded simple products and low fashion garments in the low and medium range prices.[44] Hence, cost competitiveness is more important.

A majority of the Indian garment export firms deal *indirectly* with the marketing and manufacturing of their products. This can be seen from the dominant presence of merchant-exporters and fabricators in the industry. Of the 30,844 garment exporters registered with the Apparel Export Promotion Council (AEPC) by 1994, 9.97 per cent were manufacturer-exporters and 90.03 per cent were merchant-exporters.[45] At the production level, as mentioned earlier, core tailoring operations are mostly subcontracted to fabricators. The significance of the fabricators can be seen from the fact that they have 71 per cent of the total machinery and contribute an equal percentage to the total employment of the industry.[46] It indicates less control over quality, time, costs and the ability to satisfy the customers.

Although majority of the population even in urban areas even today go for made-to-measure clothing,[47] the domestic market for garments has been growing at a rate of 25 per cent per annum and was estimated as worth US$ 5 billion rupees in 1994[48] mainly on account of children's clothing. Further, this domestic market is dominated by wholesale dealers who get the garments made by tiny fabricators after supplying them with the sample piece and fabric.

Changes in the rules of international trade in textiles as well as the on-going domestic policy reforms are expected to aggravate the market competition for Indian garment units. As per the ATC, quota restrictions on different textile products by the importing developed countries will be eliminated by the end of 2004. Consequently, international trade in textile

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[41] Bhavani and Tendulkar (2000: 4).

[42] These two items together constitute 40.25 per cent in quantity and 43.48 per cent in value of total garment exports in the year 1994. See Koshy (1997: 16); Khanna (1991: 77–78); and Ramaswamy and Gereffi (1998: 125).

[43] 81.44 per cent of the exports in 1994 were of cotton garments. See Koshy (1997: 83); and Khanna (1991: 41 78).

[44] For cotton woven garments, unit value realisation (UVR) of India is much lower than Malaysia, Hong Kong and China. See Koshy (1997: 83); Khanna (1991: 41 & 78); and Meyanathan and Ahmed (1994: 15).

[45] Koshy (1997: 37).

[46] Textile Committee Report 1991 cited in Berry (1997: 4 & 6).

[47] Khanna (1991: 104).

[48] Koshy (1997: 12).

products will directly come under the jurisdiction of the World Trade Organisation (WTO). With the elimination of quotas, there would be a free-for-all situation in which a large number of exporting countries have to compete with each other.[49] With the entrance of other low-wage countries like Bangladesh and Vietnam, there would be severe competition for Indian garment units even in the low-end market segment. Integration of the textile trade with the WTO would add to the situation the rigours of some of the new clauses of trade relating to the environment and labour.[50] On the other side, India has already opened its domestic market to textile imports from the USA and EU as per its bilateral agreements. In addition, a liberalisation of investment policies is bringing in multinational companies to the domestic market. The net result would be severe competition for Indian garment units in the domestic as well as the export markets.

In order to survive in the changed business environment, the Indian garment industry has to undergo a total metamorphosis. First, this would require *direct* dealing with the manufacturing and marketing of the products. Direct dealing with the manufacturing, demands immediate in-house tailoring operations and vertical integration of as many operations as possible in the long run. Vertical integration is expected to bring the requisite scale besides control over technology, quality and delivery. In addition, a shift from low quality manually-operated machinery to power-driven machinery is essential to ensure speed and quality. Marketing through direct channels like manufacturer-importers and developing strategic alliances with these will help Indian units to get to know the markets as well as technological changes and will equip them better to deal with the rapid market changes.

Electronics

The electronics industry[51] constitutes 7–8 per cent of the manufacturing value added of India.[52] It is one of the fast growing and labour intensive industries of India. Total employment in the industry has increased from 130,000 persons in 1981 to 345,000 persons in 1997.[53] Production in this industry has grown progressively: 150 million rupees in 1960; 1,730 million rupees in 1971; 8,885 million rupees in 1981; 102,000 million rupees in 1991–92 and to 221,000 million rupees in 1997–98.[54]

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[49] Quota regime led to the entrance of several countries in to the textile exports than otherwise. See Raffaelli (1994: 67).

[50] Some of the companies surveyed by the author reported that they had to satisfy environmental and labour standards to procure export orders.

[51] The present study considers only hardware electronics not software.

[52] Gowen and Hefler (1993: 209).

[53] GEI (1999: 120).

[54] GEI (1999: 1.4).

The Indian electronics industry comprises six categories namely, consumer electronics, instrumentation and industrial electronics, data processing systems and other office equipment, communication and broadcasting equipment, strategic electronics and electronic components. Of all the segments, consumer electronics contributed a major proportion (34.4%) of the industry's production in 1997–98 followed by the components segment (19.9%). Instrumentation and industrial electronics, and communication and broadcasting equipment accounted for about 14 per cent each, in the total production of the industry. Data processing and office equipment constituted another 13 per cent of the industry's production. The remaining 4 per cent of the industry's production came from the strategic electronics segment.[55]

At the industry level, around 13 per cent of the domestic production has been exported during 1997. At the segment level, the data processing system occupies a lead with exports amounting to almost 45 per cent of its production. Electronic components occupy the second place with 19 per cent of its production going in for exports. Exports from the other segments are much lower in percentage terms.[56]

As regards the industry structure, there were 3500 units engaged in electronics production during 1997. Of which, 71 are public sector units, 625 units are in the organised private sector and more than 2800 are registered small-scale units. In addition, there were numerous unregistered smaller units engaged in the assembly of consumer electronics, instruments and electronic components. The top 200 units including 50 small-scale units account for nearly 73 per cent of the industry's production.[57] Thus, there has been a competitive market structure for a majority of the products of the industry.

The small-scale sector accounts for nearly 35 per cent of the production and 48 per cent of the employment of the electronics industry. A majority of these units are located in the Delhi region and are involved, mostly, in the production of consumer electronics, computers and components.[58] Some of the consumer electronics products that have been produced by the small-scale sector are TVs, tape recorders, calculators, etc. The manufacturing process in a majority of the cases consisted of manual assembly of mainly imported components.[59] Hence, materials and labour are the significant constituents of the cost of production. Most of these units produce low quality products at lower prices for the lower end segment of the local markets.

Currently, the Indian electronics industry is undergoing transformation due to the new economic policy of the 1990s and the rapid technological developments in the electronics area. As a part of this new economic policy, the Indian government has liberalised the wide spectrum of investment, trade and fiscal policies relating to the electronics industry. With the de-licensing of the entire consumer electronics industry and the removal of the restrictions

[55] GEI (1999: 1.4).
[56] GEI (1999: 7.1).
[57] GEI (1999: 1.13).
[58] GEI (1999: 1.16 & 1.18).
[59] Chhachhi (1999: 9); Joseph (1995: 129); Khan (1997: 15); and Papola (1989: 75).

on foreign investments, almost all the important global players like Thomson, Sony and Gold Star have entered the Indian industry either directly or through collaborations with the local companies. These multinational companies brought in the renowned global brands and offer consumers a wider choice in terms of product features, quality and competitive prices.[60] In addition, all the components, raw materials and capital goods relating to the industry are made free to import and duties on these imports are reduced.[61] Import duties are rationalised by fixing the duties on raw materials broadly at 35 per cent, for processed parts at 50 per cent, for components and peripherals at 80 per cent and for final products in the range of 90 to 150 per cent.[62] All these changes have not only intensified the competition in the domestic market but also expected to transform the domestic industry on the pattern of the international electronics industry.

The international electronics industry has been experiencing faster technological developments. Rapid technological changes are not only affecting the product composition but are also transforming the manufacturing configurations of the industry. These technological developments, on the one hand, are creating a new set of products that are fast replacing the old ones and on the other hand, leading to automation in manufacturing.[63] These new technological developments necessitate the use of costly and complex automated manufacturing and testing facilities and highly skilled personnel.[64] Labour is becoming less important, and capital and technology are increasingly becoming more important factors of production in the electronics industry.[65] Slowly, trade-offs among different parameters like quality and cost are disappearing.[66] Technological innovations have also offered potential for lower costs though at higher volumes[67] and hence making scale important. As a result, large firms dominate the markets though small-scale firms have a scope in niche markets. See for instance, computer industry where large firms dominated the established markets and small firms are present only in the new markets and products.[68]

Technological changes have also made various parts of the industry interdependent and have transformed electronics as a global industry[69] forcing the firms across the world to go for strategic alliances, joint ventures, equity participation and marketing arrangements.[70] All these features of the electronics industry also indicate that a firm's competitiveness can largely be built through latest technology, supplier and customer networks.[71]

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[60] GEI (1999: 1.2).
[61] GEI (1999: 1.3); and *The Hindu Survey of Indian Industry*, p. 121.
[62] Gowen and Hefler (1993: 212); Chhachhi (1999: 12).
[63] Wellenius (1993: 5); and Miller (1993: 18).
[64] Wellenius (1993: 7); Joseph (1995: 136); and Sakuma (1995: 177).
[65] Wellenius (1993: 6); Kimmel (1993: 158–59); and Gowen and Hefler (1993: 214).
[66] Miller (1993: 18–21).
[67] Wellenius (1993: 5).
[68] Flamm (1993: 49).
[69] Langlois, *et al.* (1988: 5–7).
[70] Thomson (193: 96–98).
[71] Wellenius (1993: 6); and Ernst and O'Connor (1992: 9).

All these changes have made the manual assembly of lower end products by the small-scale units no longer feasible. The survival of the Indian electronic firms in future depends critically on developing or, acquiring and adopting the latest technologies. Given the high costs of technological development and short-product cycles, it is required that Indian firms go in for collaboration with other firms both for acquiring technology and for marketing their products. All these demand that the Indian small-scale units effect not a marginal change but a total transformation such as a shift away from manual assembly to automation.

Automotive Components

Automotive components refer to all those parts and components that are used in making automobiles except the chassis and body. An automobile consists of more than 20,000 components each performing a different function.[72] The Automotive Components Manufacturers Association (ACMA) of India classifies these components into six different categories depending on the broad type of function they serve in an automobile. These include the following: engine parts, electrical parts, drive transmission and steering parts, suspension and braking parts, equipment and others.

The automotive components industry in India produces the entire range of parts required by the domestic automobile industry. It caters to nearly 82 per cent of the domestic market demand while the remaining 18 per cent is served by imports.[73] Production of the automotive components industry for the year 1997–98 has been estimated at 120.318 million rupees. Of the total production of the industry, the organised sector produces goods worth 92.552 million rupees, i.e. 77 per cent. In the production by the organised sector, engine parts, electrical parts, drive transmission and steering parts, suspension and braking parts, equipment and other components constitute 34.2 per cent, 7 per cent, 20.3 per cent, 7.3 per cent, 6.3 per cent and 14.9 per cent, respectively.[74] The Indian automotive components is considered a low volume and fragmented industry.

As regards the market for automotive components, a major proportion (nearly 55 per cent) is the vehicle industry for the original equipment. Replacement demand constitutes 35 per cent of the domestic production. Exports account for the remaining 10 per cent.[75]

The industry structure of the Indian automotive components industry can be taken as a minor variant of 'dominant firm with a competitive fringe' with a few firms together controlling the dominant share of the market leaving a tiny share of this to numerous small firms.

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[72] ICRA (1999: 31).

[73] These percentages refer to the year 1996–97. Domestic market demand is calculated as the sum of domestic production and imports minus exports. The contribution of the domestic industry is taken as the percentage share of domestic production minus exports in the domestic market demand. Domestic production, exports and imports of the automotive components are given in *ACMA: Facts and Figures, 1997–98*, pp. 35, 82 and 89.

[74] ACMA (1997–98: 35); Group-level contribution is not available for the unorganised sector.

[75] ICRA (1999: xi).

Three to five firms corner more than 75 per cent of the market for almost all the products.[76] For example, three players, namely, Escorts Mahle, India Pistons and Shriram Pistons and Rings, dominate the piston segment by contributing more than 70 per cent of the turnover of the industry.[77] Jay Bharat Maruti and Mark Auto are the industry leaders in the sheet metal parts with around 70 per cent of the industry's turn over.[78] These firms play a dominant role mainly due to some degree of independence in the design of the concerned product and continued technological upgradation.[79] However, the quality levels of the Indian component manufacturers, at large, are low when taken in terms of customer rejection rates compared to their international counterparts.[80]

The unorganised small-scale sector is estimated to contribute nearly 23 per cent to the industry's total production.[81] They produce low technology products that require simple production set-ups like gaskets, engine valves and sheet metal components.[82] Most of these units employ older technologies including second-hand machines.[83] Usually, the small-scale sector plays a role in the production of those components for which excise duty is high as small-scale units are given excise duty concessions that lowers the price of their products. The unorganised small-scale sector mostly caters to the replacement demand with few exceptions like sheet metal components.

The new economic policy of liberalisation and globalisation of 1990s changed the rules of the game in the industry. Following its endorsement of the WTO agreement, India has already opened its economy to transnational corporations which resulted into the entry of many international players like General Motors, Ford, Honda, Peugout, Volvo, Mitsubishi, Hyundai and Daewoo in the vehicle industry along with Delphi and Visteon,[84] both US corporations in the Components industry. The time is not too distant before the Indian automobile industry gets fully integrated with the global industry. The immediate consequence of this will be an increasing competitive pressure in the domestic market. In the long run, it is expected that the Indian automobile industry including the components segment will take shape along the lines of the global automobile industry.[85]

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[76] ICRA (1999: 32, 40); Narayana (1989: 39–40); and Gumaste (1988: 70).

[77] ICRA (1999: 55).

[78] ICRA (1999: 104); ICRA study discusses the industry leaders of many automotive components.

[79] Narayana (1989: 49).

[80] ICRA (1999: 41).

[81] ACMA (1997–98: 35).

[82] ICRA (1999: 38); and NCAER (1999: 2.11).

[83] ICRA (1999: 38).

[84]Delphi and Visteon are controlled by General Motors and Ford respectively. These two companies manufacture almost all the automotive components with few exceptions. *Business India*, April 19–May 2, 1999, pp. 113–116.

[85] This has already been perceived by some of the Indian companies. See for instance, Suresh Krishna, Chairman and Managing Director, Sundaram Fasteners Ltd. says, "I don't think India will be able to bypass the global trend of mergers and acquisitions. There will be contraction of players in India." *Business India*, April 19–May 2, 1999, p. 113

Faced with the severe competition that is forcing cost reductions, global vehicle industry is going in for consolidation at the manufacturing level and tierisation in the component supply chains.[86] International vehicle manufacturers are consolidating their positions through acquisitions and mergers so as to produce many models economically.[87] International vehicle manufacturers are also trying to reduce their costs through a rationalisation of their supply chains. Instead of buying individual components from the numerous component manufacturers and assembling them in their own premises, vehicle manufacturers have started purchasing the systems like the entire engine. In this way, these producers are reducing several of their costs namely, overhead costs, transaction costs and research and development costs. Vehicle manufacturers are also asking component suppliers to share warranty costs. Now, the system suppliers form tier one in the supply chain and are expected to play a significant role in the development and production of the vehicle. System suppliers further procure sub-systems or components from the other suppliers. These other suppliers form either tier two or three in the supply chain. To become a tier one company, component suppliers have to be really large and technological leaders. Consequently, the components industry is also expected to witness a spate of mergers, acquisitions and alliances. So, in future the economic viability of the component suppliers depends on their ability to integrate systems, operate globally, raise quality and manage warranty costs.[88]

The new economic policy reforms of the 1990s have changed the situation drastically by reducing the importance of fiscal concessions on the one hand and by raising the market competition on the other. Industry is now facing direct competition from the international players. In order to deal with the situation, Indian component manufacturers including the dominant players have to improve their technology as also quality and have to get into the global supply chains of the vehicle manufacturers[89] or into the dealer network for the replacement market. In particular, small-scale units have to phase out their older and manual machinery and to go in for new and automatic machinery as also to improve their organisational methods so as to supply quality products in time.

4. Concluding Remarks

In this paper, we have examined the on-going changes in the business environment and the possible ways of improving the competitive strength and commercial viability of Indian small-scale units in the changing scenario.

[86] ICRA (1999: 20–23).

[87] See "Whose Car Is It Anyway?" in *Business Standard*, Weekend, July 15/16, 2000, p. viii for the picture of consolidation of major international players like General Motors, Ford, Daimler Chrysler, Volkswagen and Fiat; AIAM (1999: 40).

[88] ICRA (1999: 7).

[89] ICRA (1999: 105, 111).

Our analysis indicates that *while liberalisation has exposed all industrial units including small units to market competition to a greater extent, globalisation intensifying the market competition by allowing imports and multinational corporations into India relatively easily. In order to withstand competition, Indian industrial units especially the smaller ones need to improve their productivity and quality, to reduce costs (given the higher qualities) and to go for higher performance products and better services. This means substantial improvements in the various dimensions of technology, namely, transformation (mechanisation), organisation and information.* Small units not only need to upgrade their technologies immediately but also should keep track of the on-going changes in technologies.

Agreement on TRIPs, once implemented, makes the production of any product possible either through internal innovation or through formal transfer of technology by not allowing unauthorised imitation. This, in turn, makes the *Indian industry dependent on multinational corporations as these are the prime developers of a majority of products. This coupled with the emergence of global commodity chains due to increasing internationalisation of production and distribution of goods and services makes it sensible for Indian units to be a part of these chains as they provide industrial units access to later technologies and market.* However, to get into the international production and trade networks, individual units have to satisfy the buyers' standards in terms of quality, price and delivery schedules. This demands to begin with some technological upgradation on the part of small-scale units.

In the case of the selected industries, namely, garments, electronics and auto components, the same holds true. *Economic policy reforms of India made it inevitable for these industries to integrate with the global industry by getting into their global commodity chains for which they have to upgrade themselves in terms of the physical technology employed, the organisation as also the products*. In specific, garments units have to in-house their tailoring with high quality power-driven machinery in order to ensure quality and timely delivery of their products. Whereas, small-scale electronic units are required to get into mechanised production (which is becoming incresingly automated) with high quality testing instruments if it is to remain in production while it should consider a shift from production to sales and servicing of the products of large-scale units including multinational corporations if to remain in the electronics area. A shift away from the manual machinery to the automatic machinery and the adoption of improved organisational methods such as total quality management system (ISO9000) is essential for the small-scale auto component units to ensure the supply of quality components in time.

Our IDPAD study on technological change in the Indian small units revealed that scale of operation is one of the most important factors influencing changes in technologies followed by finance and information.

So far, the policies on small-scale units have been supply-driven and paternalistic in nature leading to dependency. The individual unit-centred atomistic approach that is dominated by continuous protective and discretionary promotional measures did not provide any incentive for these units to solve common problems such as inadequate finance and lack of information through collective efforts; and to grow into medium and large-scale units. Rather the existing policies created pervese incentives to these units to remain small and to operate in an isolated

manner while unable to provide infrastructure and to remove their basic problems, namely, limited access to markets and finance, and thus to technology.[90] This cannot continue for long.

Policy measures need to be revamped so as to encourage the growth of small units. It requires the elimination of protective measures and strict enforcement of time bound promotional concessions. Time bound concessions like for example, excise duty exemption for 5–7 years in the initial years not only gives the needed protection at the start to a particular unit but also enables government to help many more units over time. *Overhaul of policy measures should also take into account the effective ways of making information and finance available to these units, removal of hurdles like labour legislation and inspector raj and provision of basic infrastructure. While doing so, policy agencies should keep inter-industry differences in mind. Government should also encourage industry associations and various private organisations to play a role in the technological upliftment of the small-scale units* rather than itself trying to do everything ineffectively as it was doing so far.

All the external support including policy assistance has a meaning only when the individual units are motivated and seek this. Industry and government agencies can play a significant role in educating small units about the changes in the business environment and the necessity of going in for technological upgradation. To play a meaningful role, it is very essential for the both the industry associations and government agencies to change their attitudes and to instil trust and confidence in the small units.

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[90] Tendulkar and Bhavani (1997).

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Section I

Growth

(c) Agriculture

Chapter 8

The State of Indian Agriculture and Prospects for the Future

RAMESH CHAND

During last one decade several adverse trends have emerged in Indian agriculture. Growth rate of GDP agriculture has decelerated sharply after mid-1990s whereas population dependent on agriculture has been rising at almost the same pace. As a result, per capita income for the population dependent on agriculture is not growing. This is considered a major factor for the large scale rural distress and a large number of suicidal deaths by farmers in various parts of the country. Domestic produce is finding it hard to compete with import and for export; and terms of trade for agriculture have turned adverse under the influence of international prices. Disparities between per worker income in agriculture and non agriculture are widening. Inter-regional variations in agriculture productivity are high and have been rising. Natural resource base of agriculture is shrinking and there are signs of degradation of land and overexploitation of water in the country. Food security of the country, achieved through hard labour of the last four decades is also seen to be under threat.

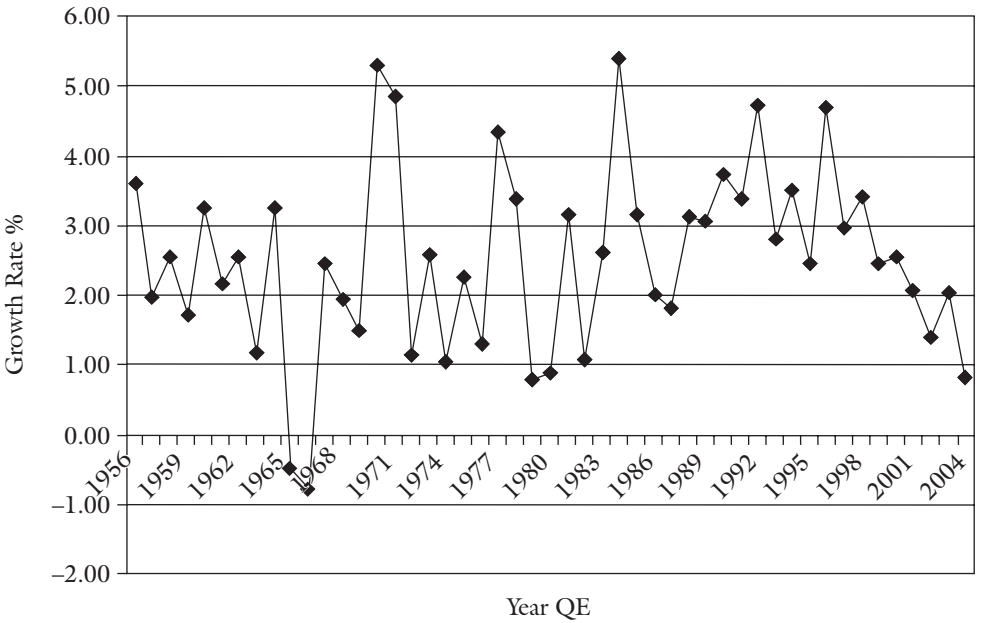
In this backdrop the present paper highlights various challenges confronting India's agriculture sector and discuss the causes underlying these challenges. The paper also offers suggestions for reforms in agriculture sector to overcome various problems that afflict India's agriculture. An attempt is made towards the end to look into the future of Indian agriculture.

I. State of Agriculture Growth and Farm Income

Indian agriculture depends heavily on vagaries of nature, particularly on the amount and distribution of rainfall, as more than 60 percent of area under cultivation does not have access to irrigation. Due to this, there are wide yearly fluctuations in total output and in the annual rates

of growth based on such output. In order to have a better understanding of growth trends, output series was smoothened by taking five yearly (quinquennium) moving average of output. Annual rates of change based on the quinquennium average of GDP agriculture since 1955–56 are presented in Figure 1.

FIGURE 1
Annual Growth Rate in GDP Agriculture based on 5 Yearly Moving Average Series: 1956 to 2004



Growth in agricultural output witnessed somewhat decelerating trend in the initial years after Independence and then turned negative during mid-1960s. The country then decided to adopt high yielding varieties of cereals, first of wheat and then of paddy, which helped in reversing the declining growth trend. Output growth improved considerably around late 1960s. In early 1970s there was a setback to growth due to oil crisis. Again in 1979–80 India faced very severe drought which caused a dip in agricultural output. After that, agricultural output followed accelerated growth trend till 1995–96 after which agricultural output moved on a declining growth path. Last 50 years do not show deceleration in growth of agricultural output for such a long time as seen after 1995–96.

The series on growth rate indicate that different phases of growth coincide with different phases of agricultural policy. In the pre green revolution period, net area under cultivation increased from 118 million hectare to 138 million hectare. Despite large expansion in area, GDP agriculture experienced 2.66 percent average annual growth rate. Adoption of high yielding varieties during late 1960s led to substantial increases in productivity of two principal crops grown in India, namely wheat and paddy, which raised output growth to 2.76 percent during

15 years following onset of the green revolution. However, adoption of green revolution technology during this period remained concentrated in north west plains and some areas in southern India, both of which had assured water supply for irrigation. Around 1980–81 improved technology spread to several other regions and agricultural economy diversified. This resulted in further acceleration in growth of agricultural output. This period also witnessed sharp acceleration in growth rate on non agriculture sector. After mid-1990s growth rate in agricultural output declined sharply.

The slowdown in growth of GDP agriculture caused much more severe impact on income of those who were dependent on agriculture. This was seen by looking at level and growth of value added in agriculture per worker during the 5 years centered on 1971, 1981, 1991 and 2001 for which census estimates of number of agricultural workers were available. During 1970s per worker farm income increased annually by 1.08 percent. The growth rate accelerated to 1.16 percent during 1980s. During the last decade farm income per worker increased merely by 0.28 percent.

II. State of Competitiveness

Efficiency was not a serious issue in Indian agriculture till recently. As there was scarcity of food in the country the policies emphasized increase in production without much emphasis on reducing average cost of production. Further, agriculture sector was by and large insulated from competition from abroad through strict regulations on imports. Thus there was no pressure to reduce supply price. With liberalization, issue of efficiency has become highly relevant as domestic production has to compete with products of other countries. In the recent years domestic prices of several agricultural commodities have turned higher than international prices. India is not able to check import of a large number of commodities even at high tariff. This is true not only in the case of import from developed countries where agriculture is highly subsidized but also in the case of products from developing countries. India is facing import threat in the case of items like edible oil from Malaysia and Indonesia, spices from Vietnam, China and Indonesia, tea from Sri Lanka and rice from Thailand and Vietnam. This raises the question as to why most of the commodities produced in India cannot compete with produce from international market. Is it due to low efficiency in production or due to some other reasons?

Efficiency in trade involves efficiency at various levels—production, marketing, processing, transport etc. Farmers in India are at a considerable disadvantage in respect of storage, marketing, processing, transport and post harvest infrastructure. For several commodities, transport cost from surplus to deficit states is much higher than the freight from other countries to India (Chand 2002). Similarly, domestic regulations and statutory charges add heavily to raise domestic prices.

III. Equity

Equity in India is generally considered in terms of sectoral and regional aspects. Sectoral inequity can be seen from growth rate in non-agricultural and agricultural sector and trend in per worker income in agriculture and non-agriculture. After mid-1990s growth rate in agriculture decelerated very sharply, whereas, non-agriculture sector witnessed growth around 7 percent (Table 1). This has created a large gap in the performance of agriculture and non agriculture sectors.

TABLE 1
Growth Rate in GDP Agriculture and Non Agriculture Sectors in Different Periods, at 1993–94 Prices: Percent/Year

Period	*Total Economy*	*Non Agriculture*	*Agriculture*
I. Pre green revolution			
1950/51 to 1964/65	3.95	5.59	2.66
II. Green revolution period			
1965/66 to 1979/80	3.62	4.40	2.76
III. Wider technology dissemination period			
1980/81 to 1994/95	5.37	6.56	3.33
IV. Post reforms			
1995/96 to 2003/04	5.69	6.95	1.86

Source of Basic data: National Accounts Statistics, CSO, GOI, various issues.

TABLE 2
Level and Growth in Per Worker Farm Income at 1993–94 Prices

Period	*Agricultural Income Per Worker Rs.*	*Growth Rate in Income in Previous 10 Years %/Year*
1968/9 to 1973/74	8947	
1978/9 to 1983/4	9961	1.08
1988/9 to 1993/4	11179	1.16
1998/9 to 2003/4	11496	0.28

Source of basic data: Population Census, GOI and Same as in Table 1.

Faster growth in output of non agriculture sector did not help much in shifting workforce from agriculture to non-agriculture sector. Between 1980–81 and 2000–01 share of agriculture in national income declined from 38.8 percent to 25.5 percent. The workforce engaged in agriculture in the same period witnessed a very small decline, from 60.5 percent to 58.4 percent (Table 3). Slow growth in agriculture, with no significant decline in labour force, has created a serious disparity between agriculture and non-agriculture and urban and rural India. The magnitude of this can be seen from per worker income in agriculture and non-agriculture presented in Table 4. During the two decades after 1980/81 per worker income in

TABLE 3
Share of Agriculture and Allied Sectors in National Income and Employment

Year	*Share in NDP at Current Price %*	*Share in Employment %*
1980–81	38.8	60.5
1990–91	33.2	59.0
2000–01	25.5	58.4

Source: Same as in Table 2.

TABLE 4
Per Worker Income in Agriculture and Non Agriculture Sectors at 1993/94 Prices

	Income Per Worker Rs.		*Ratio of Non Agriculture to Agriculture Income*	*Growth in Last Decade %/Year*	
Period	*Agriculture*	*Non Agriculture*		*Agriculture*	*Non Agriculture*
1978/9 to 1983/4	9961	28430	2.85		
1988/9 to 1993/4	11179	39355	3.52	1.16	3.31
1998/9 to 2003/4	11496	59961	5.22	0.28	4.30

Source: Same as in Table 2.

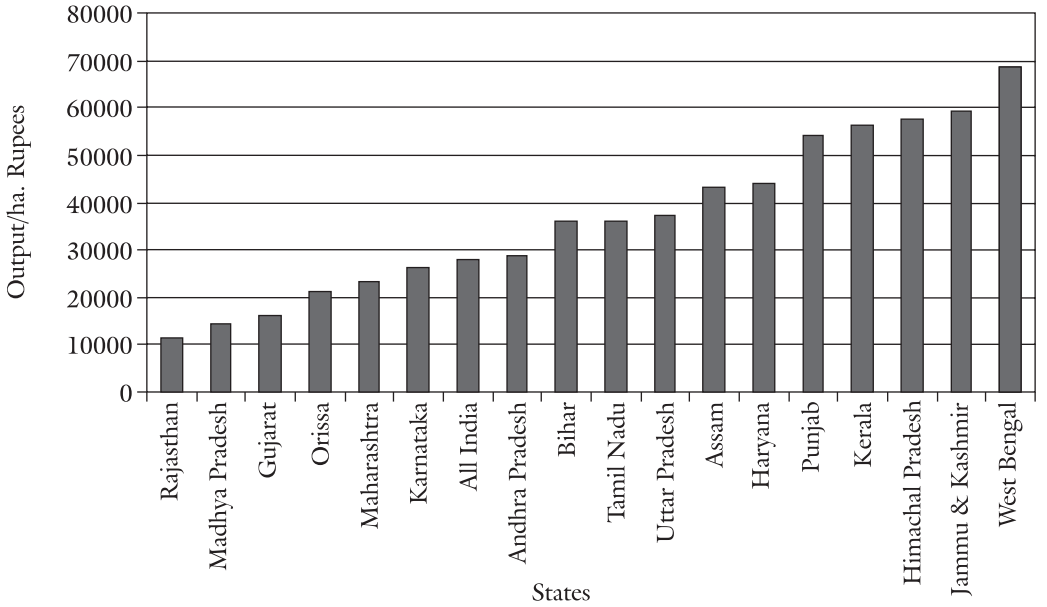
non-agriculture sector has more than doubled whereas in agriculture this increase is less than 12 percent. As a consequence, one worker in non-agriculture sector earns more than the income of five workers in agriculture. This disparity is causing lot of concern in the country.

The second aspect of disparity is inter regional. Some regions of the country are agriculturally well developed and have successfully experienced socio-economic transformation through improvement in agricultural productivity and growth. However, agriculture in several regions remains backward, with low productivity and poor growth. The extent of regional variation in agriculture sector can be seen from Figure 2. Further, regional variation in NSDP agriculture per ha cultivated area increased from 54 percent during 1984–85 and 1985–86 to 66 percent during 2003–04 and 2004–05.

IV. Sustainability

India has only 4 percent of world's water resources and 16 percent share in population. Obviously, the water scarcity is more acute in the country compared to world average. Demand for water is rising rapidly for non-agricultural uses as well as agricultural uses. The more serious conflict is seen in the case of water use in agriculture. In the case of groundwater this conflict is reflected in present v/s future use of water and in the case of surface water (river water) the conflict is seen in inter-state water disputes over sharing of river water. Conflict between two southern states namely Karnataka and Tamil Nadu over sharing of water of river Cauvery is a classic case of future scenario of water conflicts in India. The more recent incident

FIGURE 2
Regional Variations in Crop Output per ha. of Cultivated Area during TE 2002–03



occurred in North India where state of Punjab unilaterally abrogated the water treaty with neighbouring states of Haryana and Rajasthan and declined to honour the past agreement to supply water to Haryana into the newly constructed Satluj-Yamuna link canal where millions of rupees have been already invested. Farmers in Rajasthan have resorted to agitation against short supply of canal water where again some farmers have lost their lives. This kind of incidences are expected to increase in future.

According to some scholars availability of ground water for irrigation would emerge as a critical bottleneck for self sufficiency in foodgrain by the year 2020, as demand for irrigation would exceed its availability by nearly 30 percent (Chopra and Goldar 2000). Similarly, National Commission for Integrated Water Resource Development Plan has projected that requirement for irrigation water in India would grow by more than 50 percent by 2050. Based on various assessments it is concluded that even after fully exploiting available water resources, water supply can match the demand only if there is a big improvement in efficiency of irrigation.

Water table in several states is getting depleted at a fast rate. In some parts like north-west India it is leading to lowering of water table and in some parts in hard rock area of peninsular India overexploitation of water has led to mining of water from deeper and deeper aquifers and ultimately to borewell failure. In this area some years back farmers found cultivation of commercial crops very profitable and started expanding irrigation using pumpsets and borewells. As the hydrological factors were not favourable for recharging groundwater in the area the farmers driven by profit motive started digging deeper borewells crossing 800 feet.

But even the deeper borewells did not last for long. These heavy investments incurred by taking debt have not only ruined groundwater but also devastated farmers in the region. Forced by the distress hundreds of farmers have been driven to commit suicides. This is best illustrated in the story of village Musapally (available on net at: www.indiatogether.org/2004/jun/psa-sinkbore.htm) which has more borewells than people. This village in district Nalgonda, Andhra Pradesh, has over 6000 borewells for 2000 acres land under cultivation. Over 85 percent borewells have failed and rest are in for decline. The desperate search for water is reported to have bankrupted this once prosperous village.

Even in the Indo-Gangetic region, which was known to have adequate water resources for providing assured irrigation and where shallow tubewells have brought green revolution, farmers have started digging borewell at the depth exceeding 500 feet as groundwater in upper aquifers is depleting.

While demand for water is rising rapidly, flow in rivers is declining. This is happening because of siltation in rivers and degradation of watersheds due to overgrazing, deforestation and increased human activities.

V. Food Security

India achieved impressive growth in food production after adoption of green revolution technology. Per capita production of foodgrains increased from 183 kg during early 1970s to 207 kg by mid-1990s even when country's population increased by more than 50 percent. After mid-1990s foodgrain production failed to keep pace with population growth. Per capita production of cereals has declined by 17 kg and pulses production by 2 kg during the last decade (Table 5).

TABLE 5
Per Capita Production of Foodgrains, Kg: 1971 to 2007

Year	*Cereals*	*Pulses*	*Foodgrains*
1971–75	164	19	183
1976–80	172	18	190
1981–85	179	17	196
1986–90	182	16	198
1991–95	192	15	207
1996–00	191	14	205
2001–05	177	12	189
2004–07	174	12	186

Source: Economic Survey, GoI, New Delhi.

Long term trend in consumption pattern at household level shows that per capita direct consumption of foodgrains has been declining and that of livestock products and fruits and

vegetables has been going up for a fairly long time. Despite this shift in dietary pattern, foodgrains are considered to be of paramount importance for household food and nutrition security. This is because of four reasons. One, cereals and pulses are staple foods and there is no perfect substitution between staple foods and other foods. Two, due to inadequate level of intake of almost all foods, increased consumption of other foods in most cases fill only dietary deficiency. Three, foodgrains are the major and the cheapest source of energy and protein as compared to other foods (Chand and Kumar 2006, p. 360) and are thus vital for food and nutrition security of low income masses. Four, increased production and consumption of livestock products resulting from rising per capita income require high growth in use of grain as feed for livestock. Because of these reasons, foodgrains continue to be the main pillars of food security in the country and any slack in their production translates into persistent price shock and adverse impact on common people.

Despite dietary diversification, involving sharp decline in per capita direct consumption of foodgrains in future, demand for cereals and pulses is projected to grow at about 2 percent per year on account of increase in population and growth in indirect demand. This growth rate is almost four times the growth rate experienced in domestic production of foodgrains during the last decade. This had created serious imbalances between domestic production and demand, which, for some time, was met by liquidating stock and cutting down on export. If growth rate in domestic production of foodgrain fails to rise to the required level, it would result in decline in export of rice and eventually lead to increased dependence on import for meeting domestic demand for foodgrains.

VI. Factors Underlying Poor State of Agriculture

The present challenges in Indian agriculture have resulted from cumulative effect over more than two decades. Major causes for slowdown in agricultural growth are identified as: (a) decline in area under cultivation due to expanding urbanization and industrialization, (b) deterioration in terms of trade for agriculture, (c) stagnant crop intensity, (d) poor progress of irrigation and fertilizer, (e) decline in supply of electricity to agriculture and (f) slowdown in diversification (Chand et al. 2007). Besides, regulation, price policy, institutional factors and technology are also quite important for the present state of agriculture.

Infrastructure

The State has played leading role in creating hardcore infrastructure like major and medium irrigation projects, rural roads, rural electrification, setting up of agricultural markets. However, beginning of decade of 1980s witnessed a very significant change in policy of resource allocation to agriculture. It marked the beginning of decline in public investment in agriculture and a sharp rise in subsidies provided to the sector.

After 1979–80 public investments in agriculture not only failed to keep pace with growth of GDP of agriculture sector but their level also declined (Table 6). In early 1980s more than 3.5 percent of GDP agriculture was used as public investments. In the recent years this has fallen below 2 percent. This decline in public investments in agriculture is believed to have caused adverse impact on creation of infrastructure in agriculture and on long term growth of farm output.

In contrast to public investments, level of subsidies provided on fertilizer, power and irrigation increased more than five times in real terms during 1976 to 2003. Share of subsidies in GDP agriculture was as small as 2.95 percent during 1976–80. In the recent years, level of subsidies has increased beyond 7 percent of GDP agriculture (Table 6).

TABLE 6
Trend in Public Investments and Subsidies in Agriculture Since 1976

	Rs. Crore at 1993–94 Prices		*Share in GDP Agriculture %*	
Period	*Public Investment*	*Subsidy*	*Public Investment*	*Subsidy*
1976–1980	5986	4472	3.39	2.95
1981–1985	7033	6936	3.51	4.01
1986–1990	5678	9721	2.96	4.96
1991–1995	4844	12131	2.09	5.17
1996–2000	4790	15547	1.91	5.67
2001–2003	4897	21979	1.89	7.42

Source of basic data: Same as in Table 1.

The decline in public investments has coincided with increase in subsidies. Based on this, some researchers feel that to meet the increase in current account expenditure (subsidy) government has been forced to divert resources from capital account (investment heads). Studies also show that same amount of resource going into public investment gives much higher return compared to the return from same resources going into subsidies (Chand and Kumar 2004). Diversion of resources from public investments to subsidies has two more adverse consequences. One, subsidies are resulting into indiscriminate use of water resources and degradation of land. Two, subsidies provided by Central government on fertilizer is highly skewed towards some region and towards nitrogenous fertilizer. This has distorted prices of various types of fertilizers and led to imbalanced use of Nitrogen (N), Phosphorous (P) and Potash (K). As a result, soil fertility and productivity have been adversely affected.

Agricultural Price Policy

Price support has been used an instrument of ensuring remunerative prices for some crops under a system of minimum support prices for farm produce. Minimum support prices (MSP) are meant to serve as a surety to farmers. If the market price falls below the MSP or the guaranteed level, the government would be under obligation to procure the produce, offered for sale, at the guaranteed price. Every season government announces minimum support price

for paddy (rice), wheat, sorghum, pearl millet, finger millet, maize, ragi, barley, gram, pigeon pea, moong, urad, tur, rapeseed/mustard, toria, groundnut, sunflower, soybean, sesamum, nigerseed, cotton, jute, copra and tobacco. Sugarcane is covered under statutory minimum price (SMP)—it is illegal for anybody to purchase sugarcane at less than its SMP.

Here it is pertinent to mention that mere announcement of MSP does not automatically guarantee that market price would not fall below MSP. The experience shows that institutional intervention in ensuring the guaranteed price is effective only in those regions and crops where government or public sector agencies procure the concerned commodities in a big way. Implementation of MSP shows that rice and wheat are the main beneficiaries of the policy while cotton at large and edible oilseeds and pulses in some pockets have also benefited from the policy.

Government intervention in grain markets has come under much criticism due to its regional bias and commodity bias. Official procurement of foodgrains is alleged to be helping only a few states and concentrating their operations in already developed region (see Table 7). States like Bihar, Gujarat, Madhya Pradesh, Karnataka and Maharashtra experienced sharp increase in marketed surplus of wheat after 1983–84. Similarly, marketed surplus of rice has witnessed substantial increase in several states like Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, and Orissa. But farmers in these states have hardly benefited from government procurement policy.

TABLE 7
Percent of Market Arrival of Rice and Wheat Procured by Official Agencies in Various States, Average of 1997–98 to 1999–2000

State	*Rice*	*Wheat*
Punjab	76	88
Haryana	59	76
U.P.	20	18
Andhra Pradesh	68	–
Madhya Pradesh	27	–
Orissa	36	–
West Bengal	8	–
All India	40	50

Source: Food Statistics, Ministry of Agriculture, GOI.

The system of incentive prices has remained confined to the region which was early adopter of green revolution technology and is agriculturally well developed. This region has a strong infrastructure network where private trade and markets can function effectively. Productivity in this region has approached close to plateau and price incentives are not effective for further growth. On the other hand, large region of the country is at a take off stage of improved technology but this region does not have well developed markets and private trade is exploitative. This region requires government intervention in terms of price support to encourage adoption of improved technology which has large potential for growth in output.

Technology

The level of productivity of almost all the crops is quite low in most of the states. On the other hand, Institutes under Indian Council of Agricultural Research, and State Agricultural Universities claim to have varieties and technologies which are capable of giving much higher output per unit of resources. Frontline demonstration of various departments provide clinching evidence of large gap between what is attained at farmers field with adoption of improved technology and what is attained with the practice followed by farmers. This is illustrated in the case of two major crops viz. paddy and wheat, information for which is furnished in Tables 8 and 9.

TABLE 8
State-wise Performance and Potential of Wheat as Revealed by Actual Yield and Yield with Improved Practice and Farmers Practice

Yield: Kg/ha 2002–03 to 2004–05

	Improved Practice	*Farmer Practice*	*Actual 2003–04*	*Yield Gap % between*	
State	*(I)*	*(F)*	*(A)*	*I and F*	*I and A*
Uttar Pradesh	4206	3324	2794	26.5	50.5
Bihar	3651	2905	1783	25.7	104.8
Punjab	4463	4035	4207	10.6	6.1
Haryana	4751	4520	3966	5.1	19.8
Rajasthan	3948	3724	2794	6.0	41.3
Gujarat	4034	3491	2681	15.6	50.5
Madhya Pradesh	3297	2472	1789	33.4	84.3
Maharashtra	3411	2907	1335	17.3	155.5
Himachal Pradesh	2616	2126	1380	23.0	89.6
West Bengal	2766	2081	2316	32.9	19.4
Uttaranchal	3388	2444	1877	38.6	80.5
Karnataka	3608	2761	480	30.7	651.7

Punjab, which is agriculturally quite advanced, shows yield gap of 10 percent in the case of wheat. There is a scope to increase yield by more than 25 percent in Uttar Pradesh and Bihar by adopting improved practices at farmer's field. The difference between yield at farmers field and yield attained with improved practice was more than 30 percent in Madhya Pradesh, West Bengal, Uttaranchal and Karnataka. The difference was very high between improved practice and actual yield recorded during the year 2003–04 for the state as a whole. Yield with improved practice is more than double the state average in Bihar while the gap is 50 percent for Uttar Pradesh. Wheat cultivation is now expanding to warmer areas like Karnataka and Maharashtra. Average yield in these states, particularly in Karnataka, is awfully low.

Rice in India is grown under different typologies like rainfed up-land, rainfed low land and irrigated. Under rainfed conditions improved practice can raise farmers' yield by 19 percent in Chhattisgarh, 46 percent in Uttar Pradesh, 66 percent in Jharkhand and by 134 percent in North Eastern state of Manipur (Table 9). Boro rice is now getting lot of popularity. Farmers in Uttar Pradesh obtained yield close to that with improved practice, whereas, the gap was

TABLE 9
State-wise Performance and Potential of Rice as Revealed by Actual Yield and Yield with Improved Practice and Farmers Practice

Yield: Kg/ha 2003–04 to 2004–05

	Improved Practice	*Farmer Practice*	*Actual 2003–04*	*Gap % between*	
State	*(I)*	*(F)*	*(A)*	*I and F*	*I and A*
Rainfed (upland) 2003–04					
Chhattisgarh	3740	3138	1455	19.2	157.0
Jharkhand	2292	1380	1695	66.1	35.2
Manipur	4277	1830		133.7	
Uttar Pradesh	3620	2480	1942	46.0	86.4
Rainfed (shallow lowland)/Boro; 2003/04, 2004/05					
Assam	4520	2550	1534	77.3	194.7
Chhattisgarh	3554	2784	1455	27.7	144.2
Jharkhand	3480	2300	1695	51.3	105.3
Manipur	6350	5095		24.6	
UP	3656	3432	2187	6.5	67.2
Irrigated					
Chhattisgarh	3919	3137	1455	24.9	169.4
Bihar	4883	4158	1516	17.4	222.1
Gujarat	5585	4890	1891	14.2	195.3
J&K	7488	4705	1941	59.1	285.8
UP	7050	5200	2187	35.6	222.4
Uttaranchal	3850	3200	1942	20.3	98.2

Raw data on crop yield with Farmers practice and Improved practice was provided by O/O Agricultural Production Commissioner, MOA, GOI, New Delhi.

highest in Assam. Under irrigated conditions the gap between improved and farmers practice ranged between 14 to 59 percent.

The large yield gap is a clear pointer to the potential for raising output through effective dissemination of technology. But this is not happening mainly because of absence or weak Research-Extension-Farmer linkages.

Regulations

During the last one and half decade the economic and policy environment in India has undergone significant changes mainly due to new economic policy and economic reforms started in 1991, and domestic and global liberalization. This has raised new kind of issues in agricultural markets and necessitated changes in existing regulations and system. There is a strong concern that Indian agriculture has been subject to global competition through external liberalization without first going for internal liberalization.

Only recently Central government has initiated some measures to effect domestic reforms in agriculture to change regulatory and institutional environment and for increasing participation of private sector in agriculture. These reforms include change in provision of Essential

Commodities Act, removal of restrictions on inter-state movement of farm produce, model Agricultural Produce Market Committee Act, encouragement to contract farming, forward market act and issue of warehouse receipts. These changes are expected to show their impact after some time. Agriculture being a state subject, it is important to ensure that these reforms are not diluted at state level during their implementation.

VII. Prospects for Future

The present state of Indian agriculture is a matter of serious concern and there is a need to ponder over its future. It is widely acknowledged that there is lot of potential to raise agricultural output in the country. This potential is believed to be very large in the eastern and central region of the country. On the other hand, global scenario of agricultural production is undergoing profound changes. The future prospects of agriculture would depend upon how the domestic potential is exploited and how we adjust to global changes. The prospects would remain bleak if appropriate measures are not taken. We discuss below some measures which can help in improving growth and profitability of agriculture and also address the other issues.

(a) Raising agriculture growth requires substantial increase in public investments. While Central government provides a large chunk for making investments in irrigation, R&D and special area programmes, the major initiative in this must come from states.

(b) Adverse impact of input subsidies on public investments and natural resources are well known. All subsidies like free power to agriculture should be stopped forthwith. Similarly, fertilizer subsidies have favoured more use of nitrogenous fertilizer. Subsidies on fertilizer need to be rationalized to promote balanced use of NPK and more use of micro nutrients.

(c) Good quality seed is the primary determinant of productivity. Often, farmers do not distinguish between grain and seed, and the seed replacement rate is very low. The main reason for this is non availability of quality seed and to some extent awareness. Harnessing benefit of technology generation requires well developed system for sales and distribution of seeds and plant propagation material. Till now public sector dominated multiplication and supply of seed and plant propagation material but it is highly inadequate to meet the emerging and growing needs and demand. The advantage of this is being taken by unscrupulous private trade. There is a need to develop competitive seed industry by involving private sector in seed production and distribution.

(d) Farm size in India is quite small. More than 61 percent holdings are below 1 hectare and more than 80 percent are below 2 hectares. Further, 60 percent cultivated area being non irrigated the options to go for high value agriculture at such farms are highly limited. These farms faces serious constraints in adopting modern technology and in marketing their produce. To some extent size disadvantage can be obviated through contract farming. In most cases the size of farm would remain unviable and insufficient

to provide enough income for the farmers and their families. There are two ways to raise size of operational holdings. One, create suitable jobs in non-agriculture sector to attract or pull out unviable or marginal and small farmers from agriculture sector. Two, liberalise land lease markets so that those who want to rent out land can do that without fear of losing ownership rights. Large number of farmers remain tied to small plots of land because they do not want to sell their land. This constrains such farmers to explore sources of income outside agriculture. Options for easy lease out, and income from it, would encourage several farm families to venture out of agriculture. This would also create opportunity for others to raise their size of holdings by leasing in land.

(e) Share of agriculture and allied sectors in national GDP has declined from 29.3 percent during 1990–91 to 17.5 percent during 2006–07. However, share of workforce employed in agriculture in the same period declined by less than one third of the decline in GDP share in the same period. At current rates of growth, share of agriculture in national income would drop to a low level of 13.4 percent towards the end of Eleventh Plan (2011–12). However, if the past trend continues, the workforce employed in agriculture would remain above 50 percent. This would seriously aggravate disparities between agriculture and non-agriculture sectors and affect more than half of the total population of the country. The only way to escape this kind of disturbing situation is to a shift large chunk of workforce from agriculture by creating productive work opportunities in non-farm sector.

(f) Land and water need special attention for their sustainable use. Large tracts of land in east India (acidic soils) and other places in the country needs special treatments and reclamations which would enhance their productivity. Resource conserving technologies are now available for various ecological regions. These can be very helpful to save water and energy, reduce cost and increase farmers' income. Adequate emphasis and investments are needed to harvest and conserve rain water and optimally use available water.

(g) Very strong integration is needed in Research, Education and Extension for efficient and effective delivery system. Effective system need to be evolved right from basic/strategic research to location-specific technology development, so that technologies generated are adopted at the farm level.

(h) Some countries have very effectively applied tools of biotechnology to raise yield, reduce cost of production, and improve quality of some edible oilseeds which has imparted them significant advantage (see Philips and Khachatourians 2001). There are also reports of large area being brought under transgenic crops namely soyabean, cotton and vegetables in countries like USA, Argentina, Canada and China. It is estimated that globally transgenics are grown on over 100 million hectare. The new bio tech crops can help in developing drought tolerance, and reduce use of inputs and water. The immediate benefit of success of transgenics is reduction in cost of production. However, these technologies involve environment and health risk due to which India is following a very cautious approach. Some experts claim that transgenic crops and genetically

modified foods can play a crucial role in raising quantity and quality to address the future demand and food security in India (Pental 2005) while others question suitability of such technologies for a developing country like India. They feel traditional germplasm and conventional methods of breeding are far superior to GM approach to improve nutrition quality and to enhance productivity of various crop and indicate that GM technology is expensive and full of hazards which cannot be checked through weak regulation system prevailing in the developing countries (Sahai 2005). India needs to learn from the experience of other countries, particularly from China, to take advantage of future biotech crops.

(i) Past experience indicate that food and agricultural prices in real terms followed a declining trend in the long run. Various predictions of growth in food supply falling short of growth in demand proved wrong. However, this may not repeat in the future, as the long term changes in markets will result from the growing use of cereals, sugar, oilseed and vegetable oils to produce fossil fuel substitutes, ethanol and bio-diesel. This would improve terms of trade for agriculture but at the same time points to emerging scarcity of agricultural products for use as food. This also undermines the need for self-sufficiency as global markets would turn costly and less dependable.

(j) Due to various restrictions on private sector, agriculture trade has been dominated by small-sized petty players. Due to low volume of business these small players operate by keeping large margin. Despite the presence of large number of players in agricultural markets competition is weak and there are frequent reports of malpractice and incidences of collusion among buyers. After the change in regulation several private players and big business have started evincing interest in agriculture trade. The main problem in agriculture is that farmers complain they do not get genuine price for their produce while consumers feel that they are being charged higher price without much value addition on farm produce. This can be addressed by reducing marketing margins and wastages and by improving efficiency of production and marketing. Private sector should be encouraged to forge efficient linkages between production and consumption by setting up value chains, contract farming, processing, direct marketing to benefit producers as well consumers.

(k) Distress sale of rice and maize below MSP is rampant in Orissa, Chhattisgarh, Madhya Pradesh and Bihar. These states, besides being late adopter of new technology and food deficit at aggregate state level, have several growth pockets with surplus foodgrains. These pockets are in the first stage of green revolution and agricultural development, when the private trade and market institutions are not in place to provide incentive to encourage adoption of new technology and hence output growth. Agriculture growth in such areas is stifled due to weak or missing institutional support in the form of guaranteed price. Extension of government intervention in foodgrain markets, like implementing MSP and procurement, to eastern UP, Bihar, Chhattisgarh and other potential pockets in Central and Eastern parts of the country would help in exploiting foodgrain potential of this region and to sustain food security of the country.

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Chapter 9

Trade Liberalization and Diversification in Indian Agriculture

NILABJA GHOSH

Introduction

Neoclassical theory postulates that trade liberalization would lead to higher welfare through specialization of resource use in accordance with a country's comparative advantages. In the case of agriculture this would mean that land and inputs would move away from importable to exportable crops. Such specialization could be only a mixed blessing to a country that has considerable agro-climatic diversity and is afflicted by extensive rural poverty that is concentrated in less endowed regions.

Many economists and environmentalists (Porter, 1990, Anderson and Strutt, 1996) have questioned the notion of comparative advantage as also the linkage between welfare and free trade in agriculture (Wohlmeyer, 2002). Crop specialization has the potential to damage biodiversity and cause dangerous dependency on imports. Free trade in agriculture can stimulate changes guided more by current global price signals than by long-term efficiency considerations. The mismatch between regional capabilities and international demand can be acute in resource deficient regions where options are few. In agriculture as compared to other sectors free trade leaves much less to the individual efforts of participants and much more to natural endowments. An international system devised to guide free trade on its part must be coherent with the domestic concerns of the developing countries for its own success (UNCTAD, 1995). For a large country like India with diverse agro-climatic conditions existing within the geographic territory, there is a need to reconcile this specialization effect at the country level with the diversity consistent with regional conditions within the country.

Objective

This paper considers diversification within agriculture and attempts to trace the impact of the paradigm changes of the 1990s on Indian cropping pattern through empirical observation. The three major crop groups are treated as three single 'crops', namely (1) paddy and wheat constituting the superior cereals (SCER), (2) jowar, maize and other millets constituting the coarse cereals (CCER) and (3) the crop group oilseeds (OLS) consisting of the main nine oilseed crops[1] of India. The aim is to explore if with trade liberalization, Indian agriculture has moved towards crop specialization or diversification at the national level and if the same process has disseminated into the varied regions of the country. The study is based on secondary data mostly reported by Ministry of Agriculture and involves inter-temporal comparisons and trend analyses. The paper will take a brief view of the nature of the traded crops in the following two sections and the movement of cropping pattern towards specialization will be examined thereafter using two procedures. First, diversification indices will be computed to find out the tendency of Indian agriculture. Second, the actual movements will be traced by means of linear trends incorporating breaks that identify the departures in movements. The methodologies adopted and results also occupy the same two sections.

Diversification Issues

Diversification was also the argument when rice and wheat based cropping patterns were weighed against possible alternatives on grounds of their employment potentials (National Council of Applied Economic Research NCAER, 1980; Agarwal, 1980; Bardhan, 1978; Dasgupta et al., 1977), with evidences of employment contraction and seasonality effects of mechanization. While rice and wheat cultivation are known to have relatively high employment elasticities, their downstream employment potential is low compared to oilseeds, which have significant linkages with the processing sector. Given that the Indian industrial development has proved inadequate to absorb surplus rural labor, diversification to oilseeds promised an avenue to higher value-addition in production and greater employment generation (Saleth, 1999).

The agricultural conditions in India are varied, and large tracts of land have meager moisture endowments. In general the three crop groups namely the superior cereals, the coarse cereals and the oilseeds constituted till today nearly about 70% of the gross cropped area of the country but their importance varied across regions.

[1] Groundnut, rapeseed and mustard, soybean, safflower, sesamum, sunflower, castor seed, linseed and nigerseed.

Modern agriculture started its course with the green revolution that flourished in the 1970s and most part of the 1980s, when new paradigms set in motion a new era in agriculture. The technology, with its bio-chemical foundation, was skewed in favour of superior cereals that demanded relatively more resources especially water. The green revolution was biased towards the endowed regions. While these regions shifted mostly towards superior cereals rice and wheat, the drier regions continued with the tradition of diversified cropping patterns with ample share of acreage devoted to hardy but less-valued coarse cereals and oilseeds. There was some spread of the technology towards rainfed areas in 1980s but increased inter-year variability (Bhalla and Singh, 1988) suggested the incompatibility of the technology.

Production of high valued cereals remained concentrated in certain regions and entailed subsidies on prices and inputs that gradually became unsustainable to the budget. At the same time, poverty, unemployment and even food insecurity remained widespread in regions that had lesser water resource endowments. The onus of people's welfare in these regions remained with the government. The government had to intervene in food distribution to even out supply among surplus and deficit regions and promote employment generation. Some attempt to promote crops suitable for the dry regions was initiated with the diversification move in the 1980s. Moreover, since the second half of 1980s, even the more privileged regions started stagnating and generating ecological problems. Excessive use of inputs and high budgetary burden coexisted in these regions. Diversification of cropping pattern away from cereals was prescribed for the privileged regions also[2].

Diversification in agriculture has two possible interpretations or varieties. The first implies diverting the cropping pattern into new channels. The other interpretation is related to a balanced cropping pattern as opposed to a specialized one, possibly even within the traditional options. The first was evident when the drier regions were urged to move away from coarse cereals and towards other more lucrative crops or lucrative activities. This was the motivation behind State actions like the Technological Mission on Oilseeds (TMO) and market intervention operations of the National Dairy Development Board (NDDB) for promoting oilseeds cultivation. A movement towards fruits and vegetables and other non-conventional crops and non-farm activities was also encouraged. Diversified cropping patterns of the second type has been a traditional insurance method in dry and drought prone regions for stabilizing incomes by risk spreading.

Another era was started in the 1990s. This contained the structural reforms including external sector reforms, price adjustments in favor of agricultural commodities[3], the domestic market liberalization and the globalization process following India's entry into the WTO. Trade liberalization at this juncture ushered contradictory forces on specialization. Among the major crops, India has exported cereals both rice and wheat in the recent past but oilseeds

[2] The wasteful accumulation from production in northern parts of India in the face of starvation and hunger due to poverty in less endowed regions owing to budgetary controls and inadequate distribution has been criticized and even described as 'mass murder' (Dreze, 2001).

[3] Hiking procurement prices and correcting the exchange rate over valuation were the key routes.

invariably remained to be a cheaper importable. While the latter provided a ground for diversification, the advocacy for diversification away from cereals is now contended. Rice and wheat, valuable for food security are strategically crucial for the country. The allegation of resource depletion especially in Punjab has been refuted and described as correctible anyway (Chand, 2002). The underdevelopment of marketing and processing infrastructure in lagging regions makes commercial viability of value added crops difficult. Similarly the shortsightedly created infrastructure in privileged regions has been too specialized for the dominant cereals (Shergill, 2003) making diversification in the medium term difficult. Further, the Government's procurement policy which favors rice and wheat, even in the face of contending political pressures has undergone very little change. Finally, trade liberalization has not made things easy. The price advantage has moved in favour of the superior cereals if anything and against the oilseeds. Agronomic limitations restrain the movement towards many other new crops in various regions. Table 1, using the example of both a northern and a southern state, as provided by the Cost of Cultivation data given by of the government demonstrates that superior cereals have been yielding higher returns relative to oilseeds and coarse cereals in post trade liberalization years.

TABLE 1
Economics of Select Crops in Punjab and Andhra Pradesh

Punjab (North India)			*Andhra Pradesh (South India)*		
Wheat	*Returns to Cost Ratio*	*Returns (Base RM)*	*Groundnut (GNT)*	*Returns to Cost Ratio*	*Returns (Base GNT)*
1990–91	1.04	84.73	1990–91	1.28	100.00
1994–95	1.35	159.24	1994–95	0.45	100.00
1995–96	0.87	172.54	1995–96	0.86	100.00
1996–97	1.70	328.52	1996–97	0.61	100.00
1997–98	1.26	226.51	1997–98	0.37	100.00
			1998–99	0.94	100.00
Rapeseed Mustard (RM)			Paddy		
1990–91	2.02	100.00	1990–91	0.66	71.96
1994–95	2.04	100.00	1994–95	0.99	389.16
1995–96	0.90	100.00	1995–96	0.90	160.44
1996–97	1.19	100.00	1996–97	0.95	255.64
1997–98	1.48	100.00	1997–98	0.75	293.34
			1998–99	1.14	161.58
			Jowar		
			1990–91	0.38	9.36
			1994–95	0.83	84.32
			1995–96	0.68	33.49
			1996–97	0.62	53.39

Meanwhile diversification as a policy continues its significance even in the wake of trade liberalization. The Tenth Five Year Plan calls for diversification in agriculture 'both geographically and over time' (Planning Commision, 2001) and emphatically urged for a thrust

on 'diversification towards high value more remunerative crops considering the agro climatic conditions, endowments of land and water resources and market demand within the country and without'. The justifications are many.

First, globalization, that produces crop specialization and efficiency can also usher in volatility coming with the changing patterns of demand in international markets. Keeping in view that crops have specific resource demands and adjustments are difficult in agriculture, excessive specialization in the areas of current comparative advantage can be dangerous. Added to this is the fact that food habits in India are moving against cereals[4]. A certain amount of preparedness for such changes is called for. A sudden fall in prices can lead to piling unsold stocks, farmers' distress and enhanced government emergency expenses in support and safety net operations. Agricultural insurance is still in its inception and the efficacy of the futures market is yet to be established. A certain amount of crop diversification is considered desirable as insurance in an uncertain world.

Second, even if such an adjustment is made forcefully to raise crops not in conformity with the soil climatic conditions and the results are positive in the short run, the effect could be deleterious or even disastrous in the long run. The attempt to extract a given quality or quantity of output beyond the sustainable capacity of soil will cause soil exhaustion, resource degradation and pollution. Much of the resource degradation in the world is said to have resulted from man's quest for food and fuel (IEG, 2005). Water scarce regions will have the incentive to grow lucrative crops even if they are water intensive and chemicals will be used indiscriminately to increase profits with the current system of resource pricing. All this will slow down agriculture in future and hamper its very advantage in the market. Endowed regions as those in Punjab often associated with rice-wheat rotation encounter problems of water logging and ground water depletion (Kumar et al., 1998), salinization, soil quality degradation and air pollution due to disposal of residues (Sidhu et al., 1998), all of which could be ameliorated by some amount of diversification. Areas with specific deficiencies will find it unsustainable to adjust to the demands of the international market. Sections of farmers in such areas will suffer poverty for no fault of theirs while the rich can wrest the limited resources for their immediate profits. Added to this and working in the same direction is the network of price subsidies given by the government to benefit both the poor and the rich and the lack of institutions for common and natural resources. Digging of existing of wells to greater depths and repositioning of pumps in search of the receding water table by those who can afford are responses that have already brought a crisis water situation. Even as of 2001 there were 310 blocks/mandals/Talukas/watersheds found by Central Water Commission as over exploited and 160 dark in India. This problem was reported both in the

[4] Demand patterns changed adversely to food grains bringing down the share of cereal in monthly consumption expenditure from 23.3% in early 1970s to 14% in 1993–94 and further to 12.4% in 1999–00 in urban India (Sarvekshana 2001). The rural people also behaved analogously with the share falling from 40.6% to 24.2% to 22.2% correspondingly. In fact deficit was felt in respect of oilseeds and also pulses that was reflected in protein deficiency among the poor.

northern plain region and the hard rock south. The corresponding numbers are 12 (1.09%) and 14 (1.27%) in Andhra Pradesh and 72 (52%) and 11 (8%) in Punjab. Short-term commercial motive encouraged by a boundedly rational behaviour cannot be a solution in agriculture in the times of globalization and will only be self-defeating in the long run. It will mean discrimination against the poor in particular and the farmers in less endowed regions in general who find it difficult to adjust. An inter-sectoral adjustment to move out population from agriculture could be an answer but is implausible over a reasonable horizon when the population is largely deprived of education, skill and infrastructure to make them suitable for other industries.

Finally, employment is a burning problem in India. Agriculture has employed about 65% of working population. Much of this is disguised unemployment. The land man ratio has come down with land fragmentation. Meanwhile literacy has expanded with state effort and brought a transition in labour market. It is time to develop opportunities to gainfully employ the farm population. The new generation rural Indians especially in northern India has a fatigue on farm manual labour and the educated youth even from a small farmer household prefer off-farm and skilled work to a farm labour job. In many rural areas male youth are found to be out in search of a job while farm work is left to elders and women. Agriculture needs to provide greater linkage with the processing sector.

In the external sector oilseeds have passed through several phases since 1980, with successive periods of expansion and stagnation of production translated to controls and surges in imports respectively in a market that is largely regulated. With trade liberalization however, India emerged as a major importer of edible oils despite impressive growth rates of their domestic yield rates relative to foodgrains. The high income-elasticity and the consistently growing demand for edible oils (Chand, 2004) contributed to the deficit between demand and domestic supply. Tariffs continued to be used to protect[5] the domestic oil sector, which comprises of both the oilseed producers and the refiners but the interests of the consumers and commitments to the WTO were a check on this effort. Edible oil imports have constituted around 3% of total national imports in recent years and are likely to go up with further liberalization of trade. The budgetary operations in oils and oilseeds have struggled with these contradictions of producer and consumer interests. However trade in cereals has been relatively and effectively freed of such regulations as rice and wheat emerged as India's exports in the 1990s. But the domestic policy of support continues while exports are promoted, which again creates an uneven field for oilseeds producers in terms of inter-crop price parities. Even in its latest report (GOI, Economic Survey, 2003–04), the Government of India has attributed the 'sharp turnaround in agricultural exports" in spite of a drought to 'enhanced exports of cereals (mainly non basmati rice)' and the 'growth in imports to robust increases in imports … mainly edible oils'. The unequivocal stance of the government to diversification is not borne out by these eulogies.

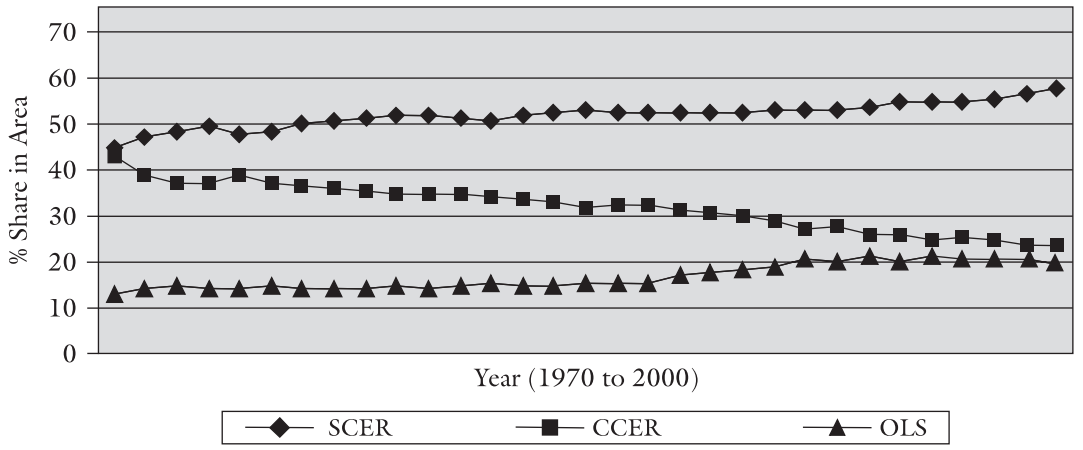
[5] Basic customs duty on refined oils have been 85% reduced to 70% for palm oil and palmolein, the major imports (GOI, 2003).

Preference for oilseeds is raised by two different factors. First, oilseeds being less water intensive are grown in drier regions and as alternatives to rice and wheat as well as coarse cereals. Second, oilseeds are linked to a large processing sector in industry. The import of re-fined oils renders the capacity excessive and discourages the sector. The major oilseeds produced in India are groundnut and rapeseed mustard. The crops act as substitutes to rice and wheat respectively and to the dwindling coarse cereals in dry regions. Rapeseed mustard is a rabi crop but others are grown in the kharif season. Other oilseeds such as sesame and castor seed are traditional but new oilseeds like sunflower and soya have taken root on Indian soils. Certain conventional crop residues are also sometimes used to produce oils.

Cropping Pattern in India

Paddy wheat, coarse cereals and oilseeds are the dominant crops in the Indian cropping pattern constituting 70% of the cropped area in 1960s. The share has come down over time mainly due to rapid fall in coarse cereal area and share. The broad trend suggests an increasing preference for superior cereals and declining one for coarse cereals and oilseeds showing changing tendencies (Figure 1).

FIGURE 1
Shares in Total Area Under Three Crops Groups



The year 1980–81 itself in the period following the new technology launch, saw a near 2% increase in share of superior cereals. The increase in share between 1995 and 1999, approximately capturing the period of globalization, was from 36.4 to 38.2%. Coarse cereals had a steady decline throughout and oilseeds share increased in late 1980s and had a small fall in 1990s.

Considering the states, all states but Karnataka, Maharashtra, Gujarat, Rajasthan all of which have extensive dry tracts, remained skewed in favour of the superior cereal crops (Table 2). Considering the period of globalization specifically, most states moved towards superior cereals crops in T.E. (triennium ending) 1992–93 to T.E. 1997–98 but against coarse cereals. No preference was noticed for oilseeds. States including drier states Karnataka, Madhya Pradesh, Gujarat and Rajasthan, and less productive states like Orissa have moved further towards SCER. The states have in general moved away from CCER and except Maharashtra, Tamil Nadu, Rajasthan and Madhya Pradesh, also from OLS during the period 1992–97.

TABLE 2
Share in Gross Cropped Area of Three Main Crops Statewise in 1990s

	Superior Cereals			*Coarse Cereals*			*Oilseeds*		
	Yield	*Area Share*		*Yield*	*Area Share*		*Yield*	*Area Share*	
T.E.	*1995–97*	*1992–93*	*1997–98*	*1995–97*	*1992–93*	*1997–98*	*1995–97*	*1992–93*	*1997–98*
AP	3727	31.56	32.25	1292	15.57	12.93	789	26.12	24.55
TN	4184	37.98	35.94	1096	20.91	14.80	1443	23.63	19.14
KRN	3126	12.68	13.94	1268	35.24	34.31	641	24.04	21.74
KRL	2823	26.91	21.37	649	0.45	0.44	603	1.16	0.93
MAH	2097	11.59	11.19	871	41.91	39.33	776	12.93	13.10
MP	1591	38.17	39.53	799	16.73	11.94	894	19.41	24.08
GUJ	2266	13.32	13.79	1157	25.82	20.75	1131	33.01	32.74
RAJ	2524	11.48	13.21	577	37.88	32.21	818	18.46	20.58
PUNJ	4394	79.23	78.65	2158	3.56	3.07	1222	2.53	3.17
UP	2743	58.31	59.83	1381	12.78	12.08	781	7.07	6.93
HRY	3823	47.64	50.87	976	15.11	13.61	1158	11.58	11.12
WB	3155	77.00	77.29	1969	1.10	0.83	782	6.87	6.28
ORS	1895	57.43	71.08	723	5.30	3.21	482	11.28	6.70
BHR	2059	71.69	73.19	1705	9.23	9.32	677	2.32	2.32

Notes: Area share in %; Yield in Kg/Hectare.

Source: Government of India.

Trade Liberalization and Crop Advantages

Literature has mostly approached the subject of competitiveness by identifying India's comparative advantage in international markets (Gulati et al., 1994; Chand, 1999; Dutta, 1997). The favorable turn in the terms of trade of globalization era was expected to promote agricultural growth and private investment in the sector. It was expected that any movement away from food grains would slow down under its effect and the growth in oilseeds sector would decelerate as India has little advantage in these products (Gulati and Sharma, 1994; Gulati, 1998). India will emerge as an exporter of rice and wheat and an importer of oilseeds. In other word the tendencies would likely move against what was accepted as diversification. The prediction was contested on grounds that non-price factors were if anything more important

than price factors and the all round specialization in superior crops defies the goal of agro-climatic regional planning set in Indian agriculture (Kashyap, 1999) that emphasizes broad based, regional and sustainable practices. Chand found that India had advantages in respect of the superior cereals, disadvantage in most oilseeds and for the coarse cereals as a whole, the direction is not confirmed either ways (see Chand, 1999). Trade liberalization and diminution of tariffs (along with progressive disprotection of industry) is viewed as ways of removing the 'tax' on agriculture which 'distorted' the production pattern towards oilseeds and away from superior cereals in which the country's comparative advantage lay (Gulati, 1998).

An alternative way of assessing the advantages is to look at it ex-post with actual trade data (Table 3), which also clearly indicates the gain of SCER in the years of trade liberalization as an export item and that of OLS as an import item. Both means of measuring the advantage however underemphasize the resource costs entailed in cultivation in various heterogeneous regions and the cost of poverty of the farmers for whom the transition is far from smooth. The ratios of the respective crop irrigation intensities to aggregate irrigation intensity reflect the well-known fact that rice and wheat constituting the export crops of the period demand more water compared to coarse cereals and oilseeds that can be raised in the vast unirrigated areas that abound in the country.

TABLE 3
Trade and Irrigation Intensiveness of the Three Crop Groups

Crop Groups	*SCER*	*CCER*	*OLS*
Net Export (Export-Import) in '000 tonnes			
1990–93	–61.67	11.47	–242.37
1996–99	1797.00	30.27	–1680.45
1999–02	1838.50	–14.83	–3857.55
Crop irrigation intensity/aggregate irrigation intensity			
1998–99	1.66	0.31	0.59

Notes: CCER refers to 'other cereals'. Oilseeds trade is reported in oils for which Export: sesamum, niger and groundnut and Imports: Edible vegetable oils fixed. Net exports are for triennium averages.

Gains from the Three Crops

Both exercises, one following the trade theory of comparative advantages and the other based on actual empirical observations of the post-WTO period trade directions confirmed that India had an advantage in SCER, a disadvantage in OLS and a near neutrality (actually with marginal advantage) in CCER. The implications of these findings can be profound for the health of agricultural sector and welfare of farmers in this agriculture-based country, besides their fiscal connotations.

Tracing the movements from late 1980s onwards the yield levels in physical terms is lowest for OLS relative to SCER as seen in Table 4. In terms of yield value (per hectare at wholesale prices) computed similarly, however CCER still falls short but OLS is close to SCER and

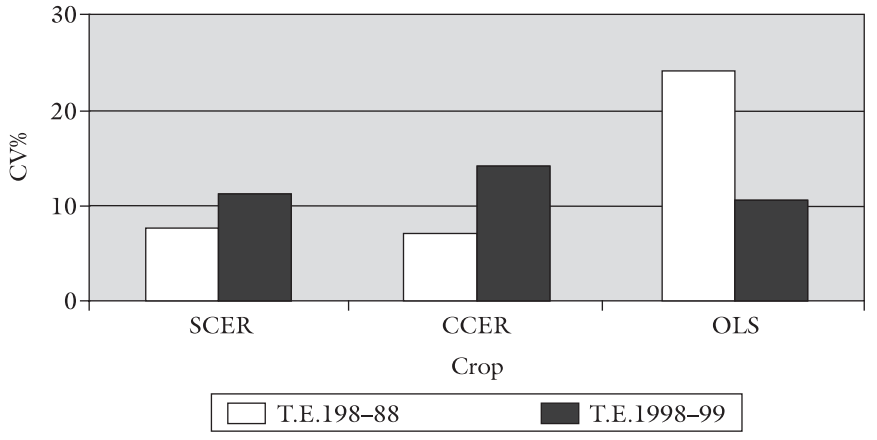
TABLE 4
Productivity Indices of the Three Crops (Base is SCER)

	Yield Rate Physical			*Yield Rate Values*		
T.E.	*SCER*	*CCER*	*OLS*	*SCER*	*CCER*	*OLS*
1983–84	100.00	38.88	31.29	100.00	39.95	100.38
1987–88	100.00	33.81	29.25	100.00	33.30	105.34
1993–94	100.00	36.01	29.98	100.00	36.05	97.94
1998–99	100.00	38.62	32.87	100.00	35.28	91.08

Note: Triennium averages are taken. Valuation is in whole-sale prices.

exceeded the latter in the first two time points. But in 1990s the yield value from OLS is found to have come down relative to SCER giving credence to the emergent advantage of the latter group. The determinant of the yield value is not only physical yield but also market price, that too adjusts to vagaries of production that has a relation with international price and is influenced by the domestic and external policies of the country, given that India has progressively integrated its agriculture with the world market from the later 1990s. The picture traced is a combined reflection of the boom and the saturation of the technology effect on SCER through the physical indices, the positive albeit an unsustained OLS related policy of the government, improved performance of CCER yields and the effect of trade liberalization and protection policy. Appreciating that variability is also an important factor in the comparison, Figure 2 indicates that SCER has become more variable in yield-value after trade liberalization and CCER has behaved even more so. This is in tune with the expectation that free trade has to be accepted with greater preparedness for volatility (Greenfield et al., 1996). OLS has however shown a different tendency reflecting its largely protected status.

FIGURE 2
Changes in Yield-value Variability



Tendencies in Cropping Patterns and Diversification: Methodology and Results

A composite measure of diversification DIV is computed based on the Hirschman-Herfindahl index HHI (see Kurosaki, 2003) where the HHI, a concentration index, gives probability of hitting the same crop in two random selections of points in the crop area domain. We have defined three diversification indices in different domains involving shares S1 and S2 of crops in the gross cropped area and the three crops total area respectively. The first (DIV_1) relates to the whole area under all crops, divides all crops into two exclusive composite groups, one of dominant crops (constituting the three crops SCER, CCER and OLS) and all 'others' as the second and is based on shares of the two groups in gross cropped area. The second (DIV_2) takes a narrow view within the set of three dominant crops only and looks at the share of each in their sum. The third index (DIV_3) has the broadest view over the whole area again, considers all the three individual crop groups and the composite group 'others' in the whole gross cropped area. The general formula for the i-th index is

$$DIV_i = 1 - HHI_i$$

The diversification index DIV_1 measures the probability of hitting both a dominant group crop (any of the three) and an 'other' (any of the others) in two tries.

Essentially it looks for a tendency to diversify towards traditionally less dominant crops away from the three dominant ones. The index DIV_2, which looks for diversity within the three dominant crops measures the probability of hitting two different crops within the three in two random tries. The third index covering the whole area under all crops and considering the three dominant groups and the non-dominant group 'others' intuitively rules out hitting the same dominant crop in two random tries over the whole crop area. This measures the probability of hitting either two different dominant crops or one dominant crop and an 'other' crop or two 'other' crops (same or different).

$$HHI_1 = \Sigma_2 S1^2;\ HH_2 = \Sigma_3 S2^2;\ HHI_3 = \Sigma_3 S1^2$$

Similarly the tendency to spatially disperse the crops across 14 major states in the country is measured by an index DISP based on the same method.

$$DISP_i = 1 - \Sigma R_j^2$$

Where R_j is the share of each state in total area under crop i in 14 states and $DISP_i$ is the probability of hitting different states in two random points within the whole area under crop i. A small DISP suggests concentration of cultivation of the specific crop in certain states.

The various diversification indices show different tendencies (Table 5). Between the dominant and non-dominant groups the diversity DIV_1 is the least in all years reflecting an overall lack of diversity in the cropping pattern but there is certainly evidence of a move towards greater diversification. Agriculture has indeed shown some tendency to move away from the dominant crops towards less dominant crops although in terms of share the latter are still small (33% in T.E. 1997–98). This tendency to diversify was seen both years prior to 1995 and later and the trade impact is not really borne out. Index DIV_2 displays a successively decreasing, increasing and decreasing trends. Within the group of the three major crops, specialization tendency increased in the green revolution period but fell in its aftermath but again responded positively in the 1990s. This tendency is reflected in the successive gain and loss encountered by oilseeds as against the superior cereals. The index DIV_3 which looks at the dominance of the three crops in the whole set of crops, is considered in this paper as the strongest indicator of diversity. It was sluggish to start with and went up moderately in 1980s. This is an evidence of some inclination for a more broad-based pattern of cropping among dominant and non-dominant crops and a lessening likelihood of growing only rice or only oilseeds. The post green revolution reaction and government promotion of oilseeds were undoubtedly responsible for this development but a slight dip in the index in the 1990s indicates a reversal and some signs of crop specialization in the post trade liberalization era (Figure 3). The relative movements of the diversification indicators are depicted graphically in Figure 4.

TABLE 5
Cropping Pattern and Diversification

Year	*T.E.1973–74*	*T.E.1983–84*	*T.E.1993–94*	*T.E. 1998–99*
SCER%	34.18	36.02	35.93	36.95
CCER%	26.54	23.55	18.09	16.19
OLS%	10.05	10.46	14.02	13.75
Others	29.23	29.97	31.96	33.11
DIV1%	41.36	41.97	43.49	44.29
DIV2%	60.58	60.00	60.79	59.39
DIV3%	80.26	80.39	81.85	81.83

Note: DIV1 is for two crop groups (3 major and others); DIV2 for 3 major crop groups: DIV3 for 4 crop groups (3 major and others).

Spatial dispersion indices DISP plotted in Figure 5 shows that between 1987–97 cultivation of SCER after an initial increase has tended to remain dispersed as compared to CCER and OLS and the dispersion has only widened slightly in 1990s suggesting that more states tended to adopt this pattern. Cultivation of CCER on the other hand narrowed down spatially throughout the period and become concentrated only in a few states. OLS too, starting at a high diffusion level following the government promotional policy, subsequently showed signs of concentration. There has been some increase in first part of the 1990s carrying the strains of the government policy but this was soon negated.

FIGURE 3
Diversification Index of Crops: DIV_3

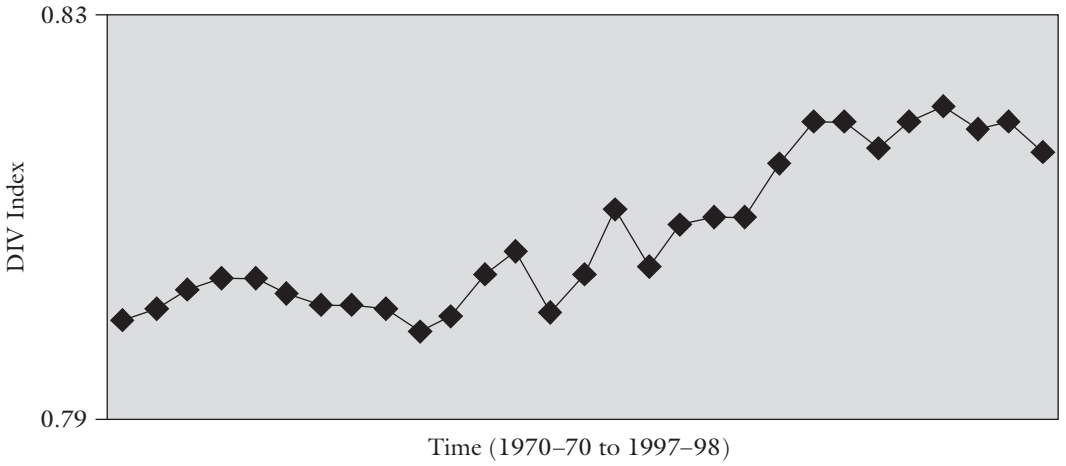


FIGURE 4
Diversification Tendencies of Indian Cropping Pattern

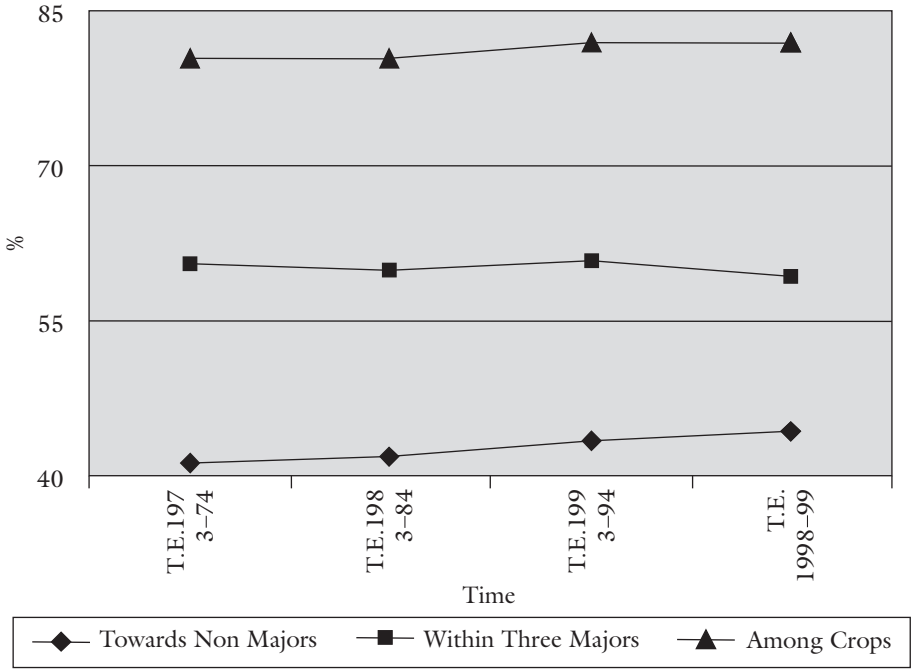
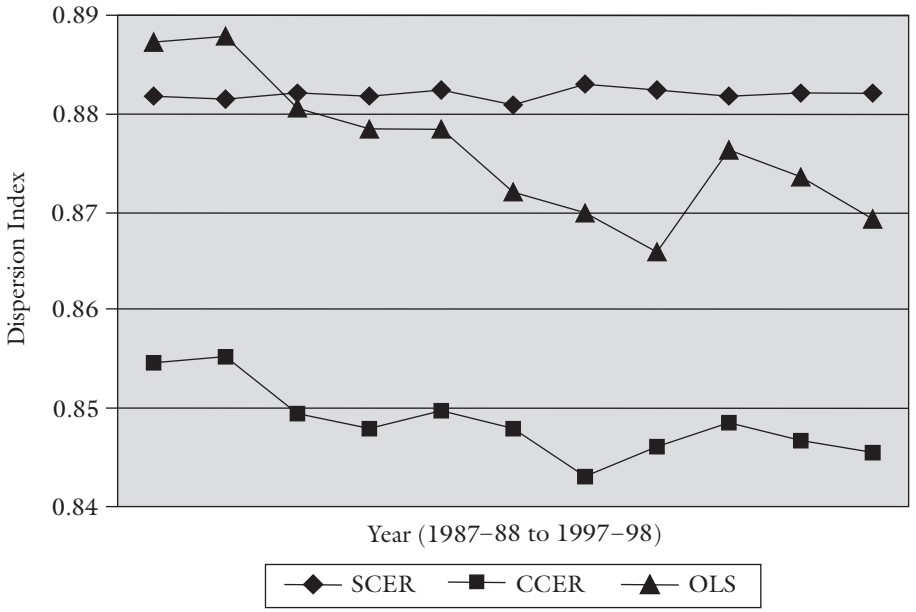


FIGURE 5
Spatial Dispersion of Crops



Trends in Areas

Much of the above analysis indicates a tendency for India's traditional crops that benefited in the green revolution to return to prominence in the post liberalization period and spread across the country regardless geographical heterogeneity. To examine the sources of such departures in 1980s a trend analysis is conducted on actual areas under these crop groups.

Possible breaks in the trends are identified following a Chow testing procedure (Kurosaki, 2003). For this purpose a deterministic and linear trend is estimated over the time series data by ordinary least squares, involving a Dummy variable from the year in which the break took place. Since the year of structural change in unknown, a preliminary view of the plot of the curve is taken to demarcate possible candidates for the break year. The plot also indicates the direction of change of trend if any, in which case an interaction term between the Dummy and time may be included. The equation is thus either

$$A_t = a_0 + b_0\, t + \Sigma_n(aj\, D_j) + u_t, \ldots.1$$

Or

$$A_t = a_0 + b_0\, t + \Sigma_n(aj + b_j\, t)\, D_j + u_t, \ldots.2$$

respectively for a case of a simple shift and in case of a shift with change in direction. The are n possible points of break starting with the most recent one j = 1. The Dummies essentially

break the entire period into different intervals showing differing trends. The term u_t is the error with usual properties. A search process is then conducted over all possible candidates identified for each break and a Wald test is carried out to test for the absence of a structural break. For identified equations 1 and 2 the tests conducted are respectively $a_j = 0$ and $a_j = b_j = 0$. The break if any is identified at the time point where the F-statistic is maximum. In case the statistic is insignificant, the null hypothesis cannot be rejected and the restricted equation with no break is selected. In addition the fit of the equation in term of R^2 and the significance of the parameters are noted.

The trend analysis summarized in Table 6 shows a positive growth of area under SCER. The area however witnessed a negative shift in 1986 that may be reflective of a dwindling profitability and ecological effects in the post green revolution era and response to diversification moves. CCER has throughout had a declining trend but this too faced a negative shift in structure in 1991 in the period of structural and external changes. OLS presents an interesting case with changing trend and multiple breaks in 1988 and 1993. Till 1988 the area showed a small growth, which picked up after 1988 but was reversed in 1993 when area started showing a decline. The trends establish the inevitability of the defeat of the crops suited for the dry regions and indicate the continuity ensured by free trade of the success of the resource demanding superior cereals rice and wheat that was once triggered by the Green Revolution.

TABLE 6
Trends in Area Under Crop Groups with Intercept and Slope Dummies

Crop	*C1 Constant*	*C2 Time*	*C3 Dummy1*	*C4 Dummy2*	*C5 Time* Dummy1*	*C6 Time* Dummy2*	*R2*	*Mean*
SCER	553.1	6.21	–25.44				0.93	640.1
(t-statistic)	(103)	(12.2)	(–2.8)					
Break			1986					
Wald test (C3 = 0) F = 7.84								
CCER	457	–4.02	–34.08				0.96	381.63
(t-statistic)	(102.1)	(–11.4)	(–5.06)					
Break			1991					
Wald test (C3 = 0) F = 25.6								
OLS	160.0	1.8	125.1	193.8	7.96	–5.37	0.97	207.5
(t-statistic)	(47)	(5.7)	(2.7)	(6.53)	(3.6)	(–4.8)		
Break			1988	1993				
Wald test (C3 = C4 = C5 = C6 = 0) F = 32.3								

Conclusions

In the aftermath of the green revolution, known for its success as well for its inequitable and ecological drawbacks, a deliberate and focused public thrust was necessary to offset the market forces and move the cropping pattern in India favor of oilseeds and a more balanced

combination that had earlier been naturally prevalent in a somewhat different form. The unavoidable collapse of the hardy and drought resistant coarse cereals due to changing demand could be combated with an expansion of acreage under oilseeds which are also suited to drier conditions and enjoy rising demand in the country. But free trade and reduction of government effort exposes the inevitable fatality against both oilseeds and the coarse cereals. While there is a mild search continuously going on to look for crops that have not traditionally been the main crops in Indian conditions, but considering the main crops only, the data reveal an expected tendency towards a broad-based specialization in the area of national comparative advantage i.e., superior cereals. Within the dominant crops and in the overall cropping pattern, there is now a growing concentration in favour of superior cereals. One is still more and more likely to come across these crops in Indian agriculture than other crops. Moreover the cultivation of superior cereals is found to be spreading across the regions regardless of their endowments while those of the dry crops concentrate into ever narrowing pockets.

The undistorted picture that emerges may be beneficial for many in agriculture but the burden can be high for the poor in less endowed regions, the unemployed masses and ultimately also the budget, which shoulders both the invisible resource cost and patent cost of distribution and safety nets. The losers and gainers in such cases can only be described by the geographical realities of the country rather than individual efficiency achievements. The replacement of the coarse cereals by oilseeds has taken a beating in the free trade regime and the gainers are mostly superior cereals demanding resources that tax environments, the poor and the government. While free trade may help Indian agriculture as a whole in the long run as established by scholars in the field, till such time that agriculture attains sufficient coverage of environment-suited new crops that are commercially lucrative too which is a formidable achievement to make or the non-agricultural sector attains the capability of absorbing much of manpower in various regions of rural India, there is a role for the government in ensuring a sustainable cropping pattern within the traditional choices, supporting those farmers in difficult conditions and negotiating for more reasonable terms in trade for taking care of the difficult regional environments.

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Chapter 10

Implications of Trade Liberalisation for the Livestock Sector

BRAJESH JHA

I. Introduction

In India, the livestock sector has emerged as an important source of rural employment and income in recent decades. It is interesting to note that after 1980s while the share of agriculture in Gross Domestic Product at factor cost (GDP) was decreasing, the share of livestock increased till recently. However, the share of livestock in aggregate GDP has started decreasing only towards the end of the 1990s (Jha, 2004). This trend is disconcerting and warrants proper investigation. The development policy related to the livestock sector suggests that trade liberalization in selected livestock products was initiated during this period, the reasons for the disturbing trends in the sector therefore appears to be rooted in the process of liberalisation. In this backdrop the present study attempts to assess the implications of trade liberalisation for the livestock sector.

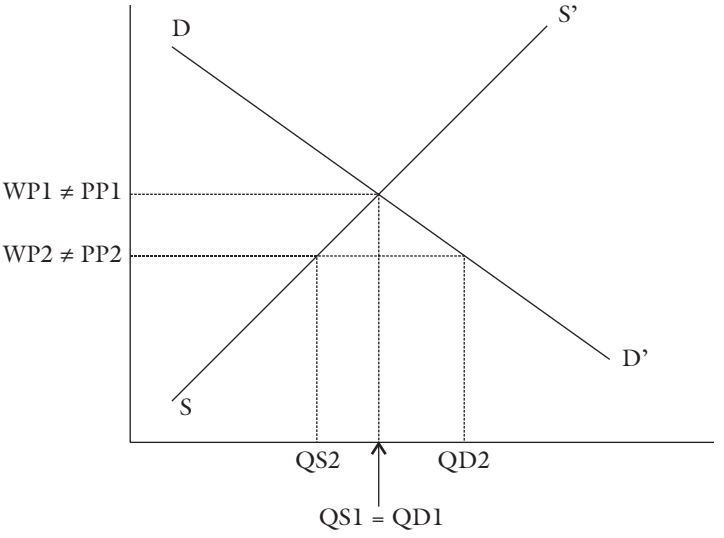
The livestock sector referred to comprises of value of output from milk, meat, eggs, wool and hair, dung, silkworm cocoons and honey; of these, milk and meat together constitute around 85 per cent of the value of livestock. A glance at trade statistics indicates that India has traditionally been an exporter of meat, and an importer (net importer) of milk products. Trade liberalization has encouraged exports during the early 1990s[1]. Imports received impetus following removal of import restrictions in the selected products during mid-1990s. Most of the non-tariff-barriers (NTBs) in the imports of milk products were replaced with tariffs

[1] In the early 1990s certain steps such as removal of fixed exchange rate, devaluation, etc., has encouraged exports of all possible exportables from the country. This was not specific to particular sector.

and tariff-rate-quotas; now there are pressures to further reduce the tariff (Jha, 2004). Tariff reduction on milk products may have large implications for the livestock sector as such since the decision to rear cattle in India is more dependent on the profitability of milk rather than the meat.[2] The present study attempts to address some of these concerns with following specific objectives. (i) To study implications of trade liberalization on the domestic price of livestock products and (ii) to evaluate the effects of changes in milk prices on producers and consumers of milk in selected states of India.

II. Methodology

The effect of changes in milk prices on producers and consumers of milk has been studied with the economic surplus approach. The economic surplus is a century old concept applied to a wide range of problems; the present study uses this approach for assessing the effect of import liberalization on milk products. The economic surplus approach here assumes that imports will affect the domestic prices; reduction in domestic price would influence the demand for the commodity and the same would affect consumers' surplus. A decline in the price of milk without a shift in the domestic supply function would adversely affect the producers' surplus. The total economic surpluses will be an aggregation of producers and consumers surpluses.



[2] A large proportion of meat in India is of cattle, so milk and meat is a joint product. Considering the special status cattle assumes in our society the decision to rear cattle depends on the profitability of milk rather meat. It must be emphasized that milk, meat and some other products obtained from cattle together accounts for more than 90 per cent of the livestock output.

Let us assume that in the existing situation, the producer's price is PP1, the quantity supplied by the producer at the PP1 price is QS1; the consumer's price in the present exercise is the wholesale price, WP1 and quantity demanded at the existing wholesale price is QD1. Following free import of milk products, the new producer's price is PP2, quantity supplied at this price is QS2, consumer's price is WP2 and quantity demanded at the corresponding price is QD2. In the figure below wholesale price (WP) and producer price (PP) are the same but in actual these prices in a region are different. The effect of price on supply and demand will depend on the supply and demand elasticities, let this be SE and DE, respectively. With these notations the various estimates presented in Table 2 have been obtained from the following expressions:

The change in producer's surplus due to imports has been obtained from: (PP2–PP1) (QS1+(QS2 – QS1)/2) when QS1 and PP1 is given; PP2 has been calculated from PP1 by adjusting this as per the changes in the wholesale price following imports, and QS2 at PP2 will be: QS1 + QS1(SE*(PP2 – PP1)/PP1).

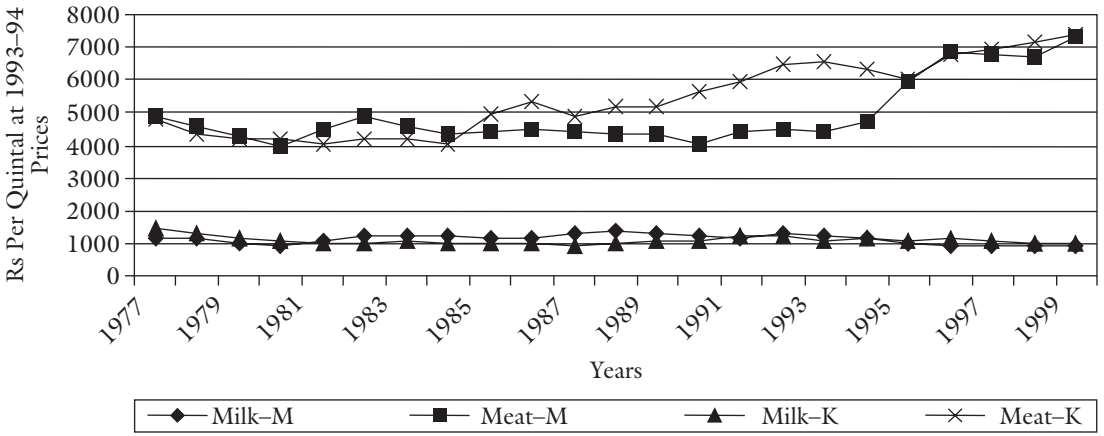
The changes in consumer's surplus due to free import has been calculated from: (WP1 – WP2) (QD1 + (QD2 – QD1)/2), when WP1, WP2 and QD1 is given and QD2 at the WP2 price will be: QD1 + QD1(DE*(WP2 – WP1)/WP1).

III. Results and Discussions

With trade liberalization domestic price of commodities get equalized with the international prices. Domestic prices of commodities, which are protected, decline; while prices of dis-protected commodities increase. Several studies suggest that milk is protected while meat is dis-protected in India (Debroy et al., 1996). In order to assess the effect of trade on livestock product prices, trend in real prices of milk and meat in Mumbai (M) and Kolkata (K) is presented in Figure 1. The real price has been derived by deflating the nominal prices with the income deflator obtained from the Development and Planning Center of the Institute of Economic Growth, Delhi. The base year for the real prices is 1993–94. The nominal price of meat is available for Mumbai and Kolkata only though milk prices are available for some more places.

The pictorial presentation of real prices (Figure 1) shows that the fluctuation in milk price is less as compared to the prices of meat. Price fluctuation for meat has further increased in the late 1990s. The real price of meat has also increased: in Mumbai this has almost doubled in nine years. The real price of milk in both the markets has started decreasing since the year 1992. It must be noted that meat is an exportable item while milk is an importable item. Though the exports of certain milk products have increased in recent years, our country remained the net importer of milk products during the large part of the 1990s (Jha, 2004). Increase in the

FIGURE 1
Trend in Real Prices of Milk and Meat in Mumbai (M) and Kolkata (K)



domestic price of meat will encourage meat production. A sustainable growth in production and exports of meat however depends on the price incentive for milk, since meat production to a large extent depends on the decision to rear cattle and this decision is more dependent on the profitability of milk rather than on the meat production in the country.

Effect of Imports on Domestic Price of Milk

Import in general reduces domestic prices, the effect of import on domestic prices would vary according to the stage of marketing. The market price of imported milk products has been worked out in domestic markets at different stage, these are—(a) Ex-port[3] (Delivered Duty Paid (DDP) Price), (b) at wholesale market[4] (wholesale price) and (c) at producers market[5] (Producers price). These prices have been worked out from the world price (WP).

[3] Once the imported commodity crosses customs boundary at port and enters into the domestic market, the price of the commodity at that point has been referred here as the price ex-port or DDP price. Even if a commodity is free-from-customs-tariff, the imported commodity requires some expenditure at the port in the form of obtaining various clearances and handling cost. In the present exercise this cost has been assumed at four per cent of the value of import, uniform at all ports.

[4] Price of the imported commodity at the wholesale market apart from other factors also depends on the distance of the respective market from the port. In the present exercise cost of marketing has been assumed to vary from 10 to 30 per cent of the value of products in the different wholesale markets.

[5] This is the price of the imported commodity at a stage beyond the wholesale market; present study assumes that changes in the wholesale prices will be transmitted at the producer's level proportionately.

The world price of milk is not appropriately quoted since trade in fresh milk is limited because of its perishable nature and bulkiness. In the world dairy market a bulk of the trade takes place in milk powder and butter; and since milk can very easily be converted into either of these products, the world price of milk in the present study is the derived price from these milk products. The conversion factor of milk powder and butter from milk is 10 and 7.5 per cent respectively. The synthesis of butter from milk however yields whey, arriving at milk prices from butter therefore also requires price of whey in the international market, which is not available. Whereas, arriving at the milk price from the whole milk powder is simple and straight since there is no joint product while milk powder is being manufactured from milk.

The export price of milk powders in New Zealand has been considered as a benchmark[6] for deriving world milk price; while exports price of US is also considered to represent extreme price ranges in the world market. A glance at the price of milk powder in world market during the past years suggests wide fluctuation; the lower range of the world price of whole milk powder is US$ 1500 (fob) per MT at a New Zealand port; the higher range of world price being considered in the present analysis is US$ 2650 (fob) which existed at one of the ports of the US; an intermediate range of the world price for milk powder US$ 2050 (fob) per MT also assumed to exist in either of the above countries. The world price (fob) of milk in the low, high and intermediate scenarios will be Rs. 647, Rs. 1140, and Rs. 884 per quintal[7], respectively. The intermediate range of the world price in the present analysis has been considered as Rs. 850 per quintal since this to some extent reflects the mid-point between the extreme prices.

Implications of imports at these extreme prices will be different and would also vary across regions. The present analysis starts with a low international price, that is, Rs. 647 per quintal of milk on board in the exporting country. The cost of import that is the cost of shipment (insurance and freight), handling and customs clearance charges at different ports has been assumed as uniform for all the chosen port cities of India namely, Mumbai, Chennai and Kolkata. With these assumptions the milk equivalent price export in these port cities will be Rs. 810 per quintal. Subsequently price supposed to prevail following imports in the selected wholesale markets of the country has also been worked out (Table 1). A comparison of these prices with the existing wholesale prices in the respective markets indicates that the prevailing prices are significantly higher than the international reference prices. This difference in price suggests possibility of imports of milk products. The difference in wholesale prices is the maximum in Mumbai followed by the Chennai, Kolkata, Delhi and Kanpur markets. The lowering of wholesale prices in these markets following imports will be realised at the level of producers as well (Table 1).

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[6] The export price of milk powder is less distorted in New Zealand as compare to other important milk exporting country like European Union (EU), United States of America (USA) (Source: Jha, 2004).

[7] This calculation is for the year 1999–2000 when one US$ was equivalent to INR 43.1, please note the changes in units: tons and quintals, as well.

TABLE 1
Tracking and Comparing Different Ranges of World Milk Prices, (Low-Rs. 647 Intermediate-Rs. 850 and High-Rs. 1140 per quintal), with the Domestic Milk Prices in Selected States of India as in the Year 1999

Prices in Rs per quintal

Particulars (1)	*Haryana (2)*	*Maharashtra (3)*	*Tamil Nadu (4)*	*West Bengal (5)*	*Uttar Pradesh (6)*
Ex-port Price (DDP Price)	–	–	–	–	–
with Low range of World Price	–	810	810	810	–
with Intermediate range of WP	–	1,204	1,204	1,204	–
with High range of World Price	–	1,425	1,425	1,425	–
Market price under free trade					
with Low range of World Prices	980	895	885	930	965
with Intermediate range of WP	1,400	1,280	1,270	1,310	1,384
with High range of world Price	1,560	1,490	1,485	1,500	1,530
Existing price in Domestic market	**1,225**	**1,300**	**1,200**	**1,250**	**1,175**
Change in prices (%)	–20.0	–31.2	–26.3	–25.6	–17.9
Trade possibility					
with Low range of World Price	Import	Import	Import	Import	Import
with Intermediate range of WP	TNP	Import	TNP	TNP	TNP
with High range of world Price	TNP	TNP	Chances of exports		
Producer price under free trade					
with Low range of world price	824	750	734	759	788
with Intermediate range of WP	LU	1,073	LU	LU	LU
with High range of world Price	Will be largely unaffected				
Producers prices: existing	**1,030**	**1,090**	**995**	**1,020**	**960**

TNP – Trade Not Possible; LU – Largely Unaffected.

The effect of import on domestic market will be different when the world price is in the intermediate range (Rs. 850 per quintal, fob). At this level of the world price, the DDP price in the major port city of the country will be Rs. 1,204 per quintal; the reference price in the wholesale market will be even large. A comparison of these reference prices with the domestic prices in the wholesale markets shows that only in Mumbai domestic price is higher than the reference price; the price difference suggests a possibility of import at the Mumbai port only. Trade possibility is not apparent in other places. With an even higher international price (Rs. 1,140 per quintal, fob), the DDP price at the Indian port will be Rs. 1,425 per quintal. This price is significantly higher than the existing prices in the domestic market; import possibility at such a high price is dim. There are in fact chances of exports from the Chennai, Kolkata and Kanpur markets since domestic prices are significantly lower than the international reference price. There is possibility of exports to some neighbouring countries, though difference in price is not so high as to suggest free export to distant market. Exports of milk products from India fluctuate in actual also, these are generally to the neighbouring countries. Domestic prices in this situation of meager exports will be largely unaffected.

Changes in milk prices at different stages of marketing following import liberalization will affect production as well as consumption of milk in the country. The quantification of the changes in production and consumption of milk will depend on the supply and demand elasticity of milk with respect to its prices.

There have been studies to estimate demand function for milk and milk products, which considers milk price as one of the explanatory variables and thus present demand elasticity of milk with respect to its price. Some of the widely quoted studies on demand functions are Radhakrishna and Ravi (1990), Kumar (1998). These studies have estimated price elasticity at the aggregate level; the present study however attempts to evaluate the effect of imports for selected states of the country. Though Kumar (1998) has estimated the coefficients at the regional level, because of certain reasons[8] these estimates have not been used for the present study.

There are not many studies to report widely acceptable milk supply elasticity; some studies on milk supply function (Munshi and Parikh, 1994; Lalwani, 1989) have estimated milk supply as a function of price of feeds and fodder rather than that of milk; few other studies which establish a direct relationship between the milk supply and milk price along with the other determinants are normative in nature. The elasticity obtained from the normative supply functions varies; in some instances these estimates have been as high as 5.6 and 3.6 for cow and buffaloes, respectively (Ratnam, 1985). A comparison of these supply estimates with similar other biological products does not support such a high supply elasticity at the aggregate level. Most of the time these normative supply estimates are too disaggregate often based on primary data pertaining to a district only.

Considering these problems in supply and demand elasticity, Jha (2004) attempts to assess these elasticities separately for Maharashtra, Tamil Nadu, West Bengal, Uttar Pradesh, and Haryana, the same has been presented in the Box (for details see Jha 2004). The present study uses these estimates. This study (Jha, 2004) finds per capita income more important than the price of milk to influence demand for milk; income elasticity coefficients range from 1.06 to 1.79 for the chosen states and are significant at 1 per cent; while, estimates for price elasticity of demand for milk ranges from 0.27 (West Bengal) to 0.47 (Maharashtra), and are significant at 10 per cent. The milk supply elasticity ranges from 0.40 (West Bengal) to 0.74 (Maharashtra). Jha (2004) has found supply and demand elasticity robust for all states, except West Bengal; the supply and demand estimates for West Bengal has therefore been assumed as that of Uttar Pradesh[9].

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[8] In all the studies barring that of Kumar (1998), the estimate for income elasticity is greater than the price elasticity of milk. For commodities similar to milk also the income elasticity has been found to be greater than the price elasticity. On this account the demand elasticity estimates of Kumar (1998) have not been used.

[9] Robustness of equation here refers to the high coefficient of determination (R-square greater than 0.91) and significance of elasticity coefficients. In West Bengal R-square has been comparatively low (0.84) and the estimate for supply and demand elasticity was not significant even at 10 per cent. These estimates have been replaced with the estimates of Uttar Pradesh, since this is the state where price elasticity is less and weak relationship in West Bengal indirectly suggests that the elasticity estimates are low.

BOX 1
Supply and Demand Elasticity with Respect to Price in the Selected States

States	*Supply Elasticity*	*Demand Elasticity*
Haryana	0.68	–0.45
Maharashtra	0.74	–0.47
Tamil Nadu	0.61	–0.44
Uttar Pradesh	0.58	–0.36
West Bengal	0.58 (0.40)	–0.36(–0.27)

Source: Jha 2004.
Note: Since the estimates for West Bengal is not robust, elasticity coefficients of Uttar Pradesh has been considered.

Effect of Import on Producers and Consumers of Milk

With the above estimates for supply and demand elasticity, the present analysis attempts to work out the producer's and consumer's benefits (positive or negative) following free imports of milk products in the country (see Table 2). Table 2 indicates a steep decline in the domestic prices of milk following the decision to import milk products at a low international price (Rs. 640 per quintal); and since supply of milk is highly price elastic, milk production in the states selected for the present analysis will be affected adversely. This decline in supply of milk will be transformed into a negative producer's surplus in all the states. The magnitude of negative surplus varies across states; this has been the highest in Uttar Pradesh, followed by Maharashtra, Tamil Nadu, Haryana and West Bengal.

As discussed earlier a decline in price will affect milk consumption in different ways. This will encourage consumers to consume more milk and since demand for milk is also price elastic this would increase consumer surpluses. Increase in consumers' surpluses has also been the maximum for Uttar Pradesh, followed by Maharashtra, Tamil Nadu, West Bengal and Haryana. A comparison of these states indicates an alteration in the order between West Bengal and Haryana. The changes in the order of these two states highlights differential impact of free-import on milk production and consumption; infact, low supply elasticity in West Bengal and a relatively higher price of imported milk products in Haryana are some of the reasons for this difference.

The changes in total surpluses are an aggregation of producer's and consumer's surpluses. A positive net surplus in all the states suggests that the benefits to consumers outweigh the losses to the producers. The amount of net surpluses is the maximum for Uttar Pradesh followed by figures for the other states. In order to factor out the effect of size from these surpluses, the unit surplus has been worked out by dividing the net surplus with the state milk production. It is interesting to know that a decline in per unit producers' surpluses have been the maximum for Maharashtra followed by Tamil Nadu, West Bengal, Haryana and Uttar Pradesh; the consumer's surplus per unit of milk production has also been the maximum for Maharashtra

TABLE 2
Impact of Free Import of Milk on Producers, Consumers and Net Social Welfare in Selected States of India with Different Range of World Prices in the Year 1999

	Low Range of World Price (Rs. 640 per quintal)					*Intermediate (Rs. 850 per qtl.)*	
Particulars (1)	*Haryana (2)*	*Maharashtra (3)*	*Tamil Nadu (4)*	*West Bengal (5)*	*Uttar Pradesh (6)*	*Maharashtra (7)*	*Other States (8)*
Production in million qtls.	46.8	57.1	45.7	34.7	141.5	57.1	
Producers price: existing	1,030	1,090	995	1,020	960	1,090	
Producers price: free trade	824	750	734	759	788	1,073	
Supply elasticity with price	0.68	0.74	0.61	0.52	0.58	0.74	
Supply—existing	46.8	57.1	45.7	34.7	141.5	57.1	
Supply under free trade	40.4	43.9	38.4	29.5	126.8	56.5	No Change
Changes in producers surplus	–8,985	–17,155	–10,981	–8,388	–23,019	–965.10	
Unit change in producers surplus	–213	–300	–240	–231	–166	–16.9	
Aggregate demand	42.1	57.1	45.7	36.3	138.7	57.1	
Wholesale price: existing	1,225	1,300	1,200	1,250	1,175	1,300	
Wholesale price under free trade	980	895	885	930	965	1,280	
Price elasticity of demand	–0.45	–0.47	–0.44	–0.36	–0.36	–0.47	
Existing demand	42.1	57.1	45.7	36.3	138.7	57.1	
Demand under free trade	45.8	65.4	50.9	39.6	147.6	57.4	No Change
Change in consumer's surplus	10,779	24,819	15,227	12,151	30,064	1,146	
Unit change in consumer's surplus	256	435	333	335	217	20.1	
Change in total surplus/welfare	1,793	7,663	4,246	3,763	7,045	181	
Employment (change in million mandays)	–35.7	–76.2	–42.1	–26.5	–84.8	–3.5	
Forex (change in million US$)	–56.8	–125.4	–79.2	–50.2	–133.9	–8.3	

followed by West Bengal, Tamil Nadu, Haryana and Uttar Pradesh. A comparison of producer's and consumer's surpluses per quintal of milk production suggests small changes in the order of the states of West Bengal and Tamil Nadu. This change in order implies that a negative impact of import on milk production will be less in West Bengal as compared to Tamil Nadu because of a difference in the supply elasticity in these states. Trend in surpluses across states clearly suggest that impact of import has been greater in the coastal states as compared to the other states of the country.

At the intermediate range of world price (Rs. 850 per quintal), the DDP price at one of the Indian ports would be Rs. 1,204 per quintal, price differences in the wholesale market suggests that import would take place only in Mumbai; and this import would have limited effects on the producers and consumers of milk. The producers and consumers in the other states would by and large remain unaffected. At the high range of world price (Rs. 1,140 quintal fob at US port), the ex-port (DDP) price at the Indian port will be Rs. 1,425 per quintal. The ex-port price is significantly higher than the domestic prices, chances of imports at such a high price are less; milk production and consumption will therefore be largely unaffected in the country.

The above analysis presents a trade off between the producer's and consumer's interest, this establishes that the imports will generally benefit the consumers. The increased benefits to consumers following free import may however be assessed with some caution. First, the amount of consumers' benefits has been over-estimated because of the simplistic assumption of a perfectly inelastic world milk price. In actuality, demand for milk products from India because of lower prices under a free trade regime will be very high.[10] The world price for milk products is bound to increase with such a high demand from India. Consequently, the gain to consumers will be subsided. Increase in consumer's surplus and total welfare is also overestimated as long as this does not account for foregoing of foreign exchange. An attempt has therefore been made to quantify the drain of foreign exchange, which is presented in the last row of Table 2.

The losses to the producers also need to be understood properly. Milk producers in India are not properly integrated with the wholesale market. This is evident from the low share of producers in the wholesale price of milk in the chosen states of India. The above analysis shows that consequent to imports the total economic welfare would increase, as a decrease in producer's surplus has been overcompensated by the increase in consumer's surplus. The decrease in producers' surplus has been underestimated in the sense that it ignores loss in employment because of decline in milk production, and the wide ramification that this decline in employment has for the other sectors of the economy.

[10] In India per capita consumption of milk is significantly lower than the recommended dose; present study with the sensitivity analysis in the demand function has found that increases in demand for milk following free imports of milk products at lower range of world price will be more than 10 per cent in most of the states.

The present analysis therefore, attempts to assess the effect of import liberalization in milk on employment in the sector. There is a dearth of estimates, which relate employment to the physical output of milk in the country. The present study after comparing the available primary and secondary information relating to milk production and employment concludes that the production of one quintal of milk output generates 5.8 mandays of direct employment in the country (for details see Appendix). In the present analysis effect on employment will be realized following a decline in milk production. The loss in employment has therefore been arrived at by multiplying decline in milk production with employment coefficient (5.8 mandays). Allowing free import at a low range of world price causes a significant loss of employment, ranging from 26.6 million mandays in West Bengal to 84.8 million mandays in Uttar Pradesh. In the intermediate range of world prices, the loss of employment following imports is much less and implications are valid for the state of Maharashtra only (around 3.46 million mandays).

Considering the amount of loss of employment and the wide ramifications this has for the rural economy; the livestock sector requires protection. In the existing multilateral trading system, protection has to be largely with the tariff; as of now protection in the form of moderate tariff (35–40 per cent) and tariff rate quota appears to be sufficient (Jha and Debroy 2000). Any argument for further reduction of tariff must be resisted. There are still other provisions, such as, antidumping duty, special safeguards for protecting a sector in the existing WTO Agreements. The subsistence nature of milk production, corroborated with very low proportion of purchased farm inputs in total inputs for milk production in the country can be articulated to protect the livestock sector. The on-going millennium round negotiations on agriculture also recognizes the need for protecting a strategic sector/sub-sector in a developing country.

IV. Conclusions and Suggestions

The present study observed that with trade liberalization domestic price of exportable commodities like meat has increased while that of importable commodities like milk has decreased. The doctrine of free import, when the world price is low (milk equivalent price US$ 640 per quintal) will cause high imports of milk products; in a short-run partial equilibrium framework this will increase consumers' welfare and decrease producers welfare; the increase has been significantly higher than the losses to the producers resulting in an increase in total welfare. The implications of imports have in general been stronger for the coastal states as compared to the land-locked states of the country.

A high import at the low range of the world price would however cause enormous loss of employment in the long run. On this account the sector requires protection from low world price of milk. As of now protection in the form of moderate tariff (35–40 per cent) and tariff rate quota appears to be sufficient. Any argument for further reduction of tariff must be resisted; the on-going negotiations on agriculture also recognizes need for protecting strategic sector/sub-sector in a developing country.

Appendix: A Note on Employment Estimate

There is a dearth of published estimate linking milk output with the number of persons employed in the livestock sector. An attempt has therefore been made in the present study to arrive at some reliable estimate for the same. Primary data collected by the present investigator during his Ph.D. thesis research in the Kurukshetra district of Haryana revealed that in a typical village herd, one milch animal (average of buffaloe, cross-bred and desi cows) during a calendar year provides on an average 12.5 quintal of milk and employs 66 mandays of labour. One quintal of milk thus generates 5.5 mandays of employment. The secondary information also provides similar estimates. The NSSO employment figure at the aggregate level on the basis of current daily status (CDS) shows that employment in the livestock sector was 16.5 million person-years, during the year 1999–2000. If we assume that share of milk and milk products in total livestock employment is as per its share in the value of output, employment in milk and milk products would have been around 12 million person-year. The milk output during the year was 731 million quintal; a comparison of milk output and employment figures during the year indicate that employment created for producing one quintal of milk has been around 5.8 mandays at the all-India level. A relatively higher employment figure from secondary information as compared to primary data is obvious; the primary data pertains to a high productivity region, whereas the secondary information at the all-India level is the average of the country. For the same reason the present study assumes that, one quintal of milk production generates 5.8 mandays of employment in India.

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Section II
Equity

Chapter 11

Regional Divergence in India during the Era of Liberalization: A Sectoral Decomposition

SABYASACHI KAR AND S. SAKTHIVEL

Introduction

According to the neoclassical growth model, the per capita income of economies continuously converge towards their steady state levels, resulting in a reduction in the income inequality among these economies over time. This proposition has been extensively tested in the "Endogenous Growth" literature using both cross-country data as well as data from regions within a single economy. In the cross-country studies, the results did not indicate (unconditional) convergence. However, studies based on regional economies (particularly for developed countries) provided stronger support to the convergence hypothesis. It is in this context that—beginning with Cashin and Sahay [*1996*]—a number of studies have tried to look at the possibility of convergence among the sub-national regions of the Indian economy. In particular, some of these studies have looked at the trends in regional inequality following the liberalization of the Indian economy in the last decade.

Following the foreign exchange crisis in 1991, the Indian economy adopted a programme for the liberalization of the Indian economy. The crisis was attributed to the state-led development policy followed till the late seventies and the early eighties. This policy envisaged the public sector as the engine of growth. Moreover, the private sector and its activities were also regulated by the government through controls on industrial licensing, imports, use of foreign exchange, financial markets, prices, etc. There were some changes in policy direction in the second half of the eighties with partial liberalization, but it was only in the early nineties,

that a complete paradigm shift took place. There were significant policy changes with most of the controls being dismantled and the state making a conscious effort to reduce its activities. Thus the crux of these reforms is a greater thrust on private sector led growth and a lesser role for the state.

The studies that have focused on the trends in regional inequality in the nineties (following the liberalization), have mostly confirmed that the Indian economy exhibited regional divergence during this period.[1] There are two plausible economic channels through which liberalization is leading to divergence. Firstly, in the past, the state had played a crucial role in maintaining regional equality in the Indian economy by directing resources to backward areas. With a reduction in the role of the state, this process has become weaker. Secondly, the private sector is attracted to areas that are developed in terms of infrastructure etc., in order to reduce costs and become competitive. As the liberalization process gives greater role to the private sector, investment and activity are likely to be concentrated in more developed areas, again strengthening the forces of divergence.

Clearly, a high rate of regional divergence can create various kinds of economic and political problems for a country.[2] Particularly for the Indian economy, it has serious ramifications for the continuation of policies of liberalization. This is because in a democratic country like India, the policy makers are elected through a democratic voting process, and policies have to reflect the aspirations of the majority of the voters. Thus, the continuation of policies of liberalization is crucially dependent on voters from most regions of the economy being satisfied that these policies are equally beneficial to them and not concentrated in a few pockets of development. In other words, in order to continue policies oriented towards higher growth, it is necessary to understand the channels strengthening regional divergence and attempt to correct or minimize them.

One useful way to understand these channels is to find out how much each of the sectors of the economy contributes to the regional divergence. This is particularly important in a developing economy like India, where for example, the agricultural, industrial and the services sectors exhibit very distinct growth patterns and are influenced by distinctly different set of factors. Thus, in order to understand the dynamics of trends in inequality, it is more meaningful to focus on the contribution of each of these sectors towards the divergence of regional output. It is with this objective that this paper tries to assess the contribution of the various sectors towards the regional divergence in India during the nineties, i.e., the period following the liberalization of the Indian economy. This calls for a framework that enables us to decompose the rate of regional divergence, giving the contribution of each sector. In the first part of the paper, we shall describe such a framework. Next, we shall use this framework to focus on the role of

[1] Section two gives details of this literature.

[2] The economic and political consequences of regional inequality are discussed in Venables and Kanbur [*2003*].

the agricultural, industrial and the services sectors of the Indian economy in bringing about changes in the level of regional inequality during the period under consideration. Section two reviews the literature. Section three describes the framework that is used to measure sectoral contribution to changes in income inequality. Section four presents some empirical results. Section five concludes the paper.

Are the Regional Economies Moving Closer?

There is a very large literature looking for evidence on whether regions are moving closer or further away from each other. In this section, we start with a brief discussion of some of these studies that have looked at this issue for various countries. Next, we present a detailed discussion of studies that concentrate on the Indian experience. We then look at studies that have focused on some of the sectoral aspects in this context. Finally, we discuss the related literature on agglomeration economies, that has important similarities with the rest of the literature.

Evidence Across the World

A number of studies, including Barro and Sala-i-Martin (*1992*) and Barro and Sala-i-Martin, (*1995*), have looked at the possibility of convergence of regions within developed economies. In many of these studies the authors find evidence of regional convergence over long sample periods (100 years for US states and 60 years for Japanese prefectures) and also over much shorter sub-periods within the same sample. De la Fuente [*2002*] records evidence of convergence across Spanish regions in each of the three decades between 1965 and 1995. On the other hand, empirical evidence on regional convergence from developing countries has been much less encouraging. Juan-Ramon and Rivera-Batiz [*1996*] study the states of Mexico over the period 1970 to 1993, and report convergence in incomes between 1970 and 1985 and divergence thereafter. Another study by Jian, Sachs, and Warner [*1996*] study the provinces of China between 1952 and 1993, and find evidence of divergence in real per capita incomes, except for the period 1978 to 1990.

The Indian Experience

In the recent past, a number of contributions have dealt with the issue of convergence or divergence of the states of the Indian economy. Here we shall classify them in terms of the methodology that they have used to analyze this issue. These contributions can be broadly divided into two groups, i.e., (a) regression based approach, (b) approaches based on measures of inequality. The regression-based approach is a corollary of the neoclassical growth theory, which argues that due to diminishing returns to capital, regional economies (which are

assumed to have similar rates of savings and technical progress) should exhibit convergence over time. In other words, this approach defines convergence as a process through which the poorer regions grow at a faster rate compared to the richer regions, and hence have a tendency to catch up with them. This is also known in the literature as beta convergence. One of the earliest papers in this area is Cashin and Sahay [*1996*], which put to test the hypothesis of beta convergence for the Indian states over the period 1961 to 1991. Their estimation results suggest that absolute beta convergence was observed during this period due to initially poor states catching up with initially richer states in India. Marjit and Mitra [*1996*] also focus on the convergence hypothesis in the context of the Indian states for the period 1961–62 to 1989–90. Although the authors do not explicitly fit a regression, they focus on the negative relationship between initial incomes and subsequent growth rates, which is a basic characteristic of the regression-based approach. Their results suggest that there is no evidence of convergence among Indian states for the period under study. Nagaraj, et al. [*1998*] also uses the regression-based approach but tests for conditional convergence instead of absolute convergence by including independent variables like agriculture's share in the states output, etc, apart from initial values of per capita output for the states. The results of their study show a negative coefficient of the initial per capita output and hence validate the conditional convergence hypothesis for the states of the Indian economy. Rao, et al. [*1999*] test the hypothesis of convergence among Indian states for the period 1965–66 to 1994–95 using regression equations. Their empirical analysis shows that initial level of per capita output is positively associated with growth of per capita output in states, suggesting that per capita output diverged across states during the period under consideration. Interestingly, the observed positive relationship appears to have strengthened during the reform process of the 1990s. Another paper that uses the regression-based approach is Singh, et al. [*2003*], which tests for absolute convergence of per capita consumption expenditures and finds that there is absolute divergence during the 1980s and 1990s.

There is an alternative approach to regional convergence that defines it as a reduction in the inequality of regional incomes over time. The simplest way to measure a reduction in regional income inequality is in terms of a fall in the standard deviation of the logarithm of regional (per capita) incomes. This standard deviation based approach is also known in the literature as sigma convergence [*Barro and Sala-i-Martin, 1995*]. Cashin and Sahay [*1996*] uses this approach and finds that the value of this measure of dispersion increases from 0.292 in 1961 to 0.333 in 1991, indicating sigma divergence. Rao, et al.[*1999*] also compute standard deviation of per capita output across states from the mid-1960s to mid-1990s. The estimated dispersion shows a steady rise from 0.22 in 1965–66 to 0.39 in 1994–95, indicating strong sigma divergence. Another simple measure that has been used to study this issue is the coefficient of variation. Nagaraj, et al. [*1998*] uses the coefficient of variation of the real per capita output across states to confirm that inequalities have indeed risen over the period 1960 to 1994. Their study reveals that although the dispersion fell mildly in the early 1960s mainly due to higher agricultural growth in the poorest of the regions brought about by 'Green Revolution', the later years witnessed sharp rise in inequality, particularly in the 1970s.

Although the 1980s saw inequalities increasing less notably, the 1990s again displayed rising tendency of inequality. According to the authors, the dispersion was observed to be 1.6 times higher in the 1990s than that found in the 1970s. Ahluwalia [*2002*], while attempting to measure variation in growth performance across 14 major Indian states in both pre-reform (1980s) and post-reform (1990s) years, observed a significant degree of dispersion in growth rates among Indian states during the later period. The coefficient of variation that was around 0.15 in the 1980s, almost doubled in the 1990s to around 0.27, indicating divergence. In another recent paper, Bhattacharya and Sakthivel [*2003*] observed the pattern of growing disparity among states in India. They show that the average coefficient of variation based on per capita output has gone up from 0.22 during the 1980s to 0.43 during the 1990s, almost a two-fold increase.

The standard deviation and the coefficient of variation are simple measures that have been used to quantify inter-state inequality in the Indian economy. There are a few studies that have used more sophisticated techniques to measure inequality including the Gini coefficient and Theil's entropy index. Ahluwalia [*2002*] attempts to look at trends in inter-state inequality for the pre-reform period (1980s) and the post-reform period (1990s), by constructing a population-weighted Gini coefficient based on per capita output. His study reveals that the coefficient remained stable at 0.15 till about 1986–87 after which it went up to reach 0.17 during the closing years of 1980s. During the nineties, the coefficient climbed steeply reflecting worsening inter-state inequality, to touch 0.23 in 1998–99. Das and Barua [*1996*] use Theil's entropy index as a measure of inequality and show that the index went up from 3.19 in 1970–71 to 8.06 in 1992–93, growing at an annual average rate of 3.55 percent. From this, they conclude that the Indian economy has developed only at the cost of raising regional disparities.

The Role of the Sectors

A few papers looking at the issue of convergence or divergence of the Indian states have specifically thrown some light on the sectoral roles in this context. Rao et al. [*1999*] find that a major source of the steady rise in standard deviation of per capita output from 0.22 in 1965–66 to 0.39 in 1994–95 is the primary sector, whose dispersion rate soared to 0.37 in 1991–92 as opposed to 0.17 in 1965–66. The standard deviation of per capita output for secondary sector was relatively stable until 1990 (around 0.48) but went up sharply later. This is attributed to better performances of industrially advanced states responding positively to the liberalization effort. As far as service sector is concerned, no consistent trend was discernible from their study. Another study that looks at the sectoral aspect in some details is Das and Barua [*1996*]. This paper uses a regression exercise to analyze the role of the sectors and finds that the regional inequalities of agricultural and services sector outputs are significant factors that explain the regional inequality of aggregate output, but not the regional inequality of total manufacturing output. Next, disaggregating manufacturing into registered

and unregistered components, they find that unregistered manufacturing is also a significant sector contributing to regional inequality while registered manufacturing is not.

Agglomeration Economies and Regional Divergence

The neoclassical growth framework leads to regional convergence due to its assumption of constant returns to scale. There is an alternative literature that stresses the increasing returns associated with the process of growth that may lead to uneven growth between regions and even regional divergence. This literature, including Duranton and Puga (*2003*) and Rosenthal and Strange (*2003*), focuses on agglomeration economies associated with the production process. The central proposition of this literature is that economic activities in general and industrial activity in particular, tend to be attracted to particular geographical locations that are already developed compared to other regions. These are the result of agglomeration economies and lead to urban concentration in these regions whose income and growth rates keep diverging from those in the peripheral regions. Marshall [*1920*] had suggested three sources of such agglomeration economies. These are (i) the sharing of inputs whose production involves internal increasing returns to scale, (ii) labour market pooling that allows a better match between an employer's needs and a worker's skills and (iii) knowledge spillovers between workers. Other sources of agglomeration that have come up in the literature include home market effects, economies of consumption, etc.

There is some empirical literature that test for these agglomerating forces and their effects across regions. The standard approach has been to take a region (states, counties, etc.) and then grouping all the industrial activity within them, assuming all of them to be located in the same area. Glaeser, et al. (*1992*) and Henderson, et al. (*1995*), while studying the industrial growth in cities, analyze the various sources of agglomerating economies, and attempt to identify those that play a crucial role at various stages of industrial development. Ciccone and Hall [*1996*] on the other hand focus on the states of the U.S. economy and explain their labour productivity in terms of measures of agglomeration economies like county level employment densities. Ciccone [*2002*] studies the same issue for the European economies and finds that the agglomeration effects are slightly smaller compared to the U.S. economy. In a study on Japanese prefectures, Dekle and Eaton [*1999*] find that for finance and manufacturing industries, there is evidence of agglomeration economies.

It is interesting to contrast and compare between the literature on regional divergence and that on the agglomeration economies. The difference between the two approaches is that while the agglomeration economies focus on the urbanization process, there is no such element in the regional divergence literature. Secondly, the former focuses on the density of development as a factor that explains subsequent development, while the later focuses on the productive capacity of a region (say, in terms of per capita output) for the same. Notwithstanding these differences in focus, the important factor that underlies both approaches is the assumption of increasing returns that leads to divergent outcomes between regions.

A Framework to Decompose the Rate of Divergence

The literature on the convergence of regional economies has largely ignored the role played by the various sectors in this process. Even though a few contributions have tried to throw some light on the role of the sectors, they have not quantified the contribution of each the sectors in the trends in regional inequality.[3] In order to quantify these roles, it is necessary to decompose these trends in regional inequality into their sectoral components. In this section, we shall describe a framework that can be used for this purpose. For the sake of convenience, we shall present the following analysis in terms of divergence, although it is also applicable for analyzing convergence. Our starting point is to choose a measure for the rate of divergence of regions over time. Since the objective of this study is to decompose regional divergence into its sectoral components, we need a measure that is amenable to algebraic treatment. As we shall show in this section, the coefficient of variation can be used for this purpose.[4]

According to the coefficient of variation-based approach, any increase in the inequality among the regions (measured by the coefficient of variation of the distribution of their output) over time indicates divergence.[5] In order to estimate how much each of the sectors contribute to the regional divergence, the first step is to quantify the rate of divergence. In the regression-based approach, this is measured by the speed of divergence, and is determined from the estimation of the neoclassical growth model. However, there is no equivalent term in the coefficient of variation-based approach, although the degree of divergence is determined by the extent of the increase in the coefficient of variation. We formalize this idea by defining the rate of regional divergence as the rate of growth of regional inequality, i.e., the growth rate of the coefficient of variation of regional output over time.[6] Thus, denoting per capita regional output by X_i, its coefficient of variation by $C(X_i)$, and the rate of regional divergence by D, we have

$$D = \frac{\dot{C(X_i)}}{C(X_i)} \tag{1}$$

[3] Das and Barua [*1996*] comes closest to this objective but their study uses a regression-based approach and not an exact decomposition of the regional inequality. Moreover, their study includes data up to 1992, and hence does not capture the effect of the major reforms in India which took place after 1993.

[4] The Gini coefficient is another popular measure that can be used for measurement and decomposition of inequality. However, the decomposition of the Gini coefficient by sources of income is not always easy to interpret in terms of economic behavior and hence we have used the coefficient of variation.

[5] The literature on regional convergence/divergence in India has used unweighted measures of inequality and in this paper we have adopted the same methodology.

[6] This is similar to the concept of *proportionate inequality changes* that has been used in the literature on personal income inequality and its trends. See Jenkins [*1995*].

Let there be n regions such that the output of each region is given by X_i, $i = 1 \ldots n$. Let there be m sectors that contribute to each region's output X_i, such that the output of each sector in each region is given by X_{ij}, $i = 1 \ldots n, j = 1 \ldots m$.

Then,
$$X_i = \sum_j X_{ij} \tag{2}$$

Let $\bar{X}$ be the arithmetic mean of X_i and $\bar{X}_j$ be the arithmetic mean of $X_{ij.}$ Next, define P_j as the ratio between the average output of the jth sector and the average output of the economy.

Thus,
$$P_j = \frac{\bar{X}_j}{\bar{X}} \tag{3}$$

Let us also assume that $\sigma(X_i)$, $\mathrm{Var}(X_i)$, $\mathrm{Cov}(X_{ij}, X_{ik})$ and $r_{ij,ik}$ are the symbols for the standard deviation, variance, covariance and the correlation coefficient of the corresponding variables, respectively. Then, using percentage decomposition of inequality by income source [*De Janvry and Sadoulet, 2001*], the regional inequality and its components can be derived from[7]:

$$\sum_j \left(P_j \times r_{ij,i} \times \frac{C(X_{ij})}{C(X_i)} \right) = 1 \tag{4}$$

Rearranging equation (4) we can write

$$C(X_i) = \sum_j (C(X_{ij}) \times P_j \times r_{ij,i}) \tag{5}$$

Equation (5) indicates that the level of regional inequality (measured by the coefficient of variation of regional output) is equal to the sum of each sector's contribution. The contribution of each sector is equal to the product of (i) the regional inequality at the sectoral level, i.e., the inequality in the distribution of a particular sector's output amongst the regions, (ii) the

[7] The mathematical decomposition of inequality by income sources given in De Janvry and Sadoulet (2001) is part of a large theoretical literature on inequality measurement and decomposition [Drescher 1999]. This theoretical literature does not attribute any particular intuitive explanation to the decompositions, but studies that have applied the decomposition results interpret them according to the context of their studies. Our study interprets the decompositions in terms of agglomeration economies, structural transformation and sectoral linkages with the aggregate economy.

average regional output of the sector as a proportion of the average regional output and (iii) the correlation coefficient between the sector and the whole economy. This means that the regional inequality for the economy is affected not only by the regional inequalities at the sectoral level, but also by the relative size of the sectors and their interlinkage with the economy. The size of the sectors add a scale effect to the sectoral inequality, i.e., a larger sector adds more to the economy's inequality compared to a smaller sector. The interlinkages of a sector with the whole economy—represented by the correlation coefficient between the two—also has an important role. This is due to the fact that a high correlation between any sector and the economy implies that a region that has a relatively high output from that sector also has a relatively high aggregate output, while a region that has a relatively low output from that sector also has a relatively low aggregate output. Thus, for a given level of inequality in the sector, an increase in the correlation coefficient increases the economy's inequality.

Equation (5) breaks up the coefficient of variation of regional output into its sectoral components. However, in order to derive the rate of divergence, we need to derive the growth rate of the coefficient of variation. Differentiating both sides of equation (5) with respect to time and dividing by $C(X_i)$ we get,

$$\frac{\dot{C}(X_i)}{C(X_i)} = \sum_j \left[\left(\frac{C(\dot{X}_{ij})}{C(X_{ij})} + \frac{\dot{P}_j}{P_j} + \frac{\dot{r}_{ij,i}}{r_{ij,i}} \right) \times \left(\frac{C(X_{ij}) \times P_j \times r_{ij,i}}{C(X_i)} \right) \right] \tag{6}$$

Equation (6) implies that the regional divergence is equal to the weighted sum of growth rates of the three components in equation (5). In each case, the weights are the sectors contribution to the economy's initial levels of regional inequality, as a ratio of economy's initial levels of regional inequality. It should be noted here that equation (6) follows from equation (5) only in continuous time, when certain cross products arising out of an expansion of equation (5) take up negligible values and are assumed to be equal to zero. However when we will use these equations to undertake some measurement in discrete time (in the next section), errors creep in due to non-negligible values of the cross products. In that case, the right hand side of equation (6) becomes approximately equal to the left hand side of the equation.

Data and Results

In this section, we shall quantify the contributions of the agricultural, industrial and the services sector towards the changes in regional inequalities in India after the liberalization of the economy. Most studies dealing with the regional dimensions of the Indian economy base their work on the major states of India.[8] In consonance with this approach, we use data from

[8] See for example, Das and Barua [*1996*], Rao, Shand and Kalirajan [*1999*].

seventeen major Indian states, i.e., Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Goa, Haryana and Himachal Pradesh. In order to generate data on the aggregate and sectoral output of the states, we use GSDP (Gross State Domestic Product) data classified by industry of origin.[9] The GSDP and the population data series for this study are obtained from Central Statistical Organization (CSO).[10] The time period chosen for the study is 1990–91 to 1999–2000, i.e., it coincides largely with the period of liberalization that was initiated during the early parts of the nineties.[11] It may be noted that, in order to avoid the complexity arising out of reorganization of states (which resulted in a number of new states) we have used data till 1999–2000, which is the last year for which data from the undivided states (such as, Uttar Pradesh, Bihar and Madhya Pradesh) are available.

We use the framework described in the earlier section to decompose the regional divergence into sectoral contributions. Each sector's contribution is equal to the weighted sum of growth rates of three components i.e., (i) the regional inequality at the sectoral level, (ii) the average regional output of the sector as a proportion of the average regional output and (iii) the correlation coefficient between the sector and the whole economy. Tables 1, 2 and 3 deal with each of these three components respectively. Table 1 presents the coefficient of variation of per capita aggregate and sectoral output.

It is clear from this table that inequality increased for the aggregate economy and for the sectors during this period. This is, of course, consistent with the literature on agglomeration economies that stresses that in a market economy, investment and activity is attracted towards relatively developed regions leading to rising regional inequality. Moreover, the table shows that the divergence is much lower for the services and the agricultural sector (where the coefficient of variations have risen by about fifteen percent between 1990–91 and 1999–2000) compared to the industrial sector (where the coefficient of variation has gone up by about thirty percent over this period). This is again consistent with the literature on agglomeration economies, that stresses the fact that industrial activity in particular exhibit stronger agglomerating tendencies than other kinds of activities. To sum up, the evidence seems to indicate that during the nineties, the Indian economy exhibited strong agglomerating tendencies and this was largely driven by the industrial sector. The lower part of Table 1 also provides (i) the rates of divergence

[9] The agricultural output is derived by aggregating over agriculture, forestry and logging and fishing, while the industrial output is the aggregate of mining and quarrying, registered and unregistered manufacturing, construction and electricity, gas and water supply. The services sector comprises of estate, ownership of dwellings and business services, public administration and other services.

[10] The Central Statistical Organization provides time series estimates of State Domestic Product in soft version to researchers but does not publish them in printed form.

[11] The GSDP data supplied by the CSO corresponded to two base years, 1980–81 (for the period 1990–91 to 1992–93) and 1993–94 (for the period 1993–94 to 1999–00). In order to obtain one comparable time series for the whole period, we have constructed back series up to 1990–91 with 1993–94 as the base year using a methodology known as splicing.

TABLE 1
Aggregate and Sectoral Divergence Rates (1990–1999)

	Coefficient of Variation of per Capita Income			
	GSDP	*Agriculture*	*Industry*	*Services*
1990–1991	0.38	0.35	0.52	0.52
1991–1992	0.37	0.38	0.51	0.49
1992–1993	0.40	0.37	0.56	0.51
1993–1994	0.40	0.39	0.56	0.50
1994–1995	0.39	0.38	0.51	0.53
1995–1996	0.41	0.38	0.52	0.55
1996–1997	0.44	0.39	0.57	0.58
1997–1998	0.43	0.37	0.55	0.55
1998–1999	0.48	0.36	0.68	0.59
1999–2000	0.49	0.41	0.67	0.60
Rate of Divergence	3.00	1.70	2.87	1.60
Weights		0.14	0.36	0.51
Sectoral Contribution		0.23	1.02	0.81
Sectoral Contribution (percentage)		7.75	34.12	26.97

Source: *Author's calculation*.

(the average compound growth rate of inequality for the period) and (ii) the contributions of divergence of sectoral output to regional divergence (the divergence rates of sectoral output multiplied by corresponding weights). Note that the weights are significantly different for the three sectors. As explained in the earlier section, these weights are the particular sector's contribution to the economy's initial levels of inequality (i.e., $C(X_{ij}) \times P_j \times r_{ij,i}$), as a ratio of the economy's initial levels of inequality (i.e., $C(X_i)$). Since these weights correspond to the relative contribution of each sector in the initial period, we shall henceforth refer to them as initial conditions. The differences in these initial conditions indicate that the contribution of the sectors in explaining the level of inequality in 1990–91 (i.e., the initial period) was significantly different, with agriculture having the lowest contribution (fourteen percent), followed by industry (thirty six percent), while services had the highest contribution (fifty one percent).[12] This dissimilarity in the initial conditions ensure that although the rate of divergence of the services sector is roughly similar to that for the agricultural sector and about half of that in the industrial sector, the contribution of the services sector divergence is more than three times that of the agricultural sector and about eighty percent of that from the industrial sector.

The second component of regional inequality, *Pj* (the average regional output of the sectors as a proportion of the average regional output) is given in Table 2. The upper part of the table

[12] The sum of the three contributions exceeds hundred percent due to rounding off of the weights up to two decimal places.

TABLE 2
Changes in the Relative Size of the Sectors

	Average Sectoral per Capita Output as a Proportion of Average per Capita Output		
	Agriculture	*Industry*	*Services*
1990–1991	0.33	0.28	0.39
1991–1992	0.32	0.28	0.40
1992–1993	0.32	0.28	0.40
1993–1994	0.31	0.28	0.40
1994–1995	0.31	0.29	0.41
1995–1996	0.29	0.29	0.42
1996–1997	0.29	0.29	0.42
1997–1998	0.27	0.30	0.43
1998–1999	0.25	0.30	0.44
1999–2000	0.24	0.31	0.45
Rate of Growth	–3.52	1.11	1.65
Weights	0.14	0.36	0.51
Sectoral Contribution	–0.48	0.40	0.83
Sectoral Contribution (percentage)	–16.10	13.20	27.78

Source: *Author's calculation*.

gives the average per capita state output of each sector as a proportion of the average per capita state output. As we have already stated, this is a measure of the relative size of the sector. It is clear from this table that over this period, the relative size of average per capita agricultural output (i.e., the proportion of per capita GSDP for an average state that comes from agriculture) has come down from about one third to about one fourth. This fall has been made up by rising shares, principally in the services sector and partly in the industrial sector. This indicates that the Indian economy is undergoing significant structural transformation, changing from an agricultural to a non-agricultural economy.

The lower part of Table 2 calculates the contributions of the change in the relative size of the sectors. The last four rows of this table are similar to those in Table 1, i.e., they correspond to the steps involved in the calculation of the sectoral contributions towards aggregate divergence. From these rows, we can surmise two points. Firstly, in consonance with their changing relative sizes, the growth rate of *Pj* from agriculture is negative while those from the industrial and services sectors are positive. Secondly, although the magnitude of the growth rate is highest for the agricultural sector followed by those from the services and the industrial sector, the different initial conditions for the sectors ensure that the magnitude of the contribution from the agricultural sector is substantially lower compared to that from the services sector and only marginally higher than that from the industrial sector.

Table 3 deals with the third component of regional inequality, $r_{ij,i}$ (the interlinkage of the sectors with the economy). The upper part of the table gives the correlation coefficient between the sectors and the aggregate economy for the whole period. We find that throughout the period, agriculture is less integrated with the economy, compared to industry and services. More

TABLE 3
Changing Linkages between the Sectors and the Economy

	Correlation Coefficient Between Sectors and the Economy		
	Agriculture	*Industry*	*Services*
1990–1991	0.45	0.94	0.94
1991–1992	0.45	0.93	0.94
1992–1993	0.53	0.95	0.94
1993–1994	0.52	0.94	0.94
1994–1995	0.48	0.94	0.93
1995–1996	0.44	0.94	0.94
1996–1997	0.45	0.95	0.94
1997–1998	0.41	0.96	0.95
1998–1999	0.36	0.96	0.96
1999–2000	0.35	0.96	0.97
Rate of Growth	–2.72	0.29	0.27
Weights	0.14	0.36	0.51
Sectoral Contribution	–0.37	0.10	0.14
Sectoral Contribution (percentage)	–12.45	3.43	4.63

Source: *Author's calculation*.

significantly for the agricultural sector, the strength of the interlinkages with the economy has weakened considerably over the decade, while that for the industrial and the services sectors have remained almost the same.

The lower part of Table 3 calculates the contributions of the changing linkages between the sectors and the aggregate economy. The last four rows of this table are again similar to those in Table 1. Here, due to the sharp fall in the correlation coefficient between agriculture and the economy, the rate of growth of the interlinkage is negative (implying a weakening of the linkage) and its magnitude is almost ten times as large as those from the other two sectors. As a result, despite the different initial conditions, the magnitude of the contribution is the largest from the agricultural sector, followed by the services and the industrial sector.

In Table 4, we have aggregated the results from the first three tables, in order to highlight the total contribution of each of the three components in equation (5), as well as the total contribution of each of the sectors. The second, third and fourth row represent the contribution of the three components while the second, third and fourth column represent the contribution of each of the three sectors. The fifth row gives the total contribution of each of the sectors. Similarly, the fifth column gives the total contribution of each of the three components. As we have mentioned earlier, there is an element of error in our decomposition exercise (using equation (6)) due to the measurements in discrete time. The last column gives the error as a percentage of total divergence.

From Table 4, we find that the error is about ten percent, i.e., the decomposition explains about ninety percent of the aggregate divergence. However, this error is unavoidable and has to be kept in mind when we interpret the results of the decomposition exercise. Let us now focus on the relative contribution of each of the components of equation (5). It is clear

TABLE 4
Components of the Aggregate Divergence (percentage)

	Agriculture	*Industry*	*Services*	*Total*	*Error*
Contribution from Sectoral Divergences	7.75	34.12	26.97	68.84	
Contribution from changes in Relative Size	–16.10	13.20	27.78	24.87	
Contribution from Changing Linkages	–12.45	3.43	4.63	–4.39	
Total Sectoral Contribution	–20.80	50.75	59.37	89.33	10.67

Source: *Author's calculation*.

from the above table that about seventy percent of regional divergence is due to the regional divergence at the sectoral level, with all the sectors contributing to it. The changing size of the sectors has contributed to about a fourth of regional divergence, indicating that structural changes in the Indian economy are an important factor behind the divergence. Finally, the changing interlinkages between the sectors and the economy have played a small role in keeping a check on divergence.

Next, let us analyze the contribution of each of the sectors. The services sector, despite having the lowest rate of divergence among the three sectors, has the largest contribution due to initial conditions and high growth in the relative size of the sector. The industrial sector also makes a large contribution due to high rates of divergence, initial conditions and some growth in its relative size. The agricultural sector, on the other hand, has offset some of the aggregate divergence due to this sector's low rate of divergence, low initial conditions, shrinking size as well as weakening linkage with the aggregate economy.

Summary and Concluding Remarks

There is a significant literature that has looked into the issue of trends in regional inequality in India. However, none of these studies has focused on the contribution of the individual sectors towards these trends. In this paper, we have attempted to do this by using a framework that can measure the sectoral contributions. This framework demonstrates that the regional divergence (or convergence) is influenced by four factors i.e., (i) the regional divergences (or convergences) at the sectoral level, (ii) the changes in the relative size of the sectors, (iii) the changes in the relationship of the sector with the total economy and (iv) the initial conditions. Using this framework, we have looked at the trends in regional inequality in India during the nineties and the sectoral contributions towards these trends. Our findings are that the Indian economy experienced regional divergence, in terms of aggregate output and in each of the three sectors (agricultural, industrial and services), during the nineties. However, the divergence rate was quite uneven across the sectors. Clearly, the highest rate of divergence was in the industrial sector, while the rate was significantly lower for the agricultural sector and the lowest for the services sector. The relative rankings are completely different however, when

we consider the total contribution of the sectors towards aggregate divergence. Although the services sector has the lowest rate of divergence, it contributes more to aggregate divergence than any of the other sectors. This is partly due to its very large share in the aggregate inequality at the beginning of the period, i.e., in 1990, was very high (initial conditions) and partly due to a large change in its relative size. The industrial sector is the second largest contributor largely due to its high rate of divergence and a high share in the aggregate inequality at the beginning of the period (initial conditions). Interestingly, the agricultural sector's contribution was to significantly offset the rate of aggregate divergence. This is due to a combination of low divergence in this sector, initial conditions, shrinking relative size as well as a significant delinking with the aggregate economy.

The results also show that although the divergences within the three sectors are largely responsible for the aggregate divergence, there are other contributory factors as well. In fact, the other significant factor is the structural transformation of the economy, which is responsible for a significant part of the aggregate divergence, while the changing interlinkages play an insignificant role. What inferences can we draw about economic policy from the results of this exercise? As evident from our exercise, India is undergoing a structural transformation with a continuous shift from an agrarian to a non-agrarian economy. This of course, is a positive indicator of development, as the economies of scale associated with the production process in industry and services will enable the economy to sustain a high growth path. However, it is important to note that the nature of this transformation is also driving up the regional inequality in the Indian economy. More specifically, it is the industrial and services sectors that are responsible for this divergence, while the agricultural sector has, in fact, kept a check on the rate of divergence. As we have noted earlier, this result is consistent with the literature on agglomeration economies that has always stressed that the nature of industrial development in a market economy makes them concentrate in particular locations. However, this literature also differentiates between natural and man-made advantages of these locations vis-à-vis others. While the first type would include natural factors like distance from the coastal areas etc., the second type stresses on factors like urban infrastructural facilities, etc. that result from the concentration of economic activity in particular locations.[13] Clearly, policy interventions can limit these man-made factors far more successfully than those of the natural factors. Of course, it is impossible to estimate from this study how much of the industrial divergence during the period studied is due to each of these two types of factors, but there is ample evidence in other studies that indicate that unequal infrastructural facilities lead to unequal industrial performance in the Indian states [*Mitra, Varoudakis and Veganzones-Varoudakis, 2002*]. The upshot of this discussion is that, a part of the industrial divergence in India is due to man-made agglomerating forces like urban infrastructure, and hence it is possible to keep this divergence within control by ensuring a more equitable regional distribution of such infrastructure and developing better infrastructure in the backward areas.

[13] See Venables [*2003*] for a discussion of these two types of agglomerating forces.

As we have shown in this study, the industrial sector contributes about fifty percent of the aggregate divergence due to its high rates of divergence, initial conditions and growth in its relative size. However, due to its strong interlinkages with the services sector, it is partly responsible for the divergence in the services sector as well. Interestingly the services sector, which made the highest contribution to inequality at the beginning of the decade, seems to have turned a corner and had the lowest rate of divergence of all the sectors during the decade. This was made possible largely due to significant growth in the services sectors of the relatively poor states. This phenomenon has very important implications for the policy makers because it indicates that the nature of the production process in the services sector is not as susceptible to the agglomerating forces as the industrial sector, and hence this sector can help in keeping a check on divergence. In terms of our framework, high growth in the services sectors of the relatively poor states will bring down the rate of divergence in two ways. Firstly, a higher rate of services growth in the poorer states will bring down the rate of divergence within the services sector. Secondly, a higher rate of services growth in the poorer states will also weaken the linkages of this sector with the aggregate economy, resulting in lower rates of divergence. In fact, we have found from our study that the agricultural sector has kept a check on aggregate divergence as a result of such weakening of its links with the aggregate economy. This indicates that a higher rate of agricultural growth in the poorer states also has the potential to restrict divergence in the aggregate economy. Thus, a policy package targeted towards the growth and development of the agricultural and services sectors in the backward areas may go a long way in keeping a check on regional divergence.

To sum up, in a developing economy like India with a liberalized market-friendly regime, a certain degree of divergence—especially in the industrial sector—is an inevitable part of the development process. However, the degree of divergence can be kept in check if the policy interventions reduce inequality in physical and other types of infrastructure and encourage the poorer regions to increase the growth in the agricultural and the services sectors. This may need some policy program targeted towards the development of these sectors in the backward areas. In the absence of such policies, the regional inequality may increase to an extent where they can become an obstacle in the path of sustained reforms and growth.

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Chapter 12

Growing Regional Disparities in Development in India – Post-Reform Experience and Challenges Ahead

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I. Growing Regional Disparities in Development

It is now well established that the inter-state disparities in the growth of Gross State Domestic Product (GSDP) have increased in the post-economic reform period beginning from the early nineties when compared to the eighties. In general, the richer states have grown faster than the poorer states (Ahluwalia, 2000; Dev and Ravi, 2003; Bhattacharya and Sakthivel, 2004). The regional disparities in per capita GSDP growth are even greater because the poorer states in general have experienced a faster growth in population.

Although these disparities have accentuated in the post-reform period, they have been building up in the pre-reform period itself. For example, in the early 1960s the per capita GSDP of the richer states like Punjab, Maharashtra and Gujarat was, on an average, about 80 per cent higher than the average per capita GSDP of the bottom four states viz., Bihar, Uttar Pradesh, Orissa and Madhya Pradesh. This disparity increased to 125 per cent by the early 1970s (Rao, 2005); was contained at a little over 100 per cent during the eighties; and escalated steeply to 200 per cent towards the end of the nineties.

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States whose per capita GSDP is below the national average together account for over 60 per cent of the country's population and as high as 75 per cent of the country's population below the poverty line. Further, these states account for nearly 60 per cent of the population belonging to the socio-economically disadvantaged sections like Scheduled Castes and Scheduled Tribes. There is thus a large untapped potential for equitable growth which needs to be harnessed for sustaining development in the country over a long period. This is necessary for improving regional and social equity and for strengthening national integration.

II. Sectoral Composition of Growth

How does one explain the accentuation in inter-state disparities in development in the post-reform period in the country and, indeed, the tendency of a gradual build-up in these disparities over the plan period? One way to study is to decompose by looking at the emerging regional disparities with respect to the individual sectors, i.e., the Primary, the Secondary and the Tertiary. The inter-state variation in per capita GSDP originating from the Primary Sector, measured by the coefficient of variation, has always been lower than that from the Secondary Sector GSDP. There is also no evidence of an increase in its variability across regions in the post-reform period when compared to the eighties. This is understandable because agriculture is based essentially on land and labour which are widely distributed across the country. There are, no doubt, significant regional disparities in the availability of physical and institutional infrastructure for agriculture like irrigation, rural electricity and institutional credit. However, despite these constraints, technological changes in Indian agriculture represented by Green Revolution were adopted widely in the country, including especially the eastern region, by the end of the eighties.

The GSDP per capita from the Secondary Sector, on the other hand, shows much higher variability across regions and this variability rose significantly in the post-reform period. The Tertiary Sector which has been the prime mover of GDP growth in the post-reform period has generally grown faster in the industrially advanced states and shows a significant rise in its variability across states during this period. We know that there has been a steep reduction in the share of the Primary Sector in the overall GDP, a modest rise in that of the Secondary Sector and a big rise in the share of the Tertiary Sector. Thus, the decline in the relative importance of the Primary Sector—which shows lower disparities—and the rise in the importance of the other two sectors showing higher variability explain, at the compositional level, the rise in inter-state disparities in per capita GSDP in the post-reform period.

Whereas inter-state disparities in per capita GSDP have increased significantly in the post-reform period, the corresponding disparity in HDI has declined. The coefficient of variation in HDI declined from 22.6 in 1981 to 19.0 in 1991 and 16.3 in 2001. This is because investment requirements in primary education and primary health care are not as heavy as in the capital-intensive physical infrastructure, and the results in terms of improving literacy rate

and the life expectancy at birth are relatively quick. However, the rise in public expenditure in these sectors has been very slow, especially in the poorer states, in the post-reform period (Dev and Mooij, 2003). This has resulted in the smaller decline in regional disparities in HDI in the post-reform decade. Since human development has a positive impact on GDP growth, inadequate attention to this sector in the poorer states in the post-reform period could partly be responsible for the rise in regional disparities in per capita GSDP growth.

III. Causal Factors

A. Investment

(i) Planning and Public Investment

Investment in physical and human capital, technical change and institutions, including those of governance, are the three key variables usually invoked for understanding the growth performance. A glaring feature of the investment scene in the post-reform period is the steady decline in the rate of public investment and a steep rise in the share of private investment with a stagnation in the rate of total investment. According to the estimates by the Central Statistical Organisation, gross capital formation by the public and private sectors were roughly equal at around 10 per cent of GDP each in the early 1980s. Public sector investment declined to a little over 5 per cent of GDP in recent years whereas private sector investment rose to a little over 17 per cent of GDP[1].

The decline in public investment is even more glaring at the state level where bulk of the public expenditure on irrigation, power and social sectors is incurred. This is indicated by the fact that the share of the states declined from around 50 per cent of total plan expenditure in the country in the eighties to 40 per cent towards the close of the nineties.

Within the states, the per capita plan outlays of the poorer states have always been much lower than those of the better-off states. These disparities have widened in the post-reform period. For instance, during the Sixth Plan period (1980–85), the actual per capita plan expenditure for the poorest four states, on an average, was a little over half of the average per capita plan expenditure of the better-off states like Gujarat, Maharashtra and Punjab. But during the Ninth Plan period (1997–2002) this proportion came down to around 40 per cent.

Central assistance for state plans (including assistance for externally aided projects), which is a major component of state plan resources, has been progressive in that the per capita as-sistance for the poorer states has been higher than for the richer states. The poorer states have been handicapped basically by their own weaker resource position. The per capita own plan resources of the poorer states for plans, including market borrowing, constituted around 40 per cent of own per capita resources for plans of some of the better-off states, viz., Punjab, Maharashtra,

[1] In 2005–06, Gross Capital Formation by the Public Sector constituted 7.4 per cent of GDP, while Household Sector 23.6 per cent (See Reserve Bank of India, Annual Report 2006–07.)

Haryana and Kerala during the Sixth Plan period. This ratio deteriorated to 28 per cent in 2003–04 and further to less than 20 per cent in 2004–05. An important factor responsible for this deterioration in the financial position of the poorer states is the decline in the tax-GDP ratio of the Centre in the post-reform period and the consequent decline in the transfers to the states through devolution as recommended by the successive Finance Commissions. The loss to the states, that is, the difference between the devolution estimated by the Finance Commissions and the actual devolution, amounts to Rs. 100,000 crores for the decade 1995 to 2005 (Reddy, 2005). The decline in per capita transfers to the poorer states was even greater because the formula for devolution by the Finance Commissions is quite progressive. Therefore, the 12th Finance Commission has done well by raising the tax devolution by 1 percentage point (Government of India, Report of the Twelfth Finance Commission, 2004).

As expected, among states, there is a strong positive correlation between the per capita income and tax-GDP ratio. For richer states, because of their higher tax-GDP ratio, their own tax revenues per capita are much higher than those for the poorer states (Singh, 2005). This is so even when the tax effort of some of the richer states is lower, and that of some of the poorer states higher than the desirable norm considering their per capita income, rate of urbanization, etc. A multiple regression analysis with per capita own revenues of state as dependent variable and per capita net state domestic product and rate of urbanization as independent variables, shows that Punjab and Maharashtra whose per capita net state domestic product as well as own tax revenues were among the highest during the triennium 2001–2004, could have mobilized 5–10 per cent more revenues, given their level of per capita income and rate of urbanization. On the other hand, Bihar—the poorest state with lowest per capita tax revenues—showed highest tax effort by mobilizing 38 per cent more revenues than could be expected considering its per capita income and rate of urbanization. Although the tax devolution by the Finance Commissions has been progressive for the last 25 years, this could not offset the weaker resource position of the poorer states so far as resources for plan are concerned. Higher tax devolutions from the Finance Commissions have helped them basically to reduce their dependence on grants-in-aid for meeting their deficits on non-plan revenue account. In the absence of progressive devolution of tax revenue, the Finance Commissions would have had to take greater recourse to grants-in-aid for filling up the non-plan revenue gaps of such states. However, it must be said to the credit of the 12th Finance Commission that they have raised the proportion of grants in the total devolution and earmarked a significant portion of these grants to the poorer states for the development of social sectors like education and health.

The debt-GDP ratios of the poorer states are higher. Because of their lower credit-worthiness they have not been able to access borrowings from the market to the same extent as the richer states. The per capita market borrowings of the four poorest states which were almost equal to the market borrowings of certain better-off states, viz., Punjab, Maharashtra, Haryana and Kerala during the Sixth Five Year Plan declined to 72 per cent of such borrowings by these states in 2004–05. The inability of the less developed states to access sufficient resources for the development of infrastructure through higher plan outlays has thus emerged as a critical constraint in redressing regional imbalances in development.

Among states, the correlation between per capita GSDP growth rate in the post-reform period of nineties and the index of Social and Economic Infrastructure in 1995 as well as 2000 is positive and significant. Clearly, the states whose initial or pre-reform conditions were favourable in respect of infrastructure could benefit more from the opportunities opened up, especially in the service sector, by economic reforms and register higher growth rates in GSDP (Rao and Dev, 2003).

(ii) Private Investment

This is because private investment has been flowing basically to the high income states where per capita plan outlays have been higher and where, therefore, infrastructure is well developed. For example, according to the IDBI data, the per capita cumulative disbursements by the All India Financial Institutions up to March, 2004, were Rs.15 lakhs for Maharashtra, 14 lakhs for Gujarat and 7 lakhs for Tamil Nadu, as against less than 3 lakhs for Madhya Pradesh, less than 2 lakhs for Uttar Pradesh, and less than half a lakh for Bihar. Similarly, in 2003, Investment plus Credit-Deposit Ratios of Scheduled Commercial Banks were high for the Western (75 per cent) and Southern Regions(79 per cent) and quite low for the Eastern (54 per cent) and Central Regions (50 per cent). As to the amount of Foreign Direct Investment & FTC (Foreign Technical Collaboration) approved from August 1991 to December 2000, a few advanced states, viz., Maharashtra, Gujarat, Tamil Nadu, Karnataka and Delhi together accounted for half the share as against the combined share of less than 10 per cent by the four poorest states (Government of India, 2001).

B. Technical Change

The issue of technical change does not seem to figure prominently in the debate on regional disparities in development in India. This could be partly because much of the technology is embodied in capital equipment and hence is highly correlated with such investment. Also, this may be attributed to the speedy diffusion of frontier technologies like bio-technology and information technology across regions with varying levels of development and even among income groups with large differences in asset endowments, when adequate support services are provided. The success of green revolution in India provides a classic illustration of this process. After the initial success with wheat in the North-Western India for a decade beginning from the mid-sixties, it soon spread to different parts of the country by the eighties covering rice even in the poorer eastern gangetic plains because of its inherent profitability and relatively low investment requirements.

The experience so far with the diffusion of information technology is equally encouraging and holds the prospect for raising productivity enormously in millions of farms and factories of varying sizes and the government offices throughout the country. This experience underlines the need to exploit the potential offered by these emerging technologies as well as human development for giving a fillip to the catching-up process in the less developed areas of the country.

C. Institutions and Governance

Historically, the developed states are, in general, characterized by progressive land tenures like the *Ryotwari* or the *Mahalwari* systems, whereas most of the less developed states were under the exploitative tenures like the *Zamindari* and the *Jagirdari* systems. Many of these areas were under the princely states for a long period. The social structure evolved under progressive land tenures has been conducive to the growth of enterprise and generated incentives for work, whereas the social structure perpetuated by the exploitative land tenures has been inimical to enterprise and bred apathy. Also, historically, the developed states have had relatively more efficient systems of governance in terms of skills, responsiveness and the quality of delivery systems. Unlike capital—which is highly mobile across regions and continents—good governance cannot be transplanted in an area, as it evolves basically within the prevailing socio-political structure over a long period. An outmoded social structure can never bring about or sustain good governance in the modern sense. On the contrary, it can frustrate exogenous attempts at good governance by its debilitating and corrupting influence.

The current debate on 'good governance' in India is largely divorced from the nature of the prevailing social structure and the need to generate socio-economic impulses for its transformation. As such, it comes out essentially with technocratic prescriptions regarding good governance in the poorer states as a prerequisite for attracting greater investment flows and for stepping up growth through the efficient use of resources. It underplays the role of factors like investment in infrastructure, technical change for raising the profitability of investment and empowerment of the people in triggering off the desirable changes in the prevailing socio-economic structure, which is the root cause of poor governance and inefficient delivery systems in the less developed areas.

For understanding the causes of backwardness and for formulating appropriate development strategies one has to go deeper into the history. For example, for over a century and half before independence, the rate of taxation was very high in the eastern zone and the extraction of surplus was much higher than in many other parts of the country. We know that there has been a significant drain of resources from the country in the colonial period. But there was also a significant inter-regional flow of resources within the country. There was a large net outflow of resources from the eastern region which was partly frittered away in conspicuous consumption and partly invested in other regions in infrastructure like irrigation and transport (Rao, 2005). This is how the less developed regions inherited poor infrastructure and outmoded institutions at the time of independence.

Even after independence, the per capita transfer of resources from the Finance Commission as well as the Planning Commission were lower for many of the less developed states for at least two decades when the cost of building infrastructure was relatively low (Rao, 2005). The transfer of resources, especially from the Finance Commissions, have become progressive after the seventies. But in a federal democratic polity there are limits to such statutory transfers, particularly because many of our 'developed' states too are poor in absolute terms.

IV. The Way Ahead

It is clear from the foregoing discussion that for reducing regional disparities in development, improving social and economic infrastructure in the backward regions through greater public investment needs to be given the highest priority in the development strategy. The other two areas of priority action for these regions are: speeding up social transformation through the empowerment of the common people and measures for good governance. In this presentation I have chosen to focus mainly on the inter-state disparities in levels of development. However, growing regional disparities within certain states, especially the bigger ones, is a matter of equal concern. It is clear from the development experience and the simmering unrest in several less developed parts of the country that without major initiatives at the national level, the regional disparities in development may accentuate further to crisis proportions threatening social harmony and national integrity, apart from depriving the nation of the opportunities for higher and sustainable development.

Unfortunately, precisely at this moment when imaginative and decisive initiatives are needed towards this end by the Centre, there are conflicting signals emanating from the policy-making levels, and a clear and coherent policy is yet to emerge. The 12th Finance Commission, while linking the debt write-off scheme for states with the quantum of reduction in their revenue deficits, fixed norms, targets and the time-frame that are uniform across all states regardless of their initial levels of revenue deficit, income levels and debt-GSDP ratios. The permissible level of fiscal deficit under the Fiscal Responsibility and Budget Management Act is uniform across all states. Further, the recommendation of the 12th Finance Commission to dispense with the loan component of central assistance for state plans and leaving the states to directly access the market for loans can adversely affect the development of the poorer states whose credit-worthiness is lower, unless, as suggested by the Finance Commission, the Centre volunteers to intermediate on behalf of the poorer states. Therefore, an alternative framework for enabling the poorer states to step up their developmental expenditure needs to be quickly put in place by the Planning Commission.

The Mid-Term Appraisal of the Tenth Five Year Plan, by the Planning Commission, recognizes the growing regional disparities, and states that " the objective of bringing about greater regional balance must be the overriding consideration for determining the use of Central funds that flow as Central assistance to State Plans" (Government of India, 2005, p. 512). The Commission notes the inadequacy of the existing pattern of central assistance for state plans, through the Gadgil Formula, for making progress towards mitigating these imbalances and suggests that "The actual flow of funds to backward areas resulting from the operation of the Formula till date needs to be analysed and the Formula may need to be revisited in the present day context" (p. 508). But with the acceptance of the recommendation of the 12th Finance Commission to dispense with the loan component of plan assistance, there is not much left for revisiting, except the grant component! At the same time, the Commission expresses helplessness in modifying the Formula and gives up any hope when it says that "the recent

proposals for modification have not been able to generate the required consensus among states. It appears that the normal Central assistance is likely to continue in its present form in the near term" (p. 512).

Such constraints notwithstanding, there is a strong case for renewing efforts at revising the Gadgil Formula, if only for making the grants component of Plan assistance more favourable to the less developed states. This is especially necessary if the quantum of grants has to be raised substantially to help such states in view of the constraints in accessing loans in the market. It is indeed ironical that Central assistance for state plans, whose avowed purpose is to ensure speedy development of the poorer states, is less progressive than the devolution from the Finance Commissions. This is because the latter has been left to be decided by a few experts whereas in the case of the former, consensus among states is indispensable (Vithal and Sastry, 2002).

Even so, before making their recommendations, the Finance Commissions have been holding extensive discussions with state governments as well as with various sections of our population. It speaks highly of the trust that our people have reposed in the constitutional arrangements of our federal democratic polity that the recommendations of the Finance Commissions have been received, by and large, favourably. This suggests that a far-sighted leadership can still generate consensus among states and people at large on the need for a more progressive Formula for Central assistance for state plans in the interests of preserving social harmony and strengthening national integration.

The predominant weight now given to population (60%) in the Gadgil Formula needs to be brought down substantially to the level assigned in the Finance Commission Formula (25%), which has become acceptable. The latest figures of population should be used for the distribution of this amount among states. The existing practice of using 1971 population is iniquitous as it penalizes populous states for their lower level of socio-economic development—arising from their weaker resource position—which is indeed the basic cause for their high population growth (Rao, 2005).

Certain criteria presently used, viz., tax effort, fiscal management, population control, female literacy, on-time completion of externally aided projects and success in land reforms—which together claim 7.5% of resources for distribution need to be revisited. For one thing, the measures of 'tax effort' and 'fiscal management' currently used, being different from those used by the Finance Commissions, are far from satisfactory. Besides, the contribution of allocations, based on these criteria, towards fulfilling the avowed objectives is dubious. This is because several other factors are far more important in improving the indicators chosen. They are also iniquitous because the allocations on the basis of these criteria benefit mainly the better-off states who, in any case, have the requisite resources for improving these indicators. The amount saved by modifying or dispensing with the above criteria (42.5%) may be distributed among states on progressive criteria like the deviation and the distance methods, as used now under the Gadgil Formula for the distribution of 25% of Central assistance.

While mediating on behalf of the poorer states to access market loans, Centre should ensure that the resultant resources for plan are distinctly more progressive than hitherto under the

existing Formula. Unlike the Tenth Plan's original proposals, the Mid-Term appraisal does not seem to favour rigidly linking Central assistance with the implementation of reform packages or other measures concerning good governance. It may, nevertheless, be desirable to put in place mechanisms for ensuring that the additional resources so accessed are in fact utilized for the development of social and economic infrastructure.

The Mid-Term Appraisal also projects several proposals to strengthen the resource position of the backward states, such as raising the royalty for the poorer states which are rich in forests and minerals; helping them through better project preparation, etc. for accessing the Additional Central Assistance for the Externally Aided Projects; Backward Regions Grants Fund (BRGF) to address regional balance concerns; and refocusing Bharat Nirman project for rural infrastructure development as well as central sector expenditure from various ministries for the development of the poorer states.

At the end, it is heartening to note that the Planning Commission would like to "see itself in a more proactive role in championing the cause of states with the Central ministries in key policy issues that have strong equity and regional balance dimensions. In a liberalized, market-driven policy environment, the responsibility of the Commission is greater in that it has to ensure a level playing field for less developed states and regions"(Government of India, 2005, p. 513)."

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Chapter 13

The Idea of Gender Equality: From Legislative Vision to Everyday Family Practice

Bina Agarwal

> Can man be free if woman be a slave?
> ... well ye know
> What Woman is, for none of Woman born
> Can choose but drain the bitter dregs of woe,
> Which ever from the oppressed to the oppressors flow.
> *Shelley, 1817,* 1901

The poet Shelly paints a dark picture but also provides a deep insight: that men's emancipation is organically linked to that of women. Achieving gender equality is therefore not just women's concern—it also deeply concerns men. As this essay argues, to transform the social institutions within which unequal gender relations are embedded, and to reap the rich rewards that such transformation promises, will need the combined endeavours of all who seek a just and humane society.

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Few pieces of legislation have embodied so dramatic a shift in the vision of gender equality in Indian society as the Constitution of India, and the Hindu Succession Act (HSA) of 1956. The former promised equality before the law and no discrimination on the basis of sex as a fundamental right. The latter (although still containing inequities) sought to shift major inheritance systems from a position of gross gender inequality to quite substantial equality. Whereas earlier the majority of Hindu women could only inherit their father's (or husband's) property after four generations of agnatic males, and even then only as a limited interest, the HSA gave them inheritance rights on par with brothers (or sons) in relation to most property.

Both enactments envisioned equality between men and women, even though the HSA, as formulated, fell somewhat short of that aim.

Yet equality as an idea needs to be embodied not just in the laws, but also in the institutions and practices of everyday life. In India, as elsewhere, a yawning gap remains between *de jure* and *de facto* rights; between the ever-broadening notion of women's rights as spelt out in global arenas and international conferences, and the limited realization of such rights in local practice.

In practice, for instance, most Indian women remain propertyless. A recent sample survey of rural widows in seven states by development sociologist Martha Chen, found that at the all-India level only 13 per cent of those with landowning fathers inherited any land as daughters, and only 51 per cent of those with landowning husbands inherited any as widows. This meant that 87 per cent of the sampled women with claims as daughters, and 49 per cent with claims as widows, did not inherit (Agarwal, 1998a). Also, widows who inherit, typically hold the land jointly with sons, and can usually exercise little independent control over it. A similar pattern of women's disinheritance is to be found among city dwellers, as in Delhi (Basu, 1999).

Women's representation in public decision-making fora also remains abysmally low. Since Independence, women have held less than 10 per cent of the seats in both the lower and upper houses of Parliament. The gap is also wide in all top bureaucratic and managerial positions. Women's literacy levels are under half those of men in several states and two-thirds in most states. And the low and falling female/male ratio (929 by the 1991 census) is indicative of a violation of the right to life itself.

What underlies this gap between the idea of equality enshrined in our Constitution and most laws, and its popular acceptance? As elaborated in this essay, in my view a critical obstacle, especially but not only in relation to economic equality, lies in the perceived threat to the stability and harmony of the family unit. This threat is seen particularly in relation to women possessing property, which provides a more direct link with economic independence than do education or the employment market. And the leading question for women's rights in the coming millennium is: in what ways will the Indian family need to adapt so that we can move toward economically equal partnerships between women and men in everyday practice?

I pursue the question of women's equality through the prism of *economic* equality, because I see economic equality as a central mediator (though not the sole determinant) in the achievement of gender equality in other spheres. Also, while class, caste, and ethnicity too are significant dimensions of inequality in Indian society, which can shape the effects of gender inequality in complex ways, the issues I discuss in this essay have a relevance that I believe cuts across class and social grouping, even if the specificities might differ by such groupings.

A Pervasive Fear

The fear that gender equality in economic terms might seriously destabilize the family, and even cause it to break up, is revealed in its starkest form in relation to women's property rights.

In the late 1940s and early 1950s, this fear was expressed most vociferously by the opponents of the Hindu Code Bill which would provide women substantial rights in parental property. In 1948, at an All-India Anti-Hindu Code Convention, it was argued that "the introduction of women's share in inheritance" would cause a "disruption of the Hindu family system which has throughout the ages acted as a cooperative institution for the preservation of family ties, family property and family stability" (Kumar, 1983: 98). Similar fears were expressed in the Constituent Assembly debates on the Code in 1949. For instance, Pandit Lakshmi Kanta Maitra, Congress legislator from West Bengal, asked: "Are you going to enact a code which will facilitate the breaking up of our households?" (GOI, 1949: 1011); and Pandit Thakur Das proclaimed that giving property shares to daughters would lead to "endless trouble" and "spell nothing but disaster" (GOI: 1949:917). Two years later, in the 1951 Parliamentary debates on the Code, Mr. M.A. Ayyangar, Congress Legislator, similarly argued that if daughters inherited property it would "ultimately break up the family". In fact, women would choose not to marry at all: "May God save us from... having an army of unmarried women" (GOI, 1951: 2530).

These were not minority views. They were echoed by many others. In September 1951, of the legislators who spoke on the Bill, 10 supported it and 19 (all men) opposed it. A major reason for the opposition was the presumed threat to the family and disruption of intrafamily relations (Everett, 1979: 172).

These views reflected concerns that appear to have been widely shared in the population, as revealed by ethnographic evidence gathered in the early 1960s, soon after the passing of the HSA. Anthropologist K. Iswaran, for instance, reports that the residents of Shivapur village in Mysore saw such laws as "a deliberate and sinister attempt to destroy the family and morality". The villagers (he does not indicate whether this included women) felt that:

> [T]his equality must have the inevitable consequences of increasing divorce, desertion, adultery, destroying the love between husband and wife, depriving children of the certainty of a normal home life, and setting brother against brother, son against father, and man against man; that it [would] in a word, atomize society by gnawing at the foundations of the social bonds (Iswaran, 1968: 183).

Such fears continue to dominate perceptions even today, decades after Independence. In June 1989, for instance, at a seminar on land reform at the Indian Planning Commission when I made an invited presentation to a gathering of senior bureaucrats and two cabinet ministers, the then Minister of Agriculture exclaimed: "Are you suggesting that women should be given rights in land? What do women want? To break up the family?"

The fear that if women had property rights they would either remain unmarried or forthwith divorce their spouses continues to be voiced in various forms, including in comparisons with the West: "If women become too independent they will behave like Western women. And look at the high divorce rates there."

Is this fear justified? Will families indeed break up if women become economically equal to men? As I will argue further below, not necessarily at all. But even if this does destabilize the family, we need to ask: what is it about Indian families that makes people fear women will

wish to leave them the moment they have other choices? What kind of families do we want to live in as we move into the next century?

Before I address these questions, it appears relevant to ask: Why has the idea of women's education (which too has the potential of enhancing women's economic independence) not encountered the same bitter opposition as women's property rights? The answer, I believe, lies in the fact that education is not seen to threaten family stability in the same way as equality in property rights, for the reasons discussed below.

An Unequal Education

While the idea of women's education may have social acceptance, girls and boys need not receive the same education and skills: girls can be given skills that are more functional for the home and boys for the job market. Moreover, whatever the nature of skills imparted, education does not automatically translate into economic independence. Not all educated women may seek a job, and not all that do may find one. If there is inadequate demand in the labour market, a person can be highly qualified and yet remain jobless, as indeed is the fate of many educated unemployed in India today.

Gender differentiated education has in fact been a significant marker in the long-standing discussion on women's education. During the late 19th and early 20th centuries, for instance, a wide range of actors took up the cause of women's education in India: social reformers, Christian missionaries, Indian women's organizations that emerged in the 1920s, and many Western women who came to India and became involved in India's struggle for social reform and political freedom.

What was promised to women, however, was not an "equal" education. It was education that would make women better wives and mothers. "The central place of the educated woman was still at home" (Chatterjee, 1993: 128). Women could be educated provided their behaviour followed prescribed norms of modesty, spirituality, and homely virtues. As Chatterjee (1993:129–130) argues:

> Education was meant to inculcate in women the virtues... of orderliness, thrift, cleanliness, and a personal sense of responsibility, the practical skills of literacy, accounting, hygiene and the ability to run the household according to the new physical and economic conditions set by the outside world.

Once it was demonstrated that a woman could acquire the cultural refinements afforded by modern education "without jeopardizing her place at home", "formal education became not only acceptable but in fact a requirement for the new *bhadramahila* (respectable woman)" (*ibid.*: 128). Men would interact with the outer material world from which the family itself (and the world of women) would be relatively insulated.

It was not only the Indian male reformers who believed that women's education should have a different purpose from that of men. So did many women, both Indian and Western. For instance,

the All India Women's Conference (AIWC), a major women's organization established in 1927 (and continuing to date) emphasized at that time that education for women should be complementary to their roles as wives and mothers (Forbes, 1996; Basu and Ray, 1990). And many of the Western women active in India also took the view that male and female education should conform to their distinct social roles. Annie Besant, for example, one of the most influential of that group of women, who was even elected president of the Indian National Congress in 1917, argued:

> I presume that no Hindus... desire to educate their daughters and then send them out into the world to struggle with men *for gaining a livelihood*" (cited in Jayawardena, 1995: 129, emphasis mine).
>
> [T]he national movement for the education of girls must be one which meets the national needs, and India needs nobly trained wives and mothers, wise and tender rulers of the household, educated teachers of the young, helpful counselors of their husbands, skilled nurses of the sick rather than girl graduates, educated for the learned professions (*ibid.*: 130).

In contrast, for women in her native Britain, Besant continued to support a militant movement for women's rights and professional education (*ibid.*: 131).

Similarly, Margaret Noble ("Sister Nivedita") rejected the "Western" type of education for women, arguing: "Shall we after centuries of Indian womanhood, fashioned on the pattern of Sita and Savitri... descend to the creation of coquettes and divorcees?" (*ibid.*:190). Although some Indian and Western women (such as Pandita Ramabai and Margaret Cousins) favoured gender-equal education, overall the conservative view prevailed.

Even matrilineal communities such as the Nayars in Kerala, with a long tradition in female education, are noted to have differentiated between the genders in the kind of education the two received. When opportunities for education and employment were widening during the early part of this century, it appears that most Nayar women did not receive a "professional" education (Arunima, 1992). Hence they were not in the same position as their husbands and brothers to take advantage of the job opportunities and associated possibilities of acquiring wealth that were then opening up.

Women's educational opportunities have of course expanded substantially since Independence, including opportunities for all forms of professional training. But significant gender differences persist in the relative importance attached to the education of girls and boys, and in its perceived purpose. Women's position is still defined primarily by marriage, home and hearth, and only secondarily by the need for economic independence. This is reflected in gender differences in school enrolment, dropout rates, levels of completed education, entry into university, and the subjects chosen. In terms of enrolment, for example, in 1986–87, 51 per cent of rural girls (relative to 26 per cent boys) in the 12–14 age group had never been enrolled in school (Dreze and Sen, 1995). Even where parents send girls to school, most do so mainly to improve their marriage prospects with well-educated, well-employed men, than to improve their job prospects.

At university, the majority of girls still opt for the arts and humanities and the majority of boys for technical subjects (such as engineering, commerce or the sciences). In 1971,

72.3 per cent of female degree holders and 47.3 per cent of male degree holders were in the arts/humanities (Agarwal, 1976: 188). An analysis of more recent data by Duraiswamy and Duraiswamy (1996: 48) shows no dramatic change. They too note: "men specialize in market-specific skills and women acquire more home-specific skills." While undoubtedly there are significant numbers of women doctors, scientists, business analysts, journalists, and so on, this does not alter the larger picture of a gender-differentiated educational pattern.

An unequal education reduces women's earning prospects and possibilities of economic independence. Many educated women do not look for jobs. In 1971, 36 per cent of female degree holders relative to only 5 per cent of male degree holders were not seeking employment (Agarwal, 1976). The picture has not altered dramatically since. Those women that do seek jobs end up at much lower rungs of the professional ladder, and with lower pay scales. Part of this has to do with initial qualifications: those holding arts/humanities degrees face much higher rates of unemployment than graduates in other fields, and get less lucrative jobs. But part of the reason also lies in gender-specific factors. Responsibility for childcare and domestic work makes women less mobile and less able to sustain fulltime work over a lifetime. Social norms require that even highly qualified professional women relocate in accordance with their husbands' careers. Women as qualified as their spouses thus end up with less well-paid jobs. There is also gender discrimination in the labour market, in both hiring practices and pay scales. Employers often *presume* that women will be less committed to or less able to fulfil their work responsibilities because of their domestic roles, or will leave employment when they marry, or have less innate abilities than men, whatever be the specific commitments or abilities of particular women. This often leads to men being preferred over women, or being paid more than women with the same qualifications.

Hence, any threat that women's education may hold for family stability in the popular imagination is limited by gender inequality in education and the gap between education and employment.

Unequal Employment Prospects

Without either adequate education or property (discussed below), women's possibilities of economic independence are severely limited. Today compared with 58 per cent of all male workers, 78 per cent of all female workers (and 86 per cent of *rural* female workers) are in agriculture. Within agriculture, women are either unwaged workers on male-owned family farms or poorly paid labourers on the farms of others. As agricultural labourers, women continue to have lower real wage rates than men in most states, and lower average earnings in all states. The rise in real agricultural wage rates for both sexes and the decline in the gender wage gap, apparent between the mid-1970s and mid-1980s, has not been sustained in the 1990s (Agarwal, 1998b).

Outside agriculture, rural women's earning opportunities are much lower than men's, and have been stagnating. Between 1988–94, while 29 per cent of rural male additions to the

labour force in the over 14 age group were absorbed into the non-agricultural sector, less than 1 per cent of the additional female workers were so absorbed. This low absorption of women has been compounded by the general stagnation of rural non-farm employment in the post-reform period (*ibid.*).

Moreover the non-farm sector is very heterogenous, containing both high return/high wage activities and low return/low wage ones. These variations are apparent both regionally and by gender. A country-wide survey undertaken in 1987 by the National Commission on Self-Employed Women and Women in the Informal Sector (*Shramshakti*, 1988), and micro-studies of women workers in individual occupations, suggest that women are largely concentrated in the low-and-insecure-earnings end of the non-farm occupational spectrum. This is despite many micro- and meso- efforts by women's and other organisations to enhance women's entrepreneurial capacities across the country. Women's domestic work burden, lower mobility, lesser education, and fewer investable assets, all severely limit their range of non-farm options.

The Primacy of Property

In contrast to the limited prospects for women's economic independence opened up by an unequal education and inequitable labour markets, access to property provides a much more direct and immediate (not deferred) route to economic independence, both within and outside the family.

Take arable land—by far the most important form of property in rural India. If a rural woman acquired a field of her own, it could prove to be an immediate source of income and economic security in both direct and indirect ways (for elaboration, see Agarwal, 1994). The direct advantages stem not only from conventional production possibilities, such as growing crops, but also from other production options, such as growing fodder for keeping milch cattle or small animals, cultivating a vegetable garden, planting trees, and so on.

In addition, land provides indirect advantages, such as facilitating access to credit from institutional and private sources, helping agricultural labour maintain its reserve price, and serving as a mortgageable or saleable asset during a crisis. Some land is usually necessary even for starting a rural non-agricultural enterprise. Those with land are found to have substantially greater rural non-farm earnings, relative to the totally landless. The probability of women finding wage employment also increases if they have some land.

In other words, land can improve women's prospects for an independent income both through direct production possibilities and by enhancing earnings from other sources. These indirect effects are especially important since most households do not have enough land to survive on that basis alone, and have to depend on a diversified livelihood system. To make this viable, even a small plot can make a critical difference.

For elderly women, land or other property also improves entitlement to family resources, a means to bargain for better care and support from their families. For some the mere fact of

possessing land helps; others may use landed property and valuables for explicit bargaining, promising favour to those family members who serve them best (Basu,1999). As many elderly persons say: "Without property children don't look after their parents well" (Caldwell *et al.*, 1988). It is notable that property (unlike education and employment) is a transferable asset and can therefore help in bargaining for a better deal both within and outside the family.

For rural women, command over land would thus greatly strengthen their economic options and chances of survival both within the family and independent of it. Other forms of immovable property would also help. Owning a homestead, for instance, constitutes an important source of economic security and a place of social refuge in case of family breakup.

In an urban context, again, possessing a dwelling can make a crucial difference to a woman's options, both in economic terms (whether she lives in it or rents it out), and in social terms, since the rental market for women living outside the family is shaped not just by price but by social norms. A small piece of urban land can also provide women livelihood options for entrepreneurial activity.

The link of economic independence with ownership of property, especially with a productive asset such as land, is therefore much more direct than say with education or the labour market. It is the directness of this link, which feeds the popular fear that if women acquire property, society will lose the family.

Family Stability

Will women's economic equality indeed destabilise families? The answer in my view is: possibly, but not necessarily.

Most people hold an idealized view of the family. In contrast to the market, which is presumed to be dominated by pure self-interest, families are seen as suffused with love and altruism—"the heart of the heartless world". Resources and tasks are assumed to be shared equitably, so as to take account of everyone's needs. Incomes are assumed to be pooled, preferences shared, decisions jointly made, and conflicts either do not surface or get easily resolved.

The reality of most Indian families is, however, quite different. Family members don't necessarily share the same preferences, or pool incomes, or make joint decisions. Some preferences may be shared, others not. Some households may pool incomes, others not. Some decisions may be jointly made, others not. Nor are households characterized by equitable sharing. In fact, resources and tasks are usually quite unequally shared, especially along gender lines. There are substantial gender inequalities in the distribution of basic resources for health care, education and, in some regions, even for food. These inequalities are revealed most starkly in female-adverse sex ratios resulting from a life-threatening neglect of girl children. This neglect cannot be explained away by scarcity or poverty. Well-off families in prosperous regions also practice discrimination. Some of the lowest sex ratios in India are to be found among some of the most prosperous states, such as Haryana and Punjab. But even where the girl child survives, there are gender differences in health care, schooling, and so on. Domestic work remains the

responsibility of women and girls. In poor families, women themselves perform these tasks, but even in middleclass homes that have hired help, the overall *responsibility* to ensure that tasks get done still rests with women. Nor can the elderly today assume loving care from sons; and while the old with property (usually men) can use it as a leverage, the old without property (usually women) often face neglect. Indeed it is women who usually end up providing care for elderly relatives (Basu, 1999). Finally, there is a high incidence of domestic violence against women, varying by class but cutting across class; and child abuse is also now being documented. Clearly altruism, love and mutual caring are not all that determine how family members interact. Certainly, these are not the ideal families of the popular imagination.

Nor indeed are Indian families necessarily stable. There are a large and growing number of *de facto* female-headed families as a result of widowhood, marital breakdown, or male outmigration: estimates range from 20 per cent to 35 per cent. Although, compared with the West, formal divorce rates are still low, they are rising (Pothen, 1989). And figures on formal divorce do not capture the vast numbers of desertions and of men remarrying without formal divorce. Systematic data on the levels of "social divorce" (as versus legal divorce) and dual marriages are not easy to come by, but surveys carried out by activists in some regions, and the experience of grassroots village workers in many regions, reveal an alarming phenomenon. For instance, according to an assessment by activists in Maharashtra, in 1987 there were around 2000 deserted women just in Sangamner block (Ahmednagar district, Maharashtra), about 20 to 25 thousand in the whole of Ahmednagar district, and six lakh in Maharashtra state as a whole. Of the 621 deserted women interviewed by the activists in 55 villages of Sangamner block, the husbands of 595 had married a second time without getting a legal divorce (Datar and Upendra, 1993: 154). Deserted women come from both poor and middleclass backgrounds, and only a small percentage tend to have jobs. Most have problems finding jobs and shelter, and feeding the children. Although activists have taken up their cause, rehabilitation is constrained by the women's lack of independent economic means. Desertion is also a common phenomenon in the hills of Uttar Pradesh where male outmigration is high, according to grassroots workers whom I met in Almora in November 1998. Such family instability is not female initiated but male initiated. And what we have in India today is not one type of family structure but a complex range, including many single member or one-parent families.

How might we expect Indian families, such as they are, to be further affected by women's enhanced prospects of economic independence, especially via ownership of property? Consider the possible impact on marital stability.

On the one hand, it could increase marital stability, by making it more worthwhile for the man to stay in the marriage, for several reasons: (a) the wife would bring in more earnings or assets; (b) her economic contribution would be more "visible" and therefore "perceived" to be of greater value than say if she only did unwaged work on the husband's fields (Sen, 1990; Agarwal, 1997); and (c) there would be an improvement in overall family welfare since women (especially in poor households) tend to spend a substantially greater part of the incomes they control on the family's basic needs, relative to men (Dwyer and Bruce, 1988).

Moreover, children in rural India are found more likely to attend school and receive medical attention if the mother has more assets (Strauss and Beegle, 1996). All these advantages can make it more attractive for the man to remain in the marriage. It could also enhance the husband's perception about the wife's deservingness, leading him to treat her better by ensuring she gets a fairer share in household resources, possibly sharing in some household tasks, and desisting from domestic violence. (Women with jobs are found in some studies to be less subject to spousal violence than those who are economically dependent: Strauss *et al.,* 1980.) Equally, better treatment by the husband would increase the woman's incentive to stay in the marriage. In other words, women's greater economic independence could stabilize rather than destabilize the family, while also making it more egalitarian.

On the other hand, there are also factors pulling in the opposite direction. Where there is endemic verbal or physical abuse by the husband, or there are other causes of serious marital discord, a propertied or well-employed wife might choose to quit the marriage, whereas a propertyless or jobless one might suffer it from lack of other options. Or the husband may find the idea of an economically independent spouse threatening, or socially unacceptable, and may want to quit the marriage if she decides to take up a job. (Many Indian families still prefer housewives, and disapprove of women, even if well educated, working outside the home.) Here women's greater economic independence could weaken family stability. Certainly the possibility of women-initiated divorce would increase, as women become more economically independent.

Of course the ability to survive economically outside marriage is not the only factor that determines whether or not people divorce. Social norms play a significant mediating role. Women's exit options in marriage, for instance, depend not only on their economic prospects outside marriage, but also on the social acceptability of divorced women, their possibilities of remarriage, and so on. In India, there is a high social disapproval of divorced women. Also divorced women usually end up being responsible for the children, leaving them in difficult and poorer economic circumstances and diminished prospects of remarriage (Pothen, 1989). In general, divorced and widowed women, older women, and women with children are less "eligible" than men with these characteristics. Not surprisingly, a much higher percentage of divorced and widowed men than women remarry (Pothen, 1989; Dreze, 1990). Overall, however, we could still expect that greater economic independence among women, via employment and property, would bring some decrease in male-initiated divorce and some increase in female-initiated divorce. How this might play out on balance is hard to predict.

Most would agree that the first outcome, namely of a more egalitarian and stable family, is a desirable one. But is the second outcome necessarily a bad one in all circumstances? Should families be institutions of voluntary association or coercive confinement? Certainly from women's viewpoint, it is better to have the option of ending a coercive or violent marriage than to be forced to stay in one, however "stable". And if society also values voluntary association over coercion (as it should), then society too would be better off if women had more alternatives to dysfunctional marriages.

So where is the catch? I believe the catch lies in an issue that we as a society have yet to fully grapple with, irrespective of whether families become more or less stable with women's economic independence: the care of children and the elderly. This also impinges centrally on women's ability to establish economically equal partnerships with men.

Today much of the cost of "caring labour" (a term coined by feminist economists) is borne by women. It is they who do most of the childcare, eldercare, and all the invisible work that goes into making the home a place of comfort. The unequal sharing of domestic work, childcare, and care of the elderly, becomes both an indicator of gender inequality and a major obstacle to the path of achieving gender equality on other counts. For instance, most women provide caring labour at considerable economic cost to themselves. A growing body of studies (so far mostly in the West) shows that women, as a result of their childcare responsibilities, face a significant reduction in average lifetime earnings (Waldfogel, 1997; Joshi, 1990). This would also leave women with a weaker bargaining position in the home. Moreover, domestic work (as noted) is perceived as being less valuable than work which brings in monetary income. This too would reduce women's bargaining power within the family.

In addition, women's primary responsibility for childcare restricts their participation in collective or political activity. In my recent travels to many sites of community forest management in India and Nepal, this was a major constraint to women attending meetings in which decisions were being made on the use of resources on which they critically depended. Successful negotiation with spouses, relatives, or older children, to take care of young children, can in large degree determine whether or not women can travel, or attend group meetings. As a villager, in one of the sites I visited, said to his wife (semi-jocularly but with clear intent): "Are you going to a meeting again? Well take the children with you, and while you are about it take the cow too, and don't forget the goats!"

Forced Altruism

What causes women to undertake caring labour? One view, put forward by Amartya Sen, but some version of which is probably widely shared, is that in "traditional" societies such as India women may tend to lack a clear perception of individual self-interest; that they may suffer from a form of false consciousness in that they value family wellbeing more than their own wellbeing. This is one reason, Sen argues (1990: 126), why all kinds of gender inequalities persist in Indian homes: "acute inequalities often survive" because "the underdog comes to accept the legitimacy of the unequal order and becomes an implicit accomplice." Other scholars have argued, variously, that women are by nature more altruistic than men and get a particular pleasure out of providing caring labour; or that they have a less "separatist" self, or are socialized such as to sacrifice their own wellbeing for those of their children (see literature reviewed in England, 1989).

Both versions of the idea that motivations are gendered in this way are interesting but debatable. Take the idea that women may suffer from a form of "false consciousness".

Observationally it is difficult to infer from people's overt behavior whether they are conforming to an unequal order because they accept its legitimacy, or because they lack other options. Consider what some peasant women in north India have to say:

> We women stay at home and do backbreaking work even if we are ill. There is no sick leave for us. But we do not have any money of our own and when the men come home we have to cast our eyes down and bow our heads (Sharma, 1980: 207).

Here the overt appearance of compliance ("cast our eyes down") does not mean women lack a perception of their best interest. Rather it reflects a survival strategy stemming from constraints on their ability to overtly pursue those interests ("we do not have any money of our own"). Compliance need not imply complicity.

If these women had had some money or fields of their own, they may well have spoken up for their rights and claimed a better deal within the family. The solution would thus lie less in making women realize they deserve better, and more in providing options that would enhance their bargaining power, such as providing employment or property.

The idea that women are more inclined toward altruism than men is equally debatable, although unlike the notion of false perception, altruism implies self-awareness. Some of women's observed actions do appear to suggest that they are more altruistic than men. For instance, poor women, as noted, typically spend their earnings largely on family needs. In many Indian families women also usually eat last and feed the best food to sons and husbands. But such evidence could fit equally with self-interest. With limited outside options, women might seek to maximize family welfare because it is in their long-term self-interest (even if it reduces their immediate well-being), in so far as women are more socially and economically dependent on the family than are men, and this dependence is longer lasting since, on an average, they have higher life expectancies. Similarly, investing more in sons than in daughters would be perfectly in keeping with self-interest, given male advantage in labour markets and property ownership. It is notable that in matrilineal communities such as the Garos of Meghalaya, where women have traditionally had strong rights in land, women do not wait for late-returning husbands to have their evening meal (Nakane, 1967).

In other words, if women with a weak resource position expend their energies and earnings on the family, this would be as consistent with self-interest as with altruism. Realistically, both motivations would be operating.

Basically, most Indian women are likely to accept the substantial burden of domestic work and childcare because they lack alternatives outside marriage and feel a sense of responsibility (especially towards children)—what Folbre (1998:25) calls "socially-imposed altruism". Women from quite different backgrounds often speak of this in very similar ways. For instance, a middleclass, educated woman in the city of Bhubaneshwar, recounting the difficulties of combining a career and childcare, told researcher Susan Seymour (1999: 234): "If you're not lucky... you have to stay home and take care of children... Men are supposed to assume responsibility for their own children also. But many men don't bother that much, [so] women always take over... In every country that happens". Similarly, agricultural labourers in West Bengal told

the government's department of revenue and land reforms in 1980: "Who is responsible for our children? Not our men, They are our responsibility" (cited in Mazumdar, 1983: x).

Women often view such responsibilities as a form of social duress and express this sometimes with resignation: "this is a woman's lot", at other times with bitterness. The views of village women in north India, quoted earlier, who complained about backbreaking housework, are illustrative, as are those of the women cited below:

> When I come home after work, I am a physical wreck. But that does not matter to him. I have to cook the evening tiffin, and the night meal (urban employed woman, cited in Ramu, 1989: 125).
>
> I often call my kitchen a jail. I am put in here for life (urban housewife, cited in Ramu, 1989: 125).
>
> We are the slaves of slaves ... Women should also have fixed hours of work. We too must have a rest period (peasant women, cited in Horowitz and Kishwar, 1982: 17).

These voices ("the bitter dregs of woe?") do not suggest that women find great pleasure in being solely or mainly responsible for caring labour, day in and day out, even if they may find such work pleasurable some of the time. Indeed it would be surprising if the unremitting routine of any socially assigned task did not ultimately produce some sense of alienation.

In general, harmony and equality do not appear to be characteristic features of most Indian families. The ideal Indian family, which people feel will break up with women's economic independence, is more imagined than real. Perhaps it is time for us to rethink families more realistically, and to see if they can be transformed into the families of people's imagination.

Rethinking Families

> "It takes two wheels to run a chariot" (Gujarati village woman to author, January 1999).

To achieve economic equality between women and men, we will need gender equality in education, employment opportunities, and most of all in access to property. Last but not the least, there needs to be an equitable sharing of domestic work, childcare, and care of the elderly within the family.

For men to share equally in caring labour, however, will require a major transformation in social norms and attitudes regarding gender roles and capabilities. In Western countries, among dual-earner families, male sharing of housework and childcare, while far from universal, is not uncommon, although the proportion of sharing can vary considerably, and not many would make the 50:50 grade. Men who do take on some part of these responsibilities report finding them pleasurable and their marriages stronger (Deutsch, 1999). In India, it is still rare for men to share in domestic work and childcare, although in some social circles (say among young couples in the academia) it is not entirely unknown. That many middleclass Indian families hire some domestic help cloaks the fact that a large number of tasks are still done by women in such families, and, as noted earlier, women still bear the overall responsibility of ensuring that the work gets done.

Also most Indian women (rural or urban) do not live in large joint families where such work is shared among several women. Urbanisation, in particular, is not conducive to maintaining extended families. Urban jobs scatter families occupationally and spatially, and most urban accommodation does not allow large numbers of family members to live under one roof. Today the dominant family form in India, as elsewhere, is nuclear, and likely to become increasingly so, with a wider range of subforms emerging, including more single-parent and single-person households. Nuclear families make male sharing of domestic work, childcare, and eldercare even more of an imperative.

Moreover, shifting the division of such tasks toward gender equality will, in time, require some form of transformation in the social organisation of work outside the home. In the informal sector, among farming families, or in various types of self-employment, such task sharing could be worked out by arrangements between family members. But in the formal sector this becomes a question of more than localised adjustment, and of more than marginal legal interventions such as granting paternity leave in addition to maternity leave (as is the case in many European countries). It may require radical changes that would allow *both* women and men to have more flexible work timings (technically made possible by the technological revolution), more options of lucrative part-time work, the possibility of temporarily leaving and reentering the job market without excessive opportunity costs, and so on. So far women are usually the ones who end up either taking on the double burden of housework and outside jobs, or taking some years off work "until the children are grown", or taking up poorly-paid part-time work. Clearly, this does not make for gender-equal economic opportunity.

Some scholars, in fact, suggest that children should be viewed as "public goods" (Folbre, 1994). The benefits of children brought up as physically healthy, economically capable and socially responsible human beings would accrue not only to their families, but also to society as a whole. Children constitute society's investment in human capabilities—indicative of both a country's current development and the potential for future development. The responsibility for their care should therefore rest on everyone and not just on a subset of individuals, namely women. If indeed we are to consider children (and the elderly) as public goods, then allowing for rearrangements in work patterns, work space and work time that enable gender-equal sharing of care, is also the responsibility of society as a whole. The actual form of care needed will of course change over time as declining fertility rates reduce the need for childcare while rising life expectancies increase that for eldercare.

People have from time to time talked about the need for some aspects of caring labour to be undertaken by the State. Many Western countries have experimented with various versions of the "welfare state". Clearly, the State cannot abrogate responsibility on this count. It too has a critical role to play in helping society move toward a more gender-equal sharing of work, both as a significant employer and as a provider of significant social services. But rarely has even the most generous Welfare State substituted more than marginally for the multiple tasks performed at home, or for the quality of caring labour. And India has a long way to go to make State welfare provisions effective, even for the destitute.

A third, often little considered actor in this regard, is the local community, which could play an important role in making some part of caring labour a public responsibility. Of course

for this our communities of the future would need to look rather different from present-day ones. In the India of the fifties, among the typically male-earner middleclass families, it was women as housewives who formed neighbourhood networks with other women, creating a sense of community and initiating a range of informal inter-family support activities. This has become rarer as more women enter the labour force, and as cities are increasingly characterised by families living in relative isolation from one another.

Such trends in Western countries have been associated with a breakdown of community, with all the attendant adverse effects on the social fabric. Is this inevitable in India, or can we create new types of communities which adapt to changing family forms and provide mutual support services? For instance, can we create communities where small clusters of nuclear families cooperatively share some aspects of childcare, eldercare, and even care of the ill? Such community support systems and networks could draw partly on the voluntary labour of community members and partly on State help (say, where some infrastructure or specialised personnel are needed). Childcare and eldercare could then be a more collective and participative endeavour, without being impersonal (as with wholly State or market provided services) or burdensome (as when individual families alone provide such care). The elderly (and even the youth) could in fact play a positive role in such arrangements; and children in single-parent families could also be better looked after.

Here there are possibilities of learning across countries. For instance, some ongoing experiments in community self-provisioning in industrialised countries, as also discussions among feminist scholars on how to make care-giving more gender equal, with a better mix of public and private responsibility, could provide pointers for India (see e.g. Bergmann, 1986; Dornbusch and Strober, 1988). Similarly, new thinking and experimentation on this in India could provide pointers for other countries.

Since so much of India is still rural, as urbanisation proceeds it is still possible to plan for alternative forms of community living. It is also encouraging that within villages there are still communities willing to take some responsibility for social services. Last year, in the Uttar Pradesh hills, for instance, I saw several cases where villagers, catalyzed by non-governmental organisations (NGOs), had constructed crèches for children entirely through voluntary labour, and also raised funds for employing teachers. Mothers, who earlier had to lock up wailing pre-school children while they went to work in the fields, could now rest easy that the children would be fed, their noses wiped, and their minds and smiles energized.

Of course, these crèches are typically run by women, and the association of women with childcare remains unchallenged. In community-run institutions of the future it is important that the existing gender division of labour does not get replicated, and women do not once again end up being solely responsible for childcare and related tasks. To ensure this, the planning of new community services will need to be consciously gender equal. In other words, over time the idea of gender equality needs to take root not just within families but also in extra-family institutions, especially those of the State and the community. These institutions can then play supportive roles in the creation of more egalitarian families.

We return then to the basic, compelling questions: are men willing to take on an equal burden of (and experience equal pleasure from) tasks that have so far been seen as women's

responsibility? Is society willing to make adjustments that would allow men and women to *both* be responsible for (and take pleasure in) such tasks?

Paradoxically, measures that enable a gender-equal sharing of caring labour and domestic work would bring us closer to, rather than take us farther from, the idealized loving-sharing family (and close-knit communities) that many see as threatened by gender equality and women's economic independence.

Changing Social Norms

Can social norms regarding gender roles shift so dramatically?

Conventionally, most social scientists, and especially economists, assume that individual preferences and social norms are exogenously given. In fact, if we take a historical perspective, we know social norms are not immutable, even if the time horizon for changing some types of norms may be a long one.

At any given time, for a given society, a good deal of what is justified in the name of "tradition" would fall in the realm of what the French sociologist Pierre Bourdieu (1977: 167–70) terms "doxa"—that which is accepted as a natural and self-evident part of the social order—the "undiscussed, unnamed, admitted without argument or scrutiny." In contrast to doxa is what he terms the "field of opinion, of that which is explicitly questioned", "the locus of the confrontation of competing discourses." A first step to changing what has long been taken for granted, such as gender roles and women's rights and capabilities, is to bring the undiscussed into the arena of contestation. This has been happening to some extent due to women's efforts (both collectively and individually) in various fora. But to go beyond discourse, I believe, three factors in particular can affect social norms in terms of gender roles: one, the part played by institutions of mass culture and learning in the construction of gender roles; two, the economic compulsions pushing women to challenge restrictive norms; and three, the existence of groups that could enhance women's ability to effectively challenge such norms.

Take educational and religious establishments and the media (defined broadly to include newspapers, TV, radio, film, theatre, as well as literature and the arts). These institutions can influence the construction of social norms regarding gender roles in either gender-progressive or gender-retrogressive directions. In recent years, there have been many feminist critiques of school and university curricula and texts, and of the images and messages of modern media, as well as attempts to create alternative texts and programmes. These efforts all contribute to the defining of gender roles and gender relations in a more egalitarian direction. But we also need to follow through with the full implications of those redefinitions for institutions such as the family and community, and for the organisation of work.

Economic necessity too is leading many women to challenge social norms either explicitly or implicitly. For instance, in parts of northern rural South Asia, purdah norms require that women not seek employment outside the home, especially not in the fields of others, but poverty compels many women to do precisely that. In doing so they break purdah norms and

so implicitly challenge those norms. However, group solidarity and collective action appear critical for explicitly and effectively contesting such norms.

An illustrative example is the experience of women members of the NGO, BRAC (the Bangladesh Rural Advancement Committee) in Bangladesh. Here, on the one hand, economic want has compelled women to seek outside work and challenge restrictive purdah norms: "They say that what we do is shameful, carries no dignity ... Would it be good to sit without work and food, abiding by what they say?… We do not listen to the *mullah*s anymore" (cited in Chen, 1983: 175–6). On the other hand, group solidarity within BRAC has clearly strengthened women's ability to effectively alter the norms. As some BRAC women noted: "Now nobody talks ill of us. They say: 'They have formed a group and now they earn money. It is good'" (cited in Chen, 1983: 177). BRAC women also report that, as a result of their economic contributions and group strength, their husbands are now less opposed to them joining BRAC, less physically and verbally abusive, more willing to allow them freedom of movement, and more tolerant toward their interaction with male strangers in work contexts. In other words, there has been a loosening of restrictive social norms both within the home and outside it.

In fact the experience of many grassroots women's groups across South Asia shows that contestation over social norms about women's roles often emerges as a by-product of forming groups for the more effective delivery of economic programmes. However, what has yet to be challenged adequately is the gender unequal division of labour (as also the gender unequal division of property) within the family. Here, more creative thinking and a push to change attitudes are needed, not only by feminist scholars and activists but also by all those seeking a more egalitarian and democratic society. In particular, efforts to bring about gender equality need to be seen not just as a "women's project" but as essential also for the liberation of men.

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In conclusion, to build economically and socially equal partnerships between women and men, we will need to re-examine our assumptions about key social institutions, in particular the family, and about men's and women's roles within the home and in society. To transform these roles and institutions might take decades. It may even take a century. Hopefully it will not take a millennium.

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Section III
Environment

Chapter 14

Environment Development Linkages: Modelling a Wetland System for Ecological and Economic Value

KANCHAN CHOPRA AND SAROJ KUMAR ADHIKARI

I Introduction

The nature of human well-being derived from eco-system services depends on their availability as determined by the natural environment and demands for these services created by human populations. While the former is determined by physical and ecological factors, a series of behavioural and institutional factors determine the demands that humans make on eco-systems. Bringing the two sets of factors into a common analytical framework is important in order to understand better the linkages between ecological systems and economic value obtained from them devise appropriate policies for managing eco-systems.

However, such an undertaking raises methodological and conceptual problems. One instance of the emergence of such problems is in the context of interpreting values attached to such services. The literature on economic valuation typically focuses on use value in the short run,[1] whether within or outside the market. Ecologists on the other hand are more concerned with ecological values which provide an underlying long-run notion of value in a more general sense. This paper investigates into the nature of the link between these two aspects of value in the context of a wetland in Northern India, which has also been designated as a Ramsar site and a national park.

[1] Concepts such as total economic value have been introduced in the literature. (Pearce et al. 1989). However, in economists' value estimates the concept of trade-offs between different notions of value and opportunity cost are primary since they are relevant in economic decision making. See, for instance Starett (1998).

Section II places the issue in the context of the literature on economic valuation of wetlands and sets up a schematic representation of economic activity and ecological structure of the Keoladeo National Park. Section III gives a brief overview of the national park being studied and its ecological characteristics. Sections IV and V set up a dynamic simulation model to study alternative long run scenarios with respect to ecological health and resulting economic value derived from the park under alternative scenarios. These scenarios are extrapolated on the basis of a model structure linking aspects of the park's ecology through equations derived from past data and observation. In the latter section, we also report results from an alternative approach used to estimate economic value through the setting up of travel cost based demand functions for tourism related services. Section VI derives conclusions obtained from a study of the scenarios and the linkages between economic and ecological value.

II Valuation of Eco-System Services from Wetlands

Wetlands are "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed 6m." This definition, adopted by the Ramsar Convention conveys much of the essential characteristics of wetlands. It also suggests that they could give rise to a variety of values. However, assigning a value to an eco-system good or service implies that we define its role in increasing human welfare, whether or not it can be marketed. In order to do this we need to

- Identify the physical or environmental linkages which result in the provision of the service
- Identify the economic linkages which help realize the value of the service

The first helps us to understand what economic functions are being performed by the eco-system, in this case, the wetland. It could be production of agricultural commodities, provision of waste assimilation services or of amenity values. Each such good or service again may or may not be marketed. This implies that the economic linkages differ. Accordingly, alternative methods of valuation have been suggested.[2] While household production function approaches[3] are based on the revealed preference approach, stated preference approaches have also spawned a large literature in the context of non-marketed goods and services.[4]

[2] See Freeman (1993) for a discussion of alternative approaches to valuation.

[3] See Maler (1992) for a discussion in the context of environmental goods and services.

[4] Hanneman (1992 and 2001) develops this approach referred to in the literature as the contingent valuation method. For applications in India, see Markandaya and Murty (2000), Murty and Menkaus (1998) and Chopra and Kadekodi (1999).

Economic benefits derived from wetlands have also been estimated using alternative approaches. (See Soderquist, Mitsch and Turner (2000)). As explained by Acharya (2000), the production function approach measures the welfare change accruing to a household as the sum of the producers and consumers surplus accruing to the household out of the use of an environmental good or an eco-system service in production or in consumption. Wetlands may also act as pollution assimilation agents for nitrate pollution created by up stream agriculture. In this context, they provide a positive externality benefit (Bystorm et al. 2000). Alternatively, contingent valuation studies may be used to value wetland amenities (Turner et al. 2000). Each of these approaches integrates into utility theory in different ways[5] and is an extension of the cost benefit methodology. The latter was used in a large number of early studies as an empirical counterpart of Fisher, Krutilla and Ciccheti's (1972) evaluation of the development versus conservation argument. They argued that if the development option implies some irreversible transformation of an area, it is always optimal to develop less of the area. Hanley and Craig (1991) used the same framework to determine the relative value of preservation and afforestation of a peat-land in the "flow country" of Northern Scotland. However, while the returns from forestry were expressed on the basis of an infinite series of rotations, preservation benefits were evaluated using the results of a contingent valuation. Questions could be raised about the validity of comparing the two and hence of the conclusion that the net present value of development turns out to be negative.

Other studies of this genre ignore the ecological benefits. Kosz (1996) argues for instance that in the context of a stretch of wetland area along the River Danube, "it would be highly efficient for the Austrian economy to build a hydro-electric power station, if there were no ecological benefits at all". The assumption implicit in the statement "if there were no ecological benefits" would not now be defensible. To sum up, we have come a long way since those studies and ecological processes are being studied to determine linkages with economic value.

Approaches to economic value obtained from wetlands can be divided into static and dynamic ones. Approaches that estimate consumers or producers' surplus assuming constancy of stocks of natural capital ignore inter-temporal processes that determine ecological functioning. Alternatively, the production function approach can be incorporated into inter-temporal models of renewable resource use. In such integration exercises, the ecological function affects the rate at which a renewable resource increases and thereby impacts off-take from it. As explained by Barbier (2000), such models depict long run equilibrium of the resource in terms of steady values for effort put into extraction and resource stocks. However, most models set up for valuation treat wetland area as being a proxy variable for stocks. This variable is then treated as having a similar impact on harvest rates as the amount of effort put in for resource extraction.[6] We shall argue that a distinction needs to be made between short run factors (such as effort) impacting the accrual of value or utility from wetland or other eco-systems and the longer

[5] See Freeman (1993) on the linkages between alternative approaches to valuation and consumer theory.
[6] See Ellis and Fisher (1987) and Barbier and Strand (1998).

run slowly changing factors (such as area) that impact functioning of eco-systems and well-being accruing from them. The latter are studied better by modelling ecological aspects of the system and using scenario analysis. In this paper, we illustrate the application of such an approach to amenity values accruing from wetland eco-systems.

The link between conventional approaches and the methodology adopted in this paper is illustrated as follows. The travel cost method has been used extensively to set up demand functions and estimate the consumer surplus accruing as a welfare gain to tourists from amenity values derived from wetlands. In such a methodology, it is assumed that household *i* has the following utility function

$$U_i = f(x_1, x_2, \ldots x_n, L_i)$$

where x_1 to x_n are ordinary goods. L_i is leisure, the demand function of which is given by,

$$D(L_i) = V_i = F\ (TC_i, HC_{ij})$$

where demand for leisure translates into visits to the wetland park, V, and the number of such tourist visits is a function of travel cost incurred and other household characteristics such as income, education, opportunity cost of time etc. This formulation yields the demand for tourism and can be used to estimate the incremental welfare gain accruing to a typical household and thereby to all households by a visit to the wetland park.[7] However, this is only a short run relationship and does not account for changes in the probability of viewing multiple species of avi-fauna or of viewing an important flagship or keystone species.[8] The probability of such viewing is critically dependent on the "ecological health index" of the park. And it is just possible that while the short run economic factors remain constant, a long term erosion of ecological health caused by a combination of factors operating on the eco-system leads to a declining demand for its services and a consequently declining economic value. In other words, the underlying tourism demand function in the long run is as follows:

$$D(L_i) = V_i = F\ (TC_i, HC_{ij}, ECH_p) \quad (1)$$

Where ECH_p is the ecological health of the park which can be parameterised only on the basis of medium run or long run time series data and modelling of the wetland eco-system. Ignoring such indicators of ecological health in determining demand for its tourism related services results in an over estimation of the short run economic value.

Further, upland economic activity, such as intensified agriculture may impact the ecology of the wetland adversely by reducing water flows into it or polluting water entering it. In

[7] For an exposition of welfare calculation for a wetland in the production function context see Acharya and Barbier(2000).

[8] We have estimated such a function in the current case for Keoladeo National Park. See Chopra (forthcoming).

turn this impacts the amenity value of the downstream wetland, thereby reducing the direct and indirect income generated. Significant trade-offs between different kinds and levels of economic activity may arise, a number of which work through the impact they have on ecological structure. This paper studies such linkages in the context of the Keoladeo National Park (KNP), a Ramsar site in Northern India by setting up an integrated dynamic ecological economic model. It derives sensitivity of tourist visits to ecological health indices in a series of simulated scenarios with respect to future pressures on the park. In the process, a more complete characterization of factors impacting economic value is arrived at and its linkages with ecological value explored.

The forces impacting on the park can be viewed in a Drivers-Pressures-State- Impact-Responses (DP-S-I-R framework) where a continuous feedback between socio-economic drivers, environmental pressures created, changes in the "state" of the eco-system and consequential impact on economic activity is envisioned to describe economy ecology interactions. At times, the impacts may induce responses which feedback into the socio-economic drivers and result in the initiation of a new set of interactions.[9] The framework was originally developed by OECD and is a useful device for establishing a conceptual connection between eco-system change and the effects of that change on well-being. We use the framework to set up scenarios for studying the impact of different driving pressures on KNP and in turn, their impact on aspects of economic activity and well-being.

In the case of the Keoladeo National Park (KNP) which we propose to study, agricultural activity in the catchment and other competing demands upstream constitute the pressures that regulate release of water into the park. The state of the wetland, is determined by changing stocks of water, biomass and birds in it. These stocks in turn impact extraction and amenity values, determining the flow of use-value or direct and indirect income accruing from it. Figure 1 below gives a schematic presentation of the nature of the economy- ecology linkages and their relationship with economic and ecological value. The ecological functioning and health of the wetland has links with upstream agricultural activity which, together with rainfall determines the amount of surface water released into it. This water flow together with other factors such as evapo-transpiration, infiltration determine the stock of biomass. Changes in biomass and water storage in the park determine bird inflow prior to the tourist season. Bird inflow is measured by the numbers of species of migrant and resident birds and arrival of the flagship species.

These inflows are postulated to be one of the major determinants of the magnitude and nature of tourist arrivals and the direct and indirect incomes derived from them. The methodology envisages capturing short term behavioural response of tourists to indicators of changing ecological health by the travel cost function and the longer term impact by the scenarios built up in the integrated economic- ecological model.

We postulate that such an approach throws light on the relative significance of ecological and economic value and the links between the two.

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[9] For a description of the DP-S-I-R framework in the context of wetlands see Turner et al. (2000).

III Keoladeo National Park: History and Ecology-Economy Linkages

The Keoladeo National Park (KNP) located about 200 km from Delhi on the Indo-Gangetic Plain near the town of Bharatpur (27°13´N, 77°32´E), is a Ramsar and a designated World Heritage site since 1985. Keoladeo National Park is part of the Yamuna sub-basin floodplains. The vegetation, with many species of terrestrial and aquatic fauna, is characteristic of the north Indian floodplains. The park is a resting place for many migratory birds including the Siberian crane. Located within easy access from a number of other tourist sites, it has a very high tourism value. The KNP is a 29 sq km mosaic of monsoonal wetlands, seasonally flooded grasslands and thorny woodlands. The wetland area of the park covers a central depression of about 8.5 sq km which is divided by dykes into a number of compartments or blocks. These blocks are interconnected by gates or bunds. In some of the blocks small mounds have been constructed and planted with *Acacia* trees to provide nesting and breeding sites for the heronry species. Though the maximum potential depth of water in the blocks is about 2 metres the mean depth is usually around 1 to 1.5 metres. The variety of habitats available i.e. wetland, part grassland, and part semi-arid forested grassland give an idea of the multitude of niches present within the area. The wetland itself is at places grassy meadows, reed beds and open water regions with submerged plants, and at other places, free flowing deeper water teeming with fish. A variety of organisms inhabit these niches, and it is especially favoured as waterfowl habitat.

The destruction and fragmentation of natural floodplains due to use of land for agriculture, housing and industry has made such systems unique. As such Keoladeo National Park is one of the few surviving typical floodplain wetland systems found in the region. Even so, agriculture upstream of the park represents one of the major sources of pressure on this wetland. Surface water releases into the park depend on rainfall in the catchment and on the requirements of upstream agriculture.

The unique character of Keoladeo National Park arises from the fact that the park was created by humans. The construction of a succession of tanks and the intricate system of water movement used the natural topography and hydrology of the area to provide for the requirements of the numerous species naturally found in the floodplains. The area was first flooded in 1901 and for a long time was treated as an important duck shooting area by the Maharaja of Bharatpur. Since that time, water has perhaps been the most important constituent of the park's ecology and economy. Its presence resulted in the inflow and growth of fish as well as biomass. And on these thrived the large varieties of birds, both resident and migratory, that gave the park both its economic and ecological value.

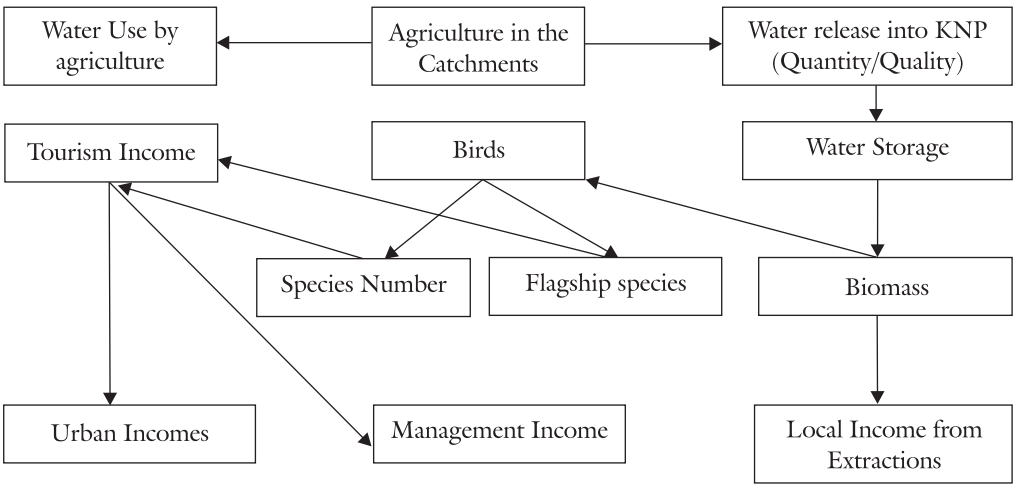
Figure 1 illustrates this link between ecological health and economic value emanating from use by users, both rural and urban. Two examples of economic value are; extraction of grass and other articles of use-value by villagers from nearby villages and recreation value derived by tourists since the creation of the park, locals have had access to it for use. They collected fuel wood, and a variety of grasses that had economic value. A significant change in the management

of the park came in 1981 when it was declared a National Park and officials of the Forest Department were required, by law, to end all human interference within the boundaries. There followed a period of conflict, at times marked by violence between the villagers and the management of the Park.

The next important watershed in the park-people interaction was a 1985 Report of the Bombay Natural History Society (BNHS), which concluded that grazing per se was not damaging the ecology of the park. On the contrary, the excess growth of *Paspalum*, an important grass species (which was earlier grazed on and controlled by cattle) restricted the growth of bulb, tuber and roots. Avifauna such as the Siberian Cranes that fed on these found that their habitat had become less friendly. The probability of grassland fires also increased. As a result of the BNHS Study, villagers were allowed to purchase permits to enter the Park during summer months and remove limited amounts of grasses since 1986. This, in turn also provided income for the management. As presented in Figure 1, the following kinds of income accruals are the direct outcome of the maintenance of KNP:

- Urban income accruing from tourist activity, this includes direct and indirect income from hotels and related economic activity
- Income from entry fees and other charges levied accruing to the management
- Income from extraction of grass and other wetland products (both legal and illegal)accruing to people.

FIGURE 1
Schematic Representation of Flows in and around Keoladeo National Park (KNP)



On the other hand, intensification of agriculture in the catchment may impact the wetland negatively by increased water demand resulting in reduced surface water inflow by nitrate and other kinds of pollution of water.

Additionally, development expenditure is incurred on maintenance of the park. This has increased considerably since it became a national park. It has catered to the creation of open water bodies, desilting, building boundary walls and control of weeds and grasses.[10]

IV Modelling Ecology-economy Linkages in KNP

Model Structure

This section of the paper develops alternative scenarios with respect to linkages between ecological functions and incomes derived from KNP. Linkages between different components of the model are studied through a generic computer simulation model using "STELLA".[11] The DP-S-I-R framework set up in Section II and Figure 1 to illustrate these relationships is represented by the following modules in the "STELLA" model;

- The water module, which has "water storage" as the stock variable, which monitors the state of the wetland
- The biomass module which examines factors impacting biomass and changes in it; biomass quantity in the park is the stock variable in this module
- The birds module which has the number of birds as the main stock variable and which then monitors factors impacting bird inflow and outflow and their impact on tourism arrivals
- The net income module which sums up the impact of changes in each of the preceding modules on income from tourism and resource extraction.

The modules are linked by control variables, determined by physical, ecological and behavioural relationships to define changes that take place in the stocks and flows. The model is run with the month as the unit of time since both ecological and economic activity is characterised by seasonality. Water releases take place after the monsoon, growth of biomass and of bird populations, both resident and migratory follows and tourism activity picks up during the winter. In fact, the arrival of the Siberian crane, much announced in the media, heralds the beginning of the tourist season. A business as usual scenario is developed as the first alternative. Later, two alternative scenarios capturing the impact of changes in surface water availability and ecological health indices on other variables are specified. An elasticity measure is derived to capture the impact of ecological health of the park on tourist visitations.

Variables and Model Equations

Table 1 lists variables and parameters used in the modelling. In the present study ecological information has been drawn from the BNHS study for the period 1984–1988 (Vijayan 1991)

[10] Details with respect to income and expenditure for the park are given in Appendix 1 in the original paper.

[11] See Ruth and Hannon (1997)and Costanza et.al. (2001) for details of the modelling framework.

TABLE 1
List of Variables used in the Modelling

S. No	*Variable Name*	*Unit*	*Variable Type, Description and Data Source*
1.	WATER STORAGE	10**6 metre cubed	State Variable defining stock Monthly water storage in KNP Initial value from water depth at fixed sampling points in KNP: data for 1984–1990 Vijayan (1991)
2.	BIOMASS	GM/M**2	State Variable defining stock Biomass of aquatic Macrophytes Initial value from monthly data for 1984–90 Vijayan (1991)
3	WATER-AJ	10**6 metre cube	DRIVER VARIABLE: flow variable; released in July-September each year: initial value form analysis of historical series, 1966–1990
4.	AREA	Km**2	Monthly water spread area in the park: Also from the BNHS (Vijayan 1991) study
5.	RAINFALL	mm.	Rainfall in Bharatpur: Initial value from historical data series: 1901–1990
6.	RAINVOL	Mm*(km**2)	Volume of rainwater (*water spread area*rainfall*)
7.	EVAPO	cm.	Monthly average evapo-transpiration from Rhower's method
8.	EVAPOVOL	10**6*m**3	Loss of water from the aquatic area through evapo-transpiration (*waterspread area*evapotranspiration*)
9.	BIRDS	Nos.	State Variable: Monthly abundance of waterfowls in the park Source of data: Vijayan study and KNP Authorities
10.	CRANE	Nos.	No. of Siberian Crane visiting the park (annual)
11.	DEVEXP	Rs. Million	Development expenditures in the park (annual): KNP Park Authorities Data
12.	DE	Rs million	Development Expenditure per square metre area of the park
13.	GRASS	000 tonnes	Wet grass weight (from *the KNP park area of 29 sq.km*)
14.	GRASSWT	Kg	Wet grass weight per square metre area
15.	TOURIST	Nos	No. of tourists visiting the park (annual)
16.	INCOME	Rs. Million	Income from Tourists fee, tourism dependent income and extraction income

and the economic data from two recent studies carried out in KNP during 1992–93 (Murty and Menkaus 1994) and 1997–98 (Chopra 1998). Table 1 shows the list of variables used in the analysis and their descriptions.

Statistical relationships are set up among variables, using monthly data for the period 1981 to 1988, and sometimes from 1984 to 1988.[12] Since the model uses monthly data, the analysis is based on a reasonably large number of observations.

[12] Data sources and methodology used for estimation (for selected variables) are obtained from secondary and unpublished data from the forest department. The interested reader may refer to the Appendix 1 in original paper for details.

The Model Equations

As stated above, the stock variables in the three sub-modules i.e. water storage, biomass and number of birds are central to the links between ecology and economy in the park. Factors affecting these stock variables are defined either as flow variables or as convertors and are estimated on the basis of econometrically or statistically defined relationships derived from historical data.

A description of the sub-modules and the equations follows:

Water Module In the water sub-model, four flows (Surface Inflow, Rainfall, Evapo-transpiration and Infiltration) are identified to affect the stock of WATER STORAGE in the park. Surface inflow from the catchment outside the park is monitored by human intervention (depicted as control inflow) to determine the release of water from Ajanbund reservoir (WATER –AJ), which has been treated as a time dependent graphical function, which drives the model. While surface inflow has been subjected to a control variable, RAINFALL is an independent driving variable introduced as a time-dependent graphical function. Evapo-transpiration and infiltration are determined on the basis of parameters obtained as indicated in Appendix I.

$$\text{WATER STORAGE}(t) = \text{WATER STORAGE}(t - dt) + (\text{rainfall} + \text{WATER-AJ} - \text{Evapo-transpiration} - \text{Infiltration})\, dt \quad (1)$$

Biomass Module In this module, two flow variables (CHANGE IN BIOMASS, EXTRACTION) determine the stock of BIOMASS (aquatic biomass). Further, the data available yields a non-linear (quadratic) relationship exists between the CHANGE IN BIOMASS and WATER STORAGE in the following form:

$$\text{CHANGE\_IN\_BIOMASS} = \underset{(2.32)}{186.85} + \underset{(3.08)}{131.04} * \text{WATER STORAGE} - \underset{(2.56)}{11.40} * (\text{WATER STORAGE})\,\hat{}\,2 \quad (2)$$

[Figures in brackets are t-values. All are significant at 5% level of significance]

This equation, arrived at by regressing known time series of the two sets of variables provides the link between the two modules, biomass and water.

EXTRACTION is the wet grass weight (per sq. metre area of the park), collected by the villagers during the period of the year (normally from November to March) when extraction is allowed. This is one of the management practices adopted by the Park Authority since 1986. It is found that on an average about 6 per cent of the total aquatic biomass is utilised by the villagers as fodder annually. Since the extraction rate for fodder and grasses are determined by policy with respect to permits, it is introduced as a converter variable, with a constant value, proportionate to biomass stock.

Birds Module Birds/waterfowl and Siberian Cranes are major attractions for the tourists visiting the park. To capture the seasonal fluctuation in the stock of birds (as seen in Figure A7 in the appendix), two variables, BIRD INFLOW and BIRD OUTFLOW have been introduced in the model. As explained earlier, inflow takes place in the months after the monsoon and refers to both migration and increased population of resident birds.

The following statistical relationship between BIRD INFLOW, WATER STORAGE and CHANGE IN BIOMASS is found to exist:

$$\begin{aligned}&\text{BIRD INFLOW} = \\ &\underset{(0.75)}{930.23} + \underset{(4.09)}{844.13} * [\text{WATER STORAGE}] - \underset{(1.65)}{2.14} * [\text{CHANGE IN BIOMASS}] \qquad (3)\end{aligned}$$

[Figures in brackets are t-values. All are significant at 5% or 1% level of significance]

Water storage is clearly the most important factor determining bird inflow. However, the stock of birds in any month depends on both inflow and outflow. Some birds migrate back to cooler regions at the outset of the summer. Natural decline rate of the resident birds in the six months prior to the onset of the monsoon is estimated on the basis of historical data and is found to depend on water storage in that period. If water availability falls below a critical level the rate of decline increases to twice its normal rate. This is modelled as a step function at the critical level of water storage.

$$\text{BIRD OUTFLOW} = \text{BIRDS} * \text{Decline rate}$$

$$\text{Decline rate} = \text{IF (WATER STORAGE}>0.90\text{) THEN 0.10 ELSE 0.20} \qquad (4)$$

Finally

$$\text{BIRDS}(t) = \text{BIRDS}(t\text{-}dt) + (\text{BIRD INFLOW} - \text{BIRD OUTFLOW}) \qquad (5)$$

ECOLOGICAL HEALTH INDICES AND TOURISTS, TOTAL INCOMES

Two alternative indices of ecological health are introduced in the model. The first is based on the tourists' perception that presence of the flagship species, Siberian Cranes, in winter months is the index of the ecological health of KNP.

The ECOLOGICAL HEALTH INDEX in the model is defined as:

$$\text{ECOLOGICAL\_HEALTH\_INDEX} = \text{EHI} = (\text{SIBERIAN CRANES}/K) * 100 \qquad (6)$$

where, K is the maximum number of cranes that visited the park during preceding years. An alternative definition of ecological health in terms of species diversity in the park is also introduced. A species diversity index, referred to as "Shannon-Weiner Diversity index (SWI) is set up on the basis of data available on species found in KNP. This is defined as:

$$\text{SWI} = -\Sigma S\, pi \log pi \qquad (7)$$

Where $pi = ni/N$; summation is over all species, s in the sample; pi = relative abundance of the I-th species N = total number of individuals.

It is then postulated that tourist arrivals are a function of the stock of birds obtained from equation (5), and the two ecological health indices, EHI and SWI obtained from (6) and (7).

The dependence of the number of TOURISTS on BIRDS and the two indices, EHI and SWI is determined by the following relationships, (8) and (9)

$$\begin{aligned}\text{TOURISTS} = {} & \\ & 1754.17 + 0.314 * \text{BIRDS} + 108.55 * \text{ECOLOGICAL\_HEALTH\_INDEX} \qquad (8)\\ & (3.50) \quad (3.85) \qquad\qquad (9.90)\end{aligned}$$

[Figures in brackets are t-values. All are significant at 5% or 1% level of significance]

$$\begin{aligned}\text{TOURISTS} = {} & -2349.37 + 0.48\ \text{BIRDS} + 6735.58 * \text{SWI} \qquad (9)\\ & (-1.414) \quad (4.11) \qquad\qquad (4.59)\end{aligned}$$

[Figures in brackets are t-values. All are significant at 5% or 1% level of significance]

Income Module Two types of income is derived from the park: income from the tourists, both direct and indirect and income from extraction to the villagers. Direct tourism income is obtained from the gate fees collected by the Park authority; whereas indirect incomes are those earned by the transporters, hotels, and restaurants in the area due to the arrival of tourists. It is estimated that on an average indirect income from tourists is about 17 times that of the direct income from the tourists (calculated using data in Murty and Menkaus 1993).

Also considering the price of the fodder collected from the park by the villagers, income from the extraction of biomass is calculated. To estimate net income, average expenditure incurred for the development of the park (DEV EXP) is subtracted from gross income

$$\begin{aligned}\text{NET INCOME} = {} & \text{DIRECT TOURISM INCOME} + \text{INDIRECT TOURISM INCOME} + \\ & \text{EXTRACTION INCOME- DEVELOPMENTAL EXPENDITURE} \qquad (10)\end{aligned}$$

V Scenario Analysis and Results

The model set up above uses equations (1) to (10) to define alternative scenarios with respect to the future. Simulation runs of the model in a dynamic framework yield values of the important variables over the time period of the model (monthly runs from 1983 to 2010). The variables and relationships set up capture the ecology-economy linkages and extrapolate them over the future. This is done in the tradition of dynamic system modeling to capture some aspects of human-ecosystems interactions.[13] Regional development models have also

[13] See Costanza and Ruth (2001) and Low, Ostrom, Costanza and Wilson (2001).

been set up using such simulation modeling.[14] Such modeling is of use when the impact of exogenous system or policy changes on a natural system need to be captured and compared with "business as usual" scenarios. It is particularly useful when the exogenous change is outside the optimizing context of individual stakeholders in a multi-stakeholder context. Multiple stakeholders may imply that optimization with respect to one set is not what the policy maker (or the analyst) is looking for. When the problem at hand is posed such that the impact of exogenous change on slowly changing long run ecological patterns needs to be determined, a long run simulation model provides the appropriate methodology. In addition, it augments a short period view of economic value that is the focus of static optimization maximizing consumer's surplus or producer's surplus based studies. Further, such simulation models do not make unrealistic demands on data and assumptions as may happen in the case of long-run optimizing models. This paper suggests that they comprise invaluable tools for policy decisions in the face of limited information. It is in this spirit that runs of the model presented above are interpreted to examine how changes in driving variables or ecological characteristics of the park as exemplified by surface water inflow (WATER-AJ) and the two bio-diversity indices (EHI and SWI) impact incomes from tourism in the long run.

V.1 Baseline BAU Scenario

The baseline scenario of the model is obtained after a series of iterations. There are seasonal fluctuations in the ecological state variables, Water Storage and Biomass. Additionally the bird population and the net income derived exhibit a trend superimposed on the seasonal fluctuations. It is found that both variables show a downward trend during the first six years (81 months), followed by fluctuation till 243 months and a little upward swing from that point upto 324 months. This presents the picture as extrapolated from the past, i.e. "business as usual". Further, it is found that these variables follow the same pattern irrespective of which of the two ecological health indices (EHI and SWI) are selected to represent biodiversity.

V.2 Scenario-I: Inflow of Surface Water is Reduced by 5% Annually

Under an alternative scenario, we assume that the inflow of surface water decreases at the rate of 5% annually resulting in a similar decrease in WATER.AJ. This is treated as an exogenous change consequent on the additional demand from agriculture in the catchment. In other words, this simulation captures the effects of increased use of water outside the park. It is observed that the stock of BIOMASS in the park decreases considerably having a linear pattern in its

[14] See, for instance, Chapter 9 in Van den Bergh (1996) which describes such a model set up for the Peel region in the Netherlands. Also see Chopra and Kadekodi(1999) for a model for a region in India.

fluctuations over the years. This in turn affects the bird and tourists population as well as the net income.

Further, two versions of the model are developed with EHI and SWI respectively used to determine number of tourists and net income as given in equations (6) and (7). Sharp fluctuations are observed in the tourist and income variables when the SWI index is used to capture biodiversity. This implies that bird species diversity index influences the tourist out turns more than the index derived from presence or otherwise of the flagship species, the Siberian cranes (EHI). Net income falls by around Rs. 3 million, a fall of 80% compared with the BAU scenario. The upturn in these variables that is observed in the BAU scenario in the period from year 20(month 243) onwards is no longer found to take place.

V.3 Scenario II: Surface Inflow (SI) and Ecological Health Index (EHI) are Both Reduced by 5% annually

The next simulation shows the number of birds and the income from the park in a situation where both the surface water inflow and the ecological health index decrease by 5% annually. The cumulative impact of the decrease in biomass and species diversity on incomes can be seen clearly. Whereas in Scenario I, the number of tourists fluctuate between six to ten thousand per month after month 243, they fall to less than 5000 per month in the same period under this scenario. Total income (which, to recapitulate, includes that from extraction to village residents and from the tourism industry to the forest department and the residents of Bharatpur) correspondingly falls from 35–40 million to less than 15 million. It is clear that economic value is a function of ecological health and water inflow.

An examination of the elasticity of tourist numbers with respect to ecological health index from the results of the simulation model yields interesting results. The elasticities exhibit wide ranges of variation from month to month as expected. For the six months in the winter when tourist traffic is high, the number of tourists is critically dependent on the ecological health index measured by the arrival or otherwise of Siberian cranes. Elasticities vary from 0.6, 0.7 to 1.5 or even 1.7 in the BAU and Scenario 1. However, the values of the elasticities decrease to a range varying from .04 to .124 in Scenario II. In other words, as biotic pressure increases and the wetland becomes less attractive as an ecosystem, one can expect a fall in elasticity. A non-linearity is to be seen in the degree of impact on tourist traffic. This can be interpreted to mean that a less attractive bird habitat reduces both number of tourists and the responsiveness of their numbers to further changes in the habitat attractiveness. Perhaps the arrivals get limited to the hard core of enthusiasts.[15]

[15] In the context of KNP, it could be the ones who visit to study species changes.

V.4 Economic Value of Tourism: An Alternative Approach

In an alternative approach,[16] the economic value accruing to tourists has been captured through the use of travel cost method. A demand function for tourism is set up in which the probability of visiting KNP depends on amount spent on travel, either by way of total cost or by way of local cost, opportunity cost of time spent (which in turn reflects household income), educational levels and reason for visiting the park. This demand function represents revealed preferences of an important segment of stakeholders in KNP, the tourists. Further, it illustrates the extent to which value of biodiversity conservation in a geographical area is reflected in the market for tourism.

As documented in the literature, the travel cost method hypothesizes that the costs incurred by the tourist to reach the site and the expenditure he/she incurs while there are measures of the price he/she is willing to pay for visiting the site. Since the travel costs vary across individuals living at different distances from the site, this data can be used to derive a demand curve for the services provided by the site. The dependent variable in the demand function is the visitation rate, $V(i, j)$ defined as tourist number in group i/number of tourists visiting from zone j to which the group belongs. This is regressed on price as approximated by total and local cost variants in the two specifications[17] which we set up for KNP. Other independent variables depicting the socio-economic characteristics of the respondent tourist are also introduced. Thus

$$V(i, j) = \text{F(TTCP/TLCP, EVM, OPPTIME, H IPF)}$$

Where $V(i, j)$ = tourist number in group i/number of tourists from zone to which group i belongs

TTCP/TCLP = total travel cost or local travel cost in two different specifications
EVM = reason for visiting park (education, recreation, religious etc)
OPPTIME = opportunity cost of time spent
HIPF = household income

Using survey-data collected regarding tourists' travel and stay expenses,[18] duration of stay, and various socio-economic characteristics, a semi-log demand function (both in its total and

[16] See Chopra (forthcoming). We reproduce the methodology and results in brief in this section.

[17] Total travel cost is defined to include travel from place of residence, cost of travel within park, cost of boarding and lodging during stay and any other miscellaneous expenditure. Local travel cost excludes the first component on the assumption of the joint product nature of the visit to the park located as it is in a tourism region. For details see Chopra (forthcoming).

[18] The final set of usable responses consisted of 111 respondents, of which 68 were Indians and 43 were foreigners. Each respondent gave information on the number of members in his group/family. Hence, the total number of tourists covered in this manner were 305 consisting of 235 Indians and 70 foreign nationals.

local cost specifications) indicates that travel cost is a valid proxy variable for price in determining demand for tourism services.[19] Visitation is impacted significantly by travel cost in the semi-log demand function. The opportunity cost of time also affects the visitation rate, as does household income.

In view of the joint product nature of the services provided by the park, it is considered more appropriate to estimate consumer's surplus from local cost estimates. This amounts to about Rs. 202 per visit if average local travel cost is taken as the reference point. This figure reflects the surplus value (utility gain) that the tourists place on visits to the park.

The demand functions were also used to estimate price elasticities of demand at the mean value of the variables. The demand for the services of KNP turns out to be inelastic. The elasticity ranges from 0.05 to 0.24 for tourists coming from the five geographical zones.

The travel cost model estimates economist value as reflected in the tourism service pricing. The inelastic nature of the demand signifies that visitation rates are not very responsive to cost incurred to avail of these services. This is of interest in view of the larger elasticity figures with respect to ecological health reported in Section V.3.

VI Conclusions: Ecological and Economic Value

The simulation model presented in Section V studies ecology-economy interactions in the Keoladeo National Park and provides projections for key variables for a period of 23 years on a monthly basis. Alternative scenarios illustrate the impact of exogenous changes, such as reductions in water inflow on account of development of upstream agriculture and reductions in indices of ecological health on economic value, derived from the park. The simulations point towards a critical dependence of economic value (direct and indirect income derived from the park) on ecological health indices. Elasticities obtained vary from 0.6, 0.7 to 1.5 or even 1.7 in two scenarios. However, as biotic pressure increases and the wetland becomes less attractive as an ecosystem, the values of the elasticities decrease to a range varying from .04 to .124. A non-linearity is to be seen in the degree of impact of an increase in ecological health indices on tourist traffic.

Benefits to be had from improved maintenance for ecological conservation are more per unit of effort at higher levels of conservation. Simultaneously, results from a conventional travel cost model reveal low elasticities with respect to cost incurred by visitors. Together, these results indicate that:

- given the present profile of visitors to KNP, visitation rates are not responsive to private cost incurred

[19] A non-linear specification was using local travel cost as the proxy for price and using a semi-log function was found to be the best fit in this case.

- however, direct and indirect income obtained from the park is more responsive to ecological health indices, measured as given above
- this responsive or elasticity with respect to ecological health is more at higher values of the indices, indicating thereby that once efforts at conservation increase attractiveness of the park above a certain level, the impact is cumulative and returns in terms of income rise more than proportionately.

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Chapter 15

Measuring Environmental Efficiency of Industry: A Case Study of Thermal Power Generation in India

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1. Introduction

Measurement of the productive efficiency of firms that generate environmental pollution (air and water pollution, and land degradation) and face the environmental regulation has to account for their efficiency in producing good output as well as in reducing pollution, the bad output. A measure of technical efficiency based on conventional input- or output-based methods that ignore the firm's efforts to reduce pollution may understate the productive efficiency of firms. For example, Shephard's output distance function with the weak disposability assumption of bad outputs presumes that a firm becomes technically inefficient (efficiency measured in terms of good output production) if it complies with the environmental regulation. There are many studies estimating the technical efficiency of polluting firms using the output distance function (Coggins and Swinton 1996; Hetemaki 1996; Swinton 1998; Boyd and McClelland 1999; Murty and Kumar 2002, 2003). Whether the radial expansion of good and bad outputs results in welfare loss or gain depends on the benefits from reducing bad outputs and the cost in terms of reducing the good output (Murty et al. 2006). Thus, the final welfare results are ambiguous when both good as well bad outputs are increasing. The input based measures of efficiency could be more appropriate in measuring productive efficiency of firms complying with environmental regulation. There are studies that estimate technical efficiency by considering pollution as one of the inputs in the production function (Murty and Kumar 2006; Murty and Gulati 2004). The Shephard's input distance function could also be appropriate because

a proportional change in inputs with good and bad outputs held constant is an unambiguous indicator of welfare change (Hailu and Veeman 2001; Murty et al. 2006). There are some recent studies using the directional distance function, a generalization of Shephard's output distance function, for estimating the technical and environmental efficiency of polluting firms (Färe and Grosskopf 2004; Färe et al. 2005; Marklund and Samakovlis 2005; Kumar 2006). The polluting firm's technical efficiency in increasing good output and reducing bad output, namely pollution, could be measured using the directional output distance function because it allows one to consider the non-proportional changes in outputs and allows one output to be expanded while another output is contracted. Since environmental regulation requires the firms to reduce pollution, the technology of firms described by the directional output distance function allows cost minimizing or profit maximizing firms to make choices among different combinations of good and bad outputs in the direction of increasing good output and reducing bad output. Therefore, the advantage of using directional output distance function is that it provides unambiguous welfare results.

The directional output distance function is estimated in this paper using data from thermal power generating plants in Andhra Pradesh (A.P.), State of India. It is specified parametrically as a quadratic functional form and is used to estimate the combined environmental and technical efficiency, shadow prices of suspended particulate matter (SPM), sulphur dioxide (SO_2) and nitrous oxide (NO_x) and the elasticity of substitution between good output, electricity and pollutants. The directional output distance function could be estimated either deterministically or stochastically. The deterministic procedure accounts for all deviations from the observed frontier in measuring inefficiency. However, some of the deviations of observed outputs from the frontier outputs might be due to measurement and random errors and therefore, the directional output distance function is estimated as a stochastic frontier in this paper.

The main findings are given as follows: The thermal power generating units could reduce emissions of SPM, SO_2, and NO_x further if they improve their technical and environmental efficiency. A representative plant, without increasing resources and developing technology, can annually increase electricity by 18.20 million units and reduce SPM, SO_2 and NO_x by 0.04, 0.053 and 0.008 thousand tonnes, respectively. The shadow prices of bad outputs or marginal costs of pollution abatement of a ton of SPM, SO_2 and NO_x are estimated, respectively as Rs. 4777, 1883 and 6725 at 2003–2004 prices. The average overall elasticity of substitution between electricity and SPM is estimated as –0.243. Less than unitary elasticity of substitution between electricity and SPM shows that there could be a significant rise in the marginal cost of abatement of SPM as the plant plans for the higher reductions. The analysis of correlation between firm specific shadow prices of bad outputs or marginal cost of abatement of pollutants and the pollution concentrations and pollution loads shows that there is a rising marginal cost of abatement with respect to pollution concentrations and a falling marginal cost of abatement with respect to pollution loads.

The remaining paper is planned as follows: Section 2 discusses the theoretical model of directional output distance function. Section 3 describes the empirical model and the data used in estimation. Section 4 discusses the results while Section 5 provides conclusions.

2. Theoretical Model

2.1 The Directional Output Distance Function

Suppose that a firm employs a vector of inputs $x \in \Re_+^K$ to produce a vector of good outputs $y \in \Re_+^M$ and bad outputs $b \in \Re_+^N$. Let $P(x)$ be the feasible output set for the given input vector x and $L(y, b)$ is the input requirement set for a given output vector (y, b). Now the technology set is defined as:

$$T = \{(y, b, x) \in \Re_+^{M+N+K}, (y, b) \in P(x), x \in L(y, b)\} \tag{1}$$

The technology is modeled in alternative ways. The output is strongly or freely disposable if $(y, b) \in P(x)$ and $(y', b') \leq (y, b) \Rightarrow (y', b') \in P(x)$ which implies that if an observed output vector is feasible, then any output vector smaller than that is also feasible. This assumption excludes production processes that generate bad outputs that are costly to dispose. For example, concerns about SO_2 and other pollutants imply that these should not be considered to be freely disposable. In such cases bad outputs are considered as being weakly disposable: $(y, b) \in P(x)$ and $0 \leq \theta \leqslant 1 \Rightarrow (\theta y, \theta b) \in P(x)$. This implies that pollution is costly to dispose and abatement activities would typically divert resources away from the production of desirable outputs and thus lead to lower good output with given inputs. Moreover, good outputs are assumed to be null-joint with the bad outputs.[1] This means that good outputs cannot be produced without producing bad outputs.

The output distance function is defined as,

$$D_O\{x, y, b) = \min\{\lambda > 0 : (y/\lambda, b/\lambda) \in P(x)\} \forall x \in \Re_+^N. \tag{2}$$

Equation (2) characterizes the output possibility set by the maximum equi-proportional expansion of all outputs consistent with the technology set (1). It implies that a firm has to do equi-proportional reduction of both good and bad outputs if it has to reduce pollution, bad output, and comply with the environmental regulation. This way of describing the technology of polluting firms does not account for the efforts the firm could make to reduce pollution while either increasing or keeping constant the production of good output. The description of technology of firms using the directional output distance function could make it possible to estimate the technical and environmental efficiency of firms trying simultaneously to increase good output and reduce bad output. Formally, the directional output distance function[2] is defined as

$$D(x, y, b; g) = \max_{\beta} \{\beta : (y + \beta \cdot g_y, b - \beta \cdot g_b) \in P(x)\}, \tag{3}$$

[1] Null-jointness implies that a firm cannot produce good output in the absence of bad outputs, i.e., if $(y, b) \in P(x)$ and $b = 0$ then $y = 0$.

[2] For the properties of directional output distance function; see Färe et al. (2005).

This function requires the simultaneous reduction in bad outputs and expansion in good outputs. The computed value of β, β^* provides the maximum expansion of good outputs and contraction of bad outputs if a firm has to operate efficiently given the directional vector g. The vector $g = (g_y, -g_b)$ specifies the direction an output vector, $(y, b) \in P(x)$, is scaled so as to reach the boundary of the output set at the point $(y + \beta^* \cdot g_y, b - \beta^* \cdot g_b) \in P(x)$ by expanding good output and contracting the bad output where $\beta^* = D(x, y, b; g)$. The directional output distance function derives its properties from the output possibility set $P(x)$ (Färe et al. 2005). It is (a) non-negative for feasible outputs, (b) monotonic corresponding to strong disposability of good outputs in the sense that if it produces more of good output and the same amount of bad outputs using the given inputs, its value will not increase, (c) monotonic corresponding to weak disposability of bad outputs in the sense that if bad output increases holding good output and inputs constant, the value of the function will not decrease, (d) concave, and finally (e) it represents weak disposability of good and bad outputs.

The directional output distance function is a generalization of output distance function given in Eq. (2). The advantage of this function is that it allows one to consider non-proportional changes in output and makes it possible the expansion of one output while contracting the other output. This property is very useful to study input–output choices of a polluting firm facing environmental regulation because a firm faced with this situation tries to simultaneously reduce pollution and increase good output production. The directional output distance function could be a measure of environmental and technical efficiency in the sense that the producer becomes more technically efficient when simultaneously increasing good outputs and decreasing bad outputs. The distance function takes the value of zero for technically efficient output vectors on the frontier, whereas positive values imply inefficient output vectors below the frontier. The higher the value, the more inefficient is the output vector, i.e., the directional output distance function is a measure of technical inefficiency.

The directional output distance function also satisfies the translation property,

$$D(x, y + \alpha \cdot g_y, b - \alpha \cdot g_b; g) = D(x, y, b; g) - \alpha, \tag{4}$$

This property states that if the good output is expanded by αg_y and the bad output is contracted by αg_b, then the value of the distance function will be more efficient with the amount α. It is the additive analogue of the multiplicative homogeneity property of the Shephard's output distance function given in Eq. (2)[3].

2.2 Shadow Prices of Pollutants

The idea of deriving shadow prices using output and input distance functions and the duality results is originally from Shephard (1970). A study by Färe et al. (1990) is the first in computing

[3] See Färe et al. (2005).

shadow prices using the distance function. Färe et al. (1993) is the first study deriving the shadow prices of undesirable outputs using the output distance function and Coggins and Swinton (1996), Swinton (1998) and Murty and Kumar (2002) among others have computed shadow prices of bad outputs. As discussed above, the output distance function projects the observed output vector on to the boundary of output set by increasing all outputs proportionally including bad outputs. However, in the case of directional output distance function it is possible to project to the frontier in a direction that decreases the bad output and increases good output. The shadow prices in this case reflect the trade off between desirable and undesirable outputs on the boundary of $P(x)$ where the directional output distance function, $D(x, y, b; g)$ takes the value zero. The derivation of absolute shadow prices for bad outputs using distance function requires the assumption that one observed output price is shadow price. Let y_1 denote the good output and assume that the observed good output price (r_1^o) equals its absolute shadow price (r_1^s)($r_1^o = r_1^s$). Färe et al. (1993) have shown that the absolute shadow prices of bad outputs b_j ($j = 2,\ldots, J$) can be derived as,

$$r_j^s = r_1^o \frac{\partial D(x, y, b; g)/\partial b_j}{\partial D(x, y, b; g)/\partial y_1}, j = 2,\ldots, J \tag{5}$$

2.3 The Morishima Elasticity of Substitution

As the directional output distance function completely describes the production technology and identifies the boundaries of technology, one may use it to describe the characteristics of the frontier or surface technology, including curvature, i.e., the degree of substitutability along the surface technology. The curvature measures how the ratio of the shadow prices of good and bad outputs changes as the relative pollution intensity (ratio of bad output to good output) changes. Following Blackorby and Russell (1989) and Grosskopf et al. (1995), the indirect Morishima elasticity of substitution between good outputs may be defined as:

$$M_{by} = \frac{\partial \ln(q/p)}{\partial \ln(y/b)} \tag{6}$$

and in terms of directional output distance function, the Morishima elasticity of substitution, following Färe et al. (2005) can be specified as,

$$M_{by} = y^* \left\{ \left(\frac{D_{by}(x, y, b; g)}{D_b(x, y, b; g)} \right) - \left(\frac{D_{yy}(x, y, b; g)}{D_y(x, y, b; g)} \right) \right\} \tag{7}$$

where $y^* = y + D(x, y, b; g)$ and the subscripts on the distance functions refer to partial derivatives with respect to outputs: e.g., $D_{yy}(x, y, b; g)$ is the second order partial derivative of

the distance function with respect to y. Given the monotonicity properties[4] of the directional distance function with respect to good and bad outputs, along the positively sloped portion of $P(x)$(when the bad outputs are assumed to be weakly disposable) the sign of M_{by} should be negative. But in the context of two bad outputs, the positive sign of Morishima elasticity of substitution implies that the bad outputs are substitute to each other, i.e., the reduction in the relative shadow price ratio of two bad outputs due to reduction in relative intensities of the bad outputs.

The higher values of M_{by} (higher in absolute terms) indicate that a given change in the ratio of outputs will yield higher changes in the shadow price ratio. Therefore, as the elasticity of substitution becomes more negative it becomes more costly for electricity generating plants to reduce the amount of pollution over time.

Here it should be noted that the Morishima and Allen elasticities yield the same result in the two-output case; when the number of outputs exceeds two, however, they no longer coincide. Moreover, the Morishima elasticities may not be symmetric, i.e., $M_{by} \neq M_{yb}$. This is as it should be and allows for the asymmetry in substitutability of different outputs.

3. The Empirical Model and Data

3.1 Empirical Model

The distance functions can be computed either non-parametrically using the data envelopement analysis (DEA) or parametrically.[5] Here we adopt the parametric approach for the computation of distance functions, the advantage of this approach is that it is differentiable. We employ the quadratic form of the distance function that is twice differentiable and flexible. The form is given by

$$\begin{aligned} D^{kt}(x^{kt}, y^{kt}, b^{kt}; g) = {} & \beta_0 + \sum_{n=1}^{3} \beta_n x_n^{kt} + \gamma_1 y_1^{kt} + \sum_{j=2}^{4} \gamma_j b_j^{kt} \\ & + \frac{1}{2} \sum_{n=1}^{3} \sum_{n'=1}^{3} \beta_{nn'} x_n^{kt} x_{n'}^{kt} + \sum_{n=1}^{3} \delta_{n1} x_n^{kt} y_1^{kt} + \sum_{n=1}^{3} \sum_{j=2}^{4} \eta_{nj} x_n^{kt} b_j^{kt} \\ & + \frac{1}{2} \gamma_{11} y_1^{kt} y_1^{kt} + \sum_{j=2}^{4} \mu_1 y_1^{kt} b_j^{kt} \\ & + \frac{1}{2} \sum_{j=2}^{4} \sum_{j'=2}^{4} \gamma_{jj'} b_j^{kt} b_{j'}^{kt} + \tau \cdot t \end{aligned} \tag{8}$$

[4] (i) $D_b(x, y, \boldsymbol{b}; g) \geq 0$; (ii) $D_y(x, y, b; g) \leq 0$; (iii) $D_{yy}(x, y, b; g) \leq 0$; and (iv) $D_{by}(x, y, b; g) \leq 0$.

[5] The LP estimating procedure is adopted in Färe et al. (2001).

where t is monthly time-trend. For the translation property to hold, and accounting for the direction vector, the required parameter restrictions are,

$$\gamma_1 - \sum_{j=2}^{4}\gamma_j = -1, \sum_{j=2}^{4}\mu_{1j} - \sum_{j'=2}^{4}\gamma_{jj'} = 0, \gamma_{11} - \sum_{j=2}^{4}\mu_{1j} = 0, \;\; j = 2,3,4.$$

In addition to the translation property, we impose symmetry conditions also,

$$\beta_{nn'} = \beta_{n'n},\ \gamma_{jj'} = \gamma_{j'j},\ n, n' = 1, 2, 3; \quad j, j' = 2, 3, 4.$$

The function can be computed either using deterministic or stochastic techniques. Estimating distance functions econometrically has some advantages over the deterministic approach. Other than allowing for an appropriate treatment of measurement errors and random shocks, several statistical hypotheses can be tested: significance of parameters, separability between outputs and inputs and between good and bad outputs and monotonicity properties of distance functions.[6] Following Kumbhakar and Lovell (2000) and Färe et al. (2005), the stochastic specification of the directional distance function takes the form,

$$0 = D(x, y, b; 1, -1) + \varepsilon \tag{9}$$

where $\varepsilon = v - \mu$ and $v \sim N(0, \sigma_v^2)$ and $\mu \sim iidG(P,\theta)$, and P and θ are the shape and scale distribution parameters, respectively.

To estimate (8), we utilize the translation property of the directional output distance function. As in Färe et al. (2005), we choose the directional vector $g = (1, -1)$, where 1 refers to g_y and -1 refers to $-g_b$. This choice of direction is consistent with environmental regulations, which require reduction in bad outputs. The translation property implies that,

$$D(x, y + \alpha, b - \alpha, 1, -1) + \alpha = D(x, y, b; 1, -1). \tag{10}$$

By substituting $D(x, y + \alpha, b - \alpha; 1, -1) + \alpha$ for $D(x, y, b; 1, -1)$ in (9) and taking α to the left hand side, we get

$$-\alpha = D(x, y + \alpha, b - \alpha; 1, -1) + \varepsilon \tag{11}$$

where $D(x, y + \alpha, b - \alpha; 1, -1)$ is the quadratic form given by (8) with α added to y and subtracted from b. Thus, one is able to get a variation on the left-hand side by choosing an a that is specific to each electricity generating plant. In our case, it may be one of the bad outputs.

The parameters of the quadratic distance function (8) and as well as the value of the directional output distance function which is a measure of technical inefficiency can be estimated

[6] However, the stochastic methods have their own disadvantages such as distributional assumptions for the inefficiency and error terms, and the problem of imposing non-linear monotonicity constraints in the estimation process.

using either the corrected ordinary least square (COLS)[7] or the maximum likelihood (ML) methods. The COLS approach is not as demanding as the ML method, which requires maximization of the likelihood function. The ML method is asymptotically more efficient than the COLS estimator but the properties of the two estimators in finite samples can be analytically determined. The finite sample properties of the half-normal frontier model were investigated in a Monte-Carlo experiment by Coelli (1995), in which the ML estimator was found to be significantly better than the COLS estimator when contribution of technical inefficiency effects to the total variance term is large. Greene (2000) shows that the gamma model has the virtue of providing a richer and more flexible parameterization of the inefficiency distribution in the stochastic frontier model than either of the canonical forms, half normal and exponential. Moreover, gamma specification enjoys essentially the same properties as the normal/half-normal model with the additional advantage of the flexibility of a two-parameter distribution. The primary advantage is that it does not require that the firm-specific inefficiency measures be predominately near zero (Greene 1990). One can test down from the gamma to the exponential by testing if the shape parameter, *P*, equals 1.0, as the gamma distribution is a generalization of the exponential distribution. The present study adopts the ML estimation approach while assuming gamma distribution for one-sided error term.[8]

3.2 Data

Andhra Pradesh Power Generation Corporation (APGENCO) (formerly known as Andhra Pradesh State Electricity Board, APSEB) came into existence on February 1, 1999. APGENCO was supposed to acquire the power plants established by APSEB and establish, construct and operate power-generating stations. All the five plants under study are now owned by APGENCO. The plants owned by APGENCO are subject to environmental regulations in the generation of power and it has an unwritten environmental policy to comply with relevant environmental legislations and regulatory requirements for establishment and operation of the power stations. High efficiency Electro-static Precipitators (ESPs) are installed to control SPM in the flue gas. All new plants are designed for SPM level of 100 mg/NM^3 a limit set by the Andhra Pradesh Pollution Control Board (APPCB). Old units are upgraded or under upgradation for 50/115 mg/NM^3 against limit of 115 mg/NM^3. Latest micro processor based EPIC-II controllers are installed for improvement of collection efficiency and reduction of power consumption. Online flue gas dust monitoring systems are installed at VTPS, RTPP and KTPS Stage-V.[9]

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[7] For an application of COLS to the Shephard output distance function, see Lovell et al. (1994) and to the directional output distance function, see Färe et al. (2005).

[8] LIMDEP 8.0 version is used in the estimation of directional output distance function.

[9] www.apgenco.com

The directional output distance function described above is estimated using data for five coal fired thermal power generating plants belonging to APGENCO. The data set used constitutes a panel consisting of monthly observations on variables during the years 1996–1997 to 2003–2004. It contains 480 observations on electricity produced, air pollutants SPM, SO_2 and NO_x generated as well as coal and other inputs used by the five electricity-generating plants. Electricity generated is considered as a good output while the three pollutants SPM, SO_2 and NO_x generated are taken as bad outputs in the estimation. Table 1 provides the descriptive statistic of the variables used in the estimation of the distance function.

TABLE 1
Descriptive Statistics of the Variables used in the Study

Variable	*Unit*	*Mean*	*SD*	*Maximum*	*Minimum*
Electricity	Million units	298.28	13.91	933.58	0.01
SPM	Tonnes	653	0.033	3.526	0.018
SO_2	Tonnes	874	0.049	4.268	0.004
NO_x	Tonnes	139	0.013	1.984	0.001
Coal	Tonnes	223460	9.93	667.05	0.01
Capital	Rupees millions	1913.231	905.46	62395.28	148.59
Wage bill	Rupees millions	255.628	111.03	9332.04	344.16

For the estimation of shadow prices of bad outputs, we need the information on electricity prices. In India, electricity sector is regulated and the state regulatory commissions decide the price of electricity for different categories of consumers accordingly and Andhra Pradesh is no exception. Cross subsidies are widespread and domestic and agricultural consumers are charged lower prices in comparison to production costs, but the commercial and industrial consumers have to pay high prices. The price charged for industrial use of electricity is taken as its market price for computing the shadow prices of bad outputs. In 2003–2004, the industrial consumers were paying Rupees 3.6 per unit of electricity use. In India source specific standards of air pollution are used for the environmental regulation. The Stack Emission Standards for the thermal power generation are 115, 80 and 80 milligrams per NM^3, respectively, for SPM, SO_2 and NO_x.

Table 1 provides the descriptive statistics of variables used in the estimation of directional output distance function.

Description of variables SPM, SO_2, and NO_x: Monthly loads in tonnes discharged by the power plant. It is computed by multiplying monthly average concentration of the pollutant (mg/NM^3) with the monthly volume of stack discharge (NM^3) for each plant.

Electricity: Electricity produced by the plant during a year in (million units).
Capital: Capital stock of a plant observed at the beginning of a year which is assumed to be fixed for the rest of the year.
Coal: Annual consumption of coal by the plant (in tonnes).
Wage bill: Annual wage bill of a plant (in million rupees).

4. Results

The directional output distance function is estimated using mean normalized input and output data since we face convergence problems in the models given the numercal size of the outputs and inputs reported in Table 1 (Färe et al. 2005). This normalization implies that $(x, y, b) = (1, 1, 1)$ for a hypothetical electricity generating plant that uses mean inputs and produces mean outputs.

For the econometric estimation of the directional output distance function, one of the bad outputs is taken as the dependent variable, as specified in Eq. (10). In the data set, we have three bad outputs and in the available literature there is no guide about the selection of dependent variable while using the translation property. Therefore, we estimate three models considering one of the bad outputs as a dependent variable in each case.

As mentioned above, we follow the ML estimation procedure for the estimation of the directional distance function and the one sided error term is assumed to be independently and identically gamma distributed (i.i.γ). As the shape parameter P tends to 1.0, the parameter estimates converge towards an exponential distribution of the one-sided error term. On the basis of the loglikelihood test we settle the case either in favor of exponential or gamma distribution of the error term. In *Model 1* (SPM is the dependent variable) and *Model 3* (NO_x is the dependent variable) we go for exponential distribution of the error term, but in *Model 2* (SO_2 is the dependent variable) we have selected the gamma distribution of the error term. Table 2 presents the model selection results.

TABLE 2
Selection of Model

	Null Hypothesis	*Log Likelihood Ratio Test Statistics (λ)*	*Decision*
Model 1	H_0: P = 1	–1396.86	Do not reject H_0
Model 2	H_0: P = 1	62.38	Reject H_0
Model 3	H_0: P = 1	0	Do not reject H_0

Note: $\lambda = -2\{\text{Log(Likelihood } H_0) - \text{Log(Likelihood H1)}\}$ where Model 1: SPM is the dependent variable; Model 2: SO_2 is the dependent variable; and Model 3: NO_x is the dependent variable.

In Table 3, the estimated parameters of all the three models are presented. In *Model 2* we have selected the model which assumes gamma distribution of the one-sided error term. In this model we find that the value of shape parameter, P is different from one and it is statistically significant even at the 1% level. Similarly, we find that the other ML estimation parameters are also statistically significant in all the three models. Most of the first order parameters have expected signs and are statistically significant in all the three models. A first look at the parameters in Table 3 indicates that the results obtained for all the three models are very close to each other. Looking at the second order parameters, it appears that they involve interesting results too; these however, require a more detailed analysis to measure their final influence.

TABLE 3
Parameter Estimates of Directional Output Distance Function

	Model 1		*Model 2*		*Model 3*	
Name of Variable	*Coefficient*	t-*stat*	*Coefficient*	t-*stat*	*Coefficient*	t-*stat*
Intercept	–0.1233	–5.8580	–0.1565	–7.9800	–0.1301	–45.8620
Y_1	–0.7433	–50.2740	–0.5826	–42.1560	–0.7629	–36.0580
Y_2	0.1317		0.0559	17.8270	0.0824	7.3040
Y_3	0.0839	2.4410	0.3224		0.1578	–0.2210
Y_4	0.0412	3.4630	0.0391	3.8030	–0.0031	
X_1	0.8733	32.3120	0.7544	29.4870	0.8397	25.5310
X_2	–0.1108	–4.0700	–0.1399	–5.0380	–0.2131	–6.9690
X_3	0.3746	5.4420	0.3082	4.5260	0.7547	11.5570
T	–0.0002	–1.3450	–0.0005	–1.0610	0.0001	0.6380
Y_1^2	–0.3229	–53.8390	–0.2969	–55.5240	–0.3282	–56.2120
Y_2^2	0.3981		0.1535	–0.0100	–0.4898	–7.5100
Y_3^2	–0.0670	–3.7500	–0.0002		–0.1133	1.7160
Y_4^2	–0.1300	–11.8500	–0.0876	–7.3360	0.0153	
X_1^2	–0.5576	–17.3710	–0.6735	–18.4610	–0.2452	–7.1830
X_{22}	0.1399	5.2260	0.1683	5.0930	–0.0856	–2.9940
X_3^2	–0.6330	–12.7610	–0.3193	–5.5760	–0.7261	–13.0790
Y_1Y_2	0.0810		–0.0057	–4.7770	–0.2449	–3.5050
Y_2Y_3	0.1901		0.1233		–0.1868	–0.8610
Y_2Y_4	0.1271		0.0359	–7.8510	–0.0582	
Y_1Y_3	–0.1267	–5.3670	–0.1091		–0.0637	33.9210
Y_1Y_4	–0.2772	–14.5140	–0.1821	33.4740	–0.0195	
Y_1X_1	0.3953	33.9510	0.4567	4.3910	0.3429	32.7510
Y_1X_2	0.0633	5.8300	0.0423	–10.4620	0.2549	–0.3610
Y_1X_3	0.0834	7.0820	–0.1063	2.6820	–0.0038	4.9920
Y_3Y_4	0.0202	0.8200	0.0585		0.0930	
Y_2X_1	0.1842		0.1715	7.8580	0.2778	9.8240
Y_2X_2	–0.0032		0.0492	–0.1750	0.1728	–6.2900
Y_2X_3	–0.0229		0.1009	–19.4490	0.1417	–9.2740
Y_3X_1	0.1057	4.7110	0.1765		0.1603	–4.8060
Y_3X_2	0.0746	4.4830	–0.0032		–0.0658	14.0060
Y_3X_3	–0.0667	–3.0330	–0.2754		–0.1285	–1.2340
Y_4X_1	0.1054	8.3270	0.1087	8.4230	–0.0951	
Y_4X_2	–0.0081	–0.7900	–0.0037	–0.3460	0.1479	
Y_4X_3	0.1731	13.9480	0.0682	3.8450	–0.0169	
X_1X_2	–0.4477	–15.4230	–0.4336	–11.8180	–0.6852	–16.8890
X_1X_3	0.1155	3.2860	0.1889	3.5990	–0.0893	–2.1280
X_2X_3	–0.0097	–0.3410	0.0646	1.8540	0.0280	0.9060
θ	15.9290	28.1600	7.3029	19.6420	8.6009	15.4370
p			0.4228	9.9300		
σ_v	0.0174	7.6690	0.0259	13.2280	0.0100	16.6590
Loglikelihood function	733.578		662.343		–409.111	

Notes: Underlined parameters are calculated by using the translation property.
Where Model 1: SPM is the dependent variable; Model 2: SO_2 is the dependent variable; Model 3: NO_x is the dependent variable.
Υ_1: Electricity; Υ_2: SPM; Υ_3: SO_2; Υ_4: NO_x; X_1: Coal; X_2: Capital; and X_3: Wage bill.

Thus, using the estimated coefficients we are able to verify that the resulting distance functions satisfy the regularity conditions for average values.

From Section 2, we know that for the directional output distance function to be well behaved it needs to be non-negative and the constraints of null-jointness, monotonicity, symmetry and the translation property need to hold. In the deterministic estimation of distance function using the linear programming approach these constraints are imposed. In stochastic estimation of distance functions the properties of non-negativity, translation and symmetry are imposed, and monotonicity and null jointness are tested for afterwards. It may be recalled that null-jointness implies that an output vector belongs to an output set only if the value of the directional output distance function is non-negative. Therefore, an appropriate test is to evaluate $D(x, y, 0; 1, -1)$ for $y > 0$. If $D(x, y, 0; 1, -1) < 0$, then the observation (y, 0) is not in $P(x)$ as implied by null-jointness. Table 4 presents the percentage of observations that satisfies monotonicity and null-jointness conditions for all the three models. We find that the monotonicity condition with respect to electricity is satisfied in all the three models. With respect to SPM, the monotonicity condition is satisfied by all the observations in the first two models but in the third model it is satisfied only by 40% of the observations. Similarly, we find that the condition of monotonicity is fulfilled by all the observations in *Model 1*, by 96% observations in *Model 2* and only by 44% observations in *Model* 3 with respect to SO_2. With respect to the third bad output, NO_x we find that in none of the models is the monotonicity condition satisfied by all the observations. However, the highest percentage is for the *Model 1* and it declines in other models.[10] The null-jointness condition is satisfied by 55%, 62% and 3% of the observations in *Models 1*, *2*, and *3*, respectively.

TABLE 4
Percentage of Observations Satisfying Monotonicity and Null-jointness Conditions

	Monotonicity Conditions				
	Y_1	Y_2	Y_3	Y_4	*Null-jointness Condition*
Model 1	100	100	100	72.50	54.79
Model 2	100	100	95.83	63.13	62.29
Model 3	100	39.79	43.96	55	2.71

Note: Model 1: SPM is the dependent variable; Model 2: SO_2 is the dependent variable; Model 3: NO_x is the dependent variables. Y_1: Electricity; Y_2: SPM; Y_3: SO_2; Y_4: NO_x.

As noted above, we used three models for the purpose of estimating the directional output distance function. This is aimed to shed some light upon the sensitivity of empirical results to the selection of the model. Moreover, the time-series literature is in favor of using the average of the predictions from a number of models. The average of estimates from various models to

[10] For the observations that violate the monotonicity conditions, the estimates of directional output distance function are scaling some (those that violate monotonicity) of the observed values of (y, b) back to the frontier along the negatively sloped portion of output set.

form predictions may potentially be better than the estimates from any one particular model. For example, in a study discussing various models of combining time-series predictions, Palm and Zellner (1992, p. 699) observe "*In many situations a simple average of forecasts will achieve a substantial reduction in variance and bias through averaging out individual bias*".[11] Therefore, all the results reported in the study are averages of the first two models since *Model 3* fails to satisfy most of theoretical properties of the directional output distance function. Moreover, the correlation matrix of technical inefficiency estimated with different models also reveals that there is a high correlation in technical inefficiency estimated with the first two models. However, the correlation between technical inefficiency estimated by *Model 1* and *Model 3* or between *Model 2* and *Model 3* is lower in comparison to the correlation between *Model 1* and *Model 2* (Table 5).

TABLE 5
Correlation Matrix of Different Model with Regard to Technical Inefficiency

Model	*1*	*2*	*3*
1	1.00	0.91	0.71
2	0.91	1.00	0.60
3	0.71	0.60	1.00

Note: Model 1: SPM is the dependent variable; Model 2: SO_2 is the dependent variable; Model 3: NO_x is the dependent variables.

Tables 6 and 7 present a yearly average and plant-wise average estimates of technical inefficiency based on the first two models and shadow prices of bad outputs. Table 10 presents the estimates of the Morishima elasticity of substitution between the outputs.[12] For a representative electricity generating plant using the sample mean of inputs to produce the sample mean of outputs, the estimated value of the directional output distance function is 0.061, indicating that the production is not technically and environmentally efficient. This implies that these electricity-generating plants could on average, without changing resources or developing technology, increase electricity by 18.20 MW (298.28 × 0.061) and reduce SPM, SO_2 and NO_x by 0.04, 0.053 and 0.008 thousand tonnes, respectively. We find that KTPS is the most inefficient and NTS is the least inefficient plant in Andhra Pradesh Electricity

[11] The averaging approach is adopted by Coelli and Parelman (1999) in measuring the relative performance of European Railways, by Drake and Simper (2003) in measuring the efficiency of the English and Welsh police force, and by Kumar and Gupta (2004) in measuring the resource use efficiency of US electricity generating plants. Here it should be noted that the averaging is done for the different estimation methods such as parametric linear programming, data evelopment analysis and stochastic estimation. This is the first study which is using the averaging approach for different models using a single estimation technique.

[12] We presented the Morishima elasticity estimates for *Model 1* only because the monotonicity conditions are satisfied by most of the observations in this model, but in the other two models the monotonicity conditions with respect to SO_2 and NO_x are not satisfied by the majority of the observations.

TABLE 6
Yearly Average Estimates of Technical Efficiency and Shadow Prices

		Shadow Prices					
	Technical and Environmental	*SPM*		SO_2		NO_x	
Year	*Inefficiency*	*Rupees*	*US$*	*Rupees*	*US$*	*Rupees*	*US$*
1996/1997	0.062	2237.60	49.72	3741.93	83.15	23741.93	208.23
1997/1998	0.075	3553.32	78.96	928.30	20.63	4505.75	100.13
1998/1999	0.055	2805.93	62.35	1071.96	23.82	2464.48	54.77
1999/2000	0.078	5338.02	118.62	2574.37	57.21	13030.16	289.56
2000/2001	0.053	8755.13	194.56	1089.14	24.20	2092.38	46.50
2001/2002	0.037	4771.03	106.02	2729.58	60.66	6735.45	149.68
2002/2003	0.023	5234.24	116.32	699.74	15.55	2852.05	63.38
2003/2004	0.100	5521.23	122.69	2227.54	49.50	12745.67	283.24

Note: Rupees 45 = US$ 1.

TABLE 7
Plant-wise Average Estimates of Technical and Environmental Inefficiency and Shadow Prices

		Shadow Prices					
	Technical and Environmental	*SPM*		SO_2		NO_x	
Year	*Inefficiency*	*Rupees*	*US$*	*Rupees*	*US$*	*Rupees*	*US$*
KTPS	0.115	2080.14	46.23	1864.56	41.43	9210.08	204.67
VTPS	0.060	6327.60	140.61	1122.97	24.95	7929.31	176.21
NTS	0.033	132.03	2.93	711.88	15.82	2830.99	62.91
RTS	0.040	14926.68	331.70	4889.60	108.6	11904.94	264.55
RTP	0.054	418.87	9.31	825.08	18.34	1747.40	38.83

Note: Rupees 45 = US$ 1.

Generation Company. Moreover, we also observe that in the latter years, inefficiency has declined in comparison to the earlier years, however, in the last year (2003/2004) inefficiency has increased to 10%.

Reviewing the shadow prices for SPM, SO_2 and NO_x, we find that to reduce the emissions of a particular pollutant by one tonne, a representative plant has to spend Rs. 4777, 1883 and 6725, respectively.[13] Moreover, the results reveal that the shadow prices or the marginal

[13] The health effects of exposure of people to a given pollutant say SPM, SO_2 or NO_x could be different from those of other pollutants. For example, very high concentrations of SPM in the atmosphere could cause serious respiratory problems while those of NO_x and SO_2 could result in changes in pulmonary functions. There are now number of studies looking at the health impacts of air pollution (Alberini et al. 1997; Hammit and Zhou 2006; Dziegielewska and Mendelsohn 2005; Hubell 2006). Also there are some studies in India estimating the benefits of air pollution abatement (Kumar and Rao 2001; Murty et al. 2003; Gupta 2006).

abatement costs of pollutants also vary considerably by year and plant. One explanation for this could be that the functional form used is only a local approximation, and the plants that differ significantly from the rest may be assigned extreme shadow prices. These wide variations in the shadow price of pollutants also favor the introduction of market-based instruments to meet the environmental standards in a cost effective way.

This wide variation can be explained by the variation in the degree of compliance as measured by the ratio of pollution load and electricity generated and the different vintages of capital used by the firms for the production of desirable output and pollution abatement. The shadow prices of SPM, SO_2 and NO_x, which may be interpreted as the marginal costs of pollution abatement, are found to be increasing with the degree of compliance of firms. Taking the index of non-compliance by the firms as the ratio of emissions of SPM, SO_2 or NO_x to the electricity generated, it is found that the higher the index, the lower the shadow price. That means, the dirtier the plant, the lower is the shadow price. Considering the logarithm of shadow price as a dependent variable and the emissions to electricity generated ratios as an independent variable, the estimated relationship between the shadow prices and the index of non-compliance for SPM, SO_2 and NO_x are given as follows:

$$\begin{aligned}
&\text{Ln(SPMP)} = 6.796 - 0.523\text{Ln(SPM/Electricity)} - 0.260\text{Ln(SPM)}\\
&\qquad\qquad (62.15) \qquad (-5.015) \qquad (-4.391)\\
&R^2 = 0.101;\ F = 26.825;\ N = 480\\
&\text{Ln}(SO_2P) = 5.815 - 0.642\text{Ln}(SO_2/\text{Electricity}) - 0.296\text{Ln}(SO_2)\\
&\qquad\qquad (85.34) \qquad (-6.277) \qquad (-6.425)\\
&R^2 = 0.143;\ F = 39.915;\ N = 480\\
&\text{Ln}(NO_xP) = 6.247 - -21.801\text{Ln}(NO_x/\text{Electricity}) - 0.327\text{Ln}(NO_x)\\
&\qquad\qquad (24.48) \qquad (-4.102) \qquad (-5.32)\\
&R^2 = 0.138;\ F = 27.929;\ N = 351
\end{aligned}$$

where SPMP is shadow price of SPM; SO_2P is shadow price of SO_2; NO_xP: shadow price of NO_x. Figures in parentheses represent *t*-statistics.

Also, the estimates show that the shadow prices of bad outputs fall with the pollution load reductions obtained by the firms in the case of all three pollutants. That means that as found in the earlier studies of the Indian water-polluting industries,[14] these results show that there are also scale economies in air pollution abatement, implying that the higher the pollution load reduction, the lower the marginal abatement cost.

Table 8 presents the estimated shadow prices of various pollutants from the existing literature and those from the present study for comparison. Although the results are not directly comparable as the different studies uses different methods for computation of shadow prices. The results presented by Färe et al. (2005) through the stochastic estimation of directional

[14] Mehta et al. (1995), Murty et al. (1999), Pandey (1998), and Misra (1999), Murty and Kumar (2002, 2004).

TABLE 8
Comparison between Shadow Prices of Present and Previous Studies

Study	*Method and Country*	*Pollutant*	*Shadow Price (US$)*
Turner (1995)	Production frontier/US	SO_2	826
		NO_x	1098
		TSP	52228
Coggins and Swinton (1996)	Output distance function/US	SO_2	292
Swinton (1998)	Output distance function/US	SO_2	7–127
Swinton (2002)	Output distance function/US	SO_2	155–193
Lee et al. (2002)	Directional output distance function/Korea	SO_2	3107
		NO_x	17393
		TSP	51093
Kumar and Rao (2002)	Output distance function/India	SPM	3273.78
Swinton (2004)	Output distance function/US	SO_2	143–269
Färe et al. (2005)	Directional output distance function/US	SO_2	1117–1974 (deterministic) 76–142 (stochastic)
Lee (2005)	Input distance function/US	SO_2	170.24
Vardynan and Noh (2006)	Directional Output Distance Function/US	SO_2	100–195
		SO_2	41.84
Present study	Directional output distance function/India	NO_x	149.43
		SPM	106.16

distance function are quite near to the SO_2 allowance prices in US market. Kumar and Rao (2002) estimated the shadow prices for SPM for Indian thermal power plants for the year 1993 using the deterministic output distance function and the estimates from that study are too high in comparison to the present study. This may be due to differences in models used and computation methods as well as sample data. This finding concurs with Färe et al. (2005) which computed SO_2 shadow prices using deterministic and stochastic methods and found that deterministic methods provide higher shadow prices in comparison to stochastic methods.

Recall that the Morishima elasticity of substitution measures the relative change in the shadow prices of outputs due to relative change in output quantities and its value is expected to be negative. As these are indirect elasticities, the higher is its value (in absolute terms) the more costly it becomes for plants to reduce pollutants. The estimates of Morishima elasticities are presented in Table 10. The yearly average ranges from –5.925 to 2.918 and the overall average is –0.243 indicating inelasticity in substitution between electricity and SPM. Similarly the elasticity between electricity and SO_2 ranges between –0.461 and 0.3 with the overall average of –0.73 and ranges between –0.186 and –0.103 with overall average of –0.135 between electricity and NO_x. The relationship between different bad outputs can be explained with the help of these estimates of Morishima elasticities. The results concerning elasticity of substitution between bad outputs indicate that if the intensity of NO_x relative to SPM is reduced, the relative shadow price ratio between the two bads is reduced. Similarly for NO_x and SO_2. It is also observed that if the intensity of SPM relative to SO2 is reduced, the relative shadow prices between SPM and SO_2 is reduced. We also observe asymmetry in the elasticity estimates.

5. Conclusion

The technology of the air polluting industry, namely the coal fired thermal power generation in India, is modeled in this paper using a methodology that could account for the industry's performance in producing electricity and reducing pollution in measuring the productive efficiency of firms. The methodology used is the directional output distance function which is estimated as a stochastic frontier. An analysis of the effects of environmental regulation on the productive efficiency of industry, shadow prices of bad outputs and elasticity of the substitution of the good and bad outputs with respect to relative shadow prices is attempted. An analysis of correlation between the firm-specific shadow prices or marginal cost of abatement and pollution concentration and pollution loads is undertaken for each bad output to know about the pollution taxes that could be levied on firms for ensuring compliance with the environmental regulation.

The model is estimated by considering that coal-fired thermal power generation produces good output, namely electricity and three bad outputs for example SPM, SO_2 and NO_x. The most important bad output, CO_2 could not be considered in the estimation because of lack of firm specific data on CO_2 emissions. Environmental regulation in India requires the industry to comply with certain standards related to bad outputs. Firm-specific estimates of technical and environmental efficiency show that with the given resources and technology many firms could increase the production of electricity and reduce production of bad outputs from the current levels of production to comply with the regulation. Estimates of elasticity of substitution between the good output and bad outputs show that the changes in output combinations in the industry could significantly affect the marginal costs of abatement (MCA) or shadow prices of bad outputs. The analysis of correlation between the marginal cost of abatement and pollution intensity and electricity generated for each pollutant show that MCA increases with a decrease in pollution concentration and decreases with an increase in firm capacity. This result reveals an increasing marginal cost of air pollution abatement in coal-fired thermal power generation.

The estimates show that there is a significant variation in the technical and environmental inefficiency among the five firms considered (0.033–0.115) with an estimate of 0.06 for the industry on the average. This means that the thermal power generating industry in A.P., India could increase the production of electricity and reduce the pollution loads by 6% from the current levels of production with the available resources and technology. This result provides evidence of the existence of incentives and win–win opportunities for the firms to voluntarily comply with environmental regulation. Also, there is a significant variation in the estimates of the shadow prices of bad outputs among the firms with a range of Rs. 14926–132 for SPM, Rs. 4889–711 for SO_2 and Rs. 11904–1747 for NO_x. This variation in the shadow price of bad output among firms could be attributed to different levels of compliance to environmental regulation. The correlation analysis of shadow price of bad output and the pollution intensity of firms show that the higher the pollution intensity the lower is the shadow price. A pollution or emission tax on firms could provide incentives to firms for complying with environmental regulation.

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Appendix

TABLE 9
Estimates of Technical Efficiency, Shadow Prices and Morishima Elasticity

			Shadow Prices					
		Technical and Environmental	*SPM*		*SO_2*		*NO_x*	
Plant	*Year*	*Efficiency*	*Rupees*	*US$*	*Rupees*	*US$*	*Rupees*	*US$*
KTPS	1996/97	0.067	2503.11	55.62	7609.48	169.10	37963.38	843.63
KTPS	1997/98	0.201	2288.57	50.86	258.65	5.75	15250.5	338.90
KTPS	1998/99	0.155	1017.31	22.61	388.72	8.64	5177.33	115.05
KTPS	1999/00	0.222	829.07	18.42	1818.63	40.41	5310.23	118.01
KTPS	2000/01	0.109	1578.43	35.08	498.38	11.08	1116.76	24.82
KTPS	2001/02	0.024	1721.67	38.26	1836.69	40.82	4812.63	106.95
KTPS	2002/03	0.027	1839.53	40.88	495.72	11.02	124.04	2.76
KTPS	2003/04	0.118	4863.45	108.08	2010.22	44.67	3925.8	87.24
VTPS	1996/97	0.050	5232.97	116.29	514.54	11.43	7280.91	161.80
VTPS	1997/98	0.058	5679.69	126.22	491.39	10.92	3709.4	82.43
VTPS	1998/99	0.024	3942.77	87.62	579.57	12.88	4615.02	102.56
VTPS	1999/00	0.040	5494.16	122.09	2691.16	59.80	7836.43	174.14
VTPS	2000/01	0.022	5546.44	123.25	293.16	6.51	6906.86	153.49
VTPS	2001/02	0.081	7736.37	171.92	2075.61	46.12	12343.94	274.31
VTPS	2002/03	0.028	6931.28	154.03	407.27	9.05	12226.75	271.71
VTPS	2003/04	0.178	10057.11	223.49	1931.07	42.91	8515.16	189.23
NTS	1996/97	0.035	55.32	1.23	116.71	2.59	134.38	2.99
NTS	1997/98	0.044	53.50	1.19	112.72	2.50	2736.44	60.81
NTS	1998/99	0.043	39.13	0.87	100.62	2.24	1909.98	42.44
NTS	1999/00	0.020	197.84	4.40	1879.38	41.76	5242.19	116.49
NTS	2000/01	0.027	67.49	1.50	79.94	1.78	1514.07	33.65
NTS	2001/02	0.027	270.45	6.01	1660.14	36.89	5037.19	111.94

(*Table 9 continued*)

(*Table 9 continued*)

			Shadow Prices					
		Technical and Environmental	*SPM*		SO_2		NO_x	
Plant	*Year*	*Efficiency*	*Rupees*	*US$*	*Rupees*	*US$*	*Rupees*	*US$*
NTS	2002/03	0.019	97.54	2.17	64.9	1.44	1407.94	31.29
NTS	2003/04	0.048	274.98	6.11	1680.66	37.35	4665.76	103.68
RTS	1996/97	0.009	3291.62	73.15	10359.11	230.20	933.29	20.74
RTS	1997/98	0.015	9504.52	211.21	3559.66	79.10	527.51	11.72
RTS	1998/99	0.024	8802.83	195.62	4071.3	90.47	573.25	12.74
RTS	1999/00	0.091	19694.37	437.65	4485.66	99.68	43017.93	955.95
RTS	2000/01	0.082	36122.65	802.73	4270.37	94.90	NA	NA
RTS	2001/02	0.040	13470.61	299.35	6053.84	134.53	7169.65	159.33
RTS	2002/03	0.016	16783.73	372.97	2464.01	54.76	NA	NA
RTS	2003/04	0.042	11743.11	260.96	3852.88	85.62	43017.93	955.95
RTP	1996/97	0.148	104.97	2.33	109.8	2.44	540.19	12.00
RTP	1997/98	0.058	240.33	5.34	219.08	4.87	304.93	6.78
RTP	1998/99	0.030	227.62	5.06	219.57	4.88	46.84	1.04
RTP	1999/00	0.018	474.66	10.55	1997	44.38	3744.02	83.20
RTP	2000/01	0.027	460.62	10.24	303.84	6.75	924.2	20.54
RTP	2001/02	0.012	656.07	14.58	2021.65	44.93	4313.84	95.86
RTP	2002/03	0.027	519.15	11.54	66.81	1.48	501.49	11.14
RTP	2003/04	0.114	667.53	14.83	1662.86	36.95	3603.69	80.08
Overall average		0.061	4777.06	106.16	1882.82	41.84	6724.55	149.43

Note: Rupees 45 = US$ 1.

TABLE 10
Estimates of the Morishima Elasticity of Substitution

	M_{y1y2}	M_{y1y3}	M_{y1y4}	M_{y2y1}	M_{y2y3}	M_{y2y4}	M_{y3y1}	M_{y3y2}	M_{y3y4}	M_{y4y1}	M_{y4y2}	M_{y4y3}
Plants												
KTPS	–7.649	–0.136	–0.333	–1.180	0.103	0.024	0.288	–0.725	–2.506	2.259	0.425	1.588
VTPS	0.741	–0.075	–0.082	–0.698	0.109	–0.087	–0.180	–0.577	–1.891	1.683	0.277	0.367
NTS	5.518	–0.062	–0.153	–1.464	0.205	–1.198	1.624	–2.383	–6.379	–1.725	0.451	1.242
RTS	1.486	–0.057	–0.060	–1.021	–0.054	–0.162	0.978	–1.920	–2.472	2.833	1.435	1.225
RTP	–1.310	–0.035	–0.046	–1.590	–0.252	0.871	0.502	–1.479	–3.210	10.300	2.396	0.469
Years												
1996/1997	1.330	–0.089	–0.116	–1.166	0.066	–1.285	1.615	–1.536	–3.978	2.983	–0.321	–0.016
1997/1998	1.402	–0.086	–0.119	–1.214	–0.011	3.182	0.449	–1.392	–3.044	–0.352	4.333	–0.120
1998/1999	1.048	–0.085	–0.122	–0.774	–0.004	–0.802	0.446	–1.426	–3.619	7.381	0.302	–0.191
1999/2000	0.927	–0.461	–0.103	–1.694	–0.017	–0.975	0.731	–1.410	–3.410	2.774	0.109	1.245
2000/2001	0.521	0.073	–0.120	–1.366	–0.007	–0.205	0.200	–1.399	–3.171	–0.307	0.958	1.099
2001/2002	–5.925	–0.157	–0.161	–1.213	–0.008	–0.302	–0.099	–1.389	–3.064	0.102	0.920	1.934
2002/2003	–4.165	–0.077	–0.150	–1.309	0.086	–0.606	1.637	–1.506	–3.231	–1.180	0.587	1.333
2003/2004	2.918	0.300	–0.186	–0.787	0.073	0.107	0.160	–1.276	–2.815	13.160	1.087	2.541

Note: Y_1: Electricity; Y_2: SPM; Y_3: SO_2; Y_4: NO_x

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Chapter 16

A Microeconometric Analysis of Household Extraction of Forest Biomass Goods in Ranthambhore National Park, India

VIKRAM DAYAL

Introduction

The objective of this paper is to study biomass (grazing, fuelwood and fodder) extraction from the Ranthambhore National Park. The biomass extraction from the park by a household is a product of (1) the total *level* of biomass extracted from all sources and (2) the *share* of biomass extracted from the park. The extraction of biomass is a key issue in the management of protected areas in developing countries. Protected area management often aims to reduce the share of biomass extracted from the park by restrictions on entry, monitoring, and in some cases, resettlement. Programmes such as encouraging the use of alternative fuels aim to reduce the level of extraction of biomass.

In a paper published in 1993, Amacher, Hyde and Joshee stated that there was a dearth of rigorous economic analyses in this area. However, about a decade later, Pattanayak, Sills and Kramer (2004) said that there was a small but growing empirical economic literature on fuelwood. According to Hyde and Kohlin (2000), 'the primary contention arising from this literature is that households follow systematic patterns of economic behaviour in their consumption and production of forest resources, and that policy interventions in social forestry should be analyzed with regard to markets, policies and institutions.'

This literature has most commonly consisted of studies of fuelwood (Pattanayak, Sills and Kramer 2004), although Chopra and Dasgupta (2003), Bluffstone (1995), and Cooke (1998) also study Non-Timber Forest Products (NTFPs) and the collection of fodder. In this paper, decisions regarding fuelwood, fodder, and grazing are studied. All three are important not only in Ranthambhore but in forests in developing countries in general.

The papers by Bluffstone (1995) and Bardhan, Baland, Das, Mookherjee, and Sarkar (2001) are written in contexts where the household extracts only from the forest. More commonly though, the household can extract wood from its own private land, village common land and even, in some cases, a protected area. Pattanayak, Sills and Kramer (2004) and Heltberg, Arndt and Sekhar (2000) distinguish between fuelwood from forests and private farmland. Managers of conservation areas increasingly express the need for a relatively undisturbed core area and buffer area, as a means of fulfilling ecological objectives along with providing surrounding human populations access to non-timber forest products. What influences spatial extraction patterns is a key question in protected area management (Robinson, Williams and Albers 2002). Bluffstone (1995) found that the presence of an off-farm labour market helped stabilize forest stocks in Nepal. Robinson, Williams and Albers (2002) demonstrate that variation in the opportunity costs of labour among villagers results in a spatial heterogeneity in aggregate extraction. A contribution of this paper is the examination of a quantitative measure of spatial extraction: of total biomass extraction by the household, what percentage comes from the park?

Amacher, Hyde and Joshee (1993) point out that there could be a complementarity between agricultural labour and fuelwood, which is incorporated in the conceptual model in this paper. In addition, this paper allows for complementarity between grazing and fuelwood collection—villagers grazing livestock can also pick up fuelwood—and examines this empirically. Also, in this paper, fuelwood purchase is an option for the household, not only the purchase of commercial energy as in Bluffstone's (1995) paper.

The conceptual framework used by papers in this literature are variants of agricultural household models, which include production as well as consumption activities. The papers by Heltberg, Arndt and Sekhar (2000), Amacher, Hyde and Kanel (1996), and Bardhan, Baland, Das, Mookherjee, and Sarkar (2001) have conceptual models with explicit treatment of corner solutions. In this paper we follow Heltberg, Arndt and Sekhar (2000), in deriving relevant Kuhn-Tucker conditions. This has the added advantage of tying up quite naturally with the Tobit regressions used in the empirical part of the paper.

Drawing on several of the studies above, a model of the extraction of biomass from Ranthambhore National Park is developed in this paper. The model consists of two sub-models that break the extraction decisions into two steps: (1) decisions regarding levels of extraction and (2) decisions regarding sources of extraction of biomass. So for example, the first sub-model examines how much fodder the household will collect by allocating labour to fodder and other activities, and the second sub-model examines where the household will collect fodder from, since it can choose to collect it from the park or from other sources.

Analytical Framework

Modelling Decision Regarding Level of Extraction

Amacher, Hyde and Kanel (1996) model household utility as a function of fuelwood, leisure and other goods. Bluffstone (1995) models household utility as a function of cooked food.

Following Bluffstone, in this model the household's utility is considered a function of cooked food. In this model, this is further simplified by taking an approximation and considering household utility as a function of energy and nutrition directly. Because the interrelationships between grazing, agricultural relationships and fuelwood collection are being considered in this model, such a simplification of the utility function helps ease the somewhat intricate analysis without changing the insights derived.

Utility (U) is a function of consumption (C) of energy (E) and nutrition (N).

$$U = U(C_E, C_N) \tag{1}$$

Consumption of energy is a function of produced (q) and/or purchased (b), fuelwood (FW), dung (D), agricultural residue (AR), and liquefied petroleum gas (LPG).

$$C_E = C_E\ (q_E^{FW} + b_E^{FW}, q_D^E, q_{AR}^E, b_E^{LPG}) \tag{2}$$

The different fuels are not perfect substitutes, and this allows for consumption of a mix of fuels.

Fuelwood gathering is by spending labour time (L) in three ways: (1) going out only for fuelwood, (2) gathering fuelwood while grazing (G), and (3) gathering fuelwood while spending labour time on agricultural production (N).

$$q_E^{FW} = q_1^{FW}\ (L_E^{FW}) + q_2^{FW}\ (L_G) + q_3^{FW}(L_N) \tag{3}$$

Our assumption is that the additional labour to gather fuelwood while grazing or working in the fields is negligible. If a villager goes out on a grazing trip lasting several hours, a few more minutes will have to be spent to gather fuelwood, while saving on time spent to and from the site of fuelwood collection.

A certain proportion e^D [0;1] of dung, D, produced by stall-fed animals, A^S, is used for energy.

$$q_D^E = e^D D\ (A^S, C_F^S) \tag{4}$$

C_F^S is the animal feed consumed by stall fed animals.

Similarly, a certain proportion e^R [0; 1]of agricultural residue is used for energy.

$$q_{AR}^E = e^R R\ q_N \tag{5}$$

where R is the proportionality factor of residues to grain. The rest is used as fodder.

Like energy, grain may be bought or produced.

$$C_N = b_N + q_N \tag{6}$$

Grain production is a function of labour (household labour L_N or hired labour L_H), dung used as fertilizer, and other inputs (I).

$$q_N = q_N\,(L_N + L_H,\, q_D^N,\, I) \tag{7}$$

Milk production (m) can be by grazing animals or stall-feeding them, and in either case it is a function of the number of animals grazed (A^G) or stall-fed (A^S), and the cattle feed consumed (q_G or C_F^S).

$$m = m^G\,(A^G,\, q_G) + m^S\,(A^S,\, C_F^S) \tag{8}$$

The consumption of stall-fed cattle-feed has several components: feed, fodder collected, purchased feed and agricultural residue used as feed.

$$C_F^S = q_F + b_F + q_{AR}^F \tag{9}$$

Grazing feed is a function of labour time spent grazing by the villager.

$$q_G = q_G\,(L_G) \tag{10}$$

Similarly, so is fodder collected.

$$q_F = q_F\,(L_F) \tag{11}$$

The village household's budget constraint is

$$p_{FW}\,b_E^{FW} + w\,L_H + p_N\,b_N + p_{LPG}\,b_{LPG}^E + p_F b_F + p_m m_{norm} \leq w\,L_{out} + p_m\,m + p_N\,q_N \tag{12}$$

where w is the wage rate when it works outside the household (L_{out}), p represents price, L is labour that is hired in, and m_{norm} is a norm for milk consumption. The left hand side of equation 12 is the sum of outflows from the household, while the right hand side is the sum of inflows to the household. It was observed among the surveyed households that there was very little difference in their milk consumption, as if they were following a norm in this respect.

The village household's time constraint is

$$L_E^{FW} + L_G + L_N + L_{out} + L_F \leq T \tag{13}$$

where T is the time that it would like to spend on labour activities—fuelwood gathering, grazing, crop production, working outside, and fodder collection.

The village household aims to maximize utility subject to the budget and time constraint. The Lagrangian is

$$K = U(C_E,\, C_N) - \lambda\,(budget) - \mu\,(time) \tag{14}$$

which is maximized by choosing the purchasables (b) and the allocations of time to different activities (L).

The Kuhn-Tucker conditions are derived below.

$$\frac{\partial K}{\partial b_N} = \frac{\partial U}{\partial C_N} - \lambda \quad p_N \le 0 \quad (=0 \quad if \quad b_N > 0) \tag{15}$$

$$\frac{\partial K}{\partial b_E^{FW}} = \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial (q_E^{FW} + b_E^{FW})} - \lambda \quad p_{FW} \le 0 \quad (=0 \quad if \quad b_E^{FW} > 0) \tag{16}$$

$$\frac{\partial K}{\partial b_E^{LPG}} = \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial b_E^{LPG}} - \lambda \quad p_{LPG} \le 0 \quad (=0 \quad if \quad b_E^{LPG} > 0) \tag{17}$$

$$\begin{aligned}\frac{\partial K}{\partial b_F} = {} & \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_D^E}e^D\frac{\partial D}{\partial C_F^S} + \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_E^{AR}}e^R R\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S} \\ & + \frac{\partial U}{\partial C_N}\frac{\partial C_N}{\partial (q_N + b_N)}\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S} \\ & - \lambda \left[p_F - p_m \frac{\partial m^S}{\partial C_F^S} - p_N \frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S} \right] \le 0 \quad (=0 \quad if \quad b_F > 0)\end{aligned} \tag{18}$$

$$\begin{aligned}\frac{\partial K}{\partial L_H} = {} & \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_D^E}e^D\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} + \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_E^{AR}}e^R R\frac{\partial q_N}{\partial (L_N + L_H)} \\ & + \frac{\partial U}{\partial C_N}\frac{\partial C_N}{\partial (q_N + b_N)}\frac{\partial q_N}{\partial (L_N + L_H)} + \frac{\partial U}{\partial C_N}\frac{\partial C_N}{\partial (q_N + b_N)}\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} \\ & - \lambda \left[w - p_m \frac{\partial m_S}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} - p_N \frac{\partial q_N}{\partial (L_N + L_H)} \right. \\ & \left. - p_N \frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} \right] \le 0 \quad (=0 \quad if \quad L_H > 0)\end{aligned} \tag{19}$$

$$\begin{aligned}\frac{\partial K}{\partial L_N} = {} & \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_D^E}e^D\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} + \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_E^{AR}}e^R R\frac{\partial q_N}{\partial (L_N + L_H)} \\ & + \frac{\partial U}{\partial C_N}\frac{\partial C_N}{\partial (q_N + b_N)}\frac{\partial q_N}{\partial (L_N + L_H)} + \frac{\partial U}{\partial C_N}\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} \\ & + \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial (q_E^{FW} + b_E^{FW})}\frac{\partial q_3^{FW}}{\partial L_N} \\ & - \lambda \left[-p_m \frac{\partial m_S}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} - p_N \frac{\partial q_N}{\partial (L_N + L_H)} \right. \\ & \left. - p_N \frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}(1-e^R)R\frac{\partial q_N}{\partial (L_N + L_H)} \right] - \mu \le 0 \quad (=0 \quad if \quad L_N > 0)\end{aligned} \tag{20}$$

$$\frac{\partial K}{\partial L_F} = \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_D^E}e^D\frac{\partial D}{\partial C_F^S}\frac{\partial q_F}{\partial L_F} + \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial q_E^{AR}}e^R R\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}\frac{\partial q_F}{\partial L_F}$$
$$+\frac{\partial U}{\partial C_N}\frac{\partial C_N}{\partial(q_N+b_N)}\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}\frac{\partial q_F}{\partial L_F}$$
$$-\lambda\left[-p_m\frac{\partial m^S}{\partial C_F^S}\frac{\partial q_F}{\partial L_F} - p_N\frac{\partial q_N}{\partial q_D^N}(1-e^D)\frac{\partial D}{\partial C_F^S}\frac{\partial q_F}{\partial L_F}\right] - \mu \le 0 \quad (=0 \quad if \quad L_F > 0) \tag{21}$$

$$\frac{\partial K}{\partial L_E^{FW}} = \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial(q_E^{FW}+b_E^{FW})}\frac{\partial q_1^{FW}}{\partial L_E^{FW}} - \mu \le 0 \quad (=0 \quad if \quad L_E^{FW} > 0) \tag{22}$$

$$\frac{\partial K}{\partial L_G} = \frac{\partial U}{\partial C_E}\frac{\partial C_E}{\partial(q_E^{FW}+b_E^{FW})}\frac{\partial q_2^{FW}}{\partial L_G} - \lambda\left[-p_m\frac{\partial m^G}{\partial q_G}\frac{\partial q_G}{\partial L_G}\right] - \mu \le 0 \quad (=0 \quad if \quad L_G > 0) \tag{23}$$

$$\frac{\partial K}{\partial L_{out}} = \lambda w - \mu \le 0 \quad (=0 \quad if \quad L_{out} > 0) \tag{24}$$

The first three Kuhn-Tucker conditions (15, 16 and 17) related to purchasable grain, fuelwood and *LPG* give us the familiar consumer theory result that the marginal rate of substitution between two goods purchased in positive quantities will be in ratio to their relative prices.

Purchased fuelwood and gathered fuelwood are perfect substitutes, and from the Kuhn-Tucker conditions (16), (22) and (24) we can deduce that fuelwood will be gathered as long as the following condition holds:

$$p_{FW} \ge w/(\partial q_1^{FW}/\partial L_E^{FW}) \tag{25}$$

If the wage rate is low, then the household is going to gather fuelwood. Further, if the household is not fully employed, that is, the time constraint is not binding, the household will gather fuelwood.

Fodder gathering and purchase are also perfect substitutes and a condition similar to (25) holds in this case.

The comparison between the benefits of putting in labour in fodder collection versus grazing is quite fruitful (conditions (21) and (23)). This, in essence, translates into the choice between stall-feeding and grazing. By stall-feeding, not only is there greater milk production, but there is also production of dung which can be used both as energy and as input into grain production. Grazing, on the other hand may offer economies of scale in that a lot of animals can be grazed by a little labour, and there may be a payoff in terms of fuelwood gathered during the grazing trip.

Labour in agriculture has multiple links and therefore, returns. Apart from grain production, agricultural residue can be used as energy and as livestock feed, in which case there is a

feedback into agricultural production, and the Kuhn-Tucker condition (19) reflects this complexity. Condition (20), while similar to (19) reflects the additional payoff to labour used in agriculture—fuelwood.

Modelling Decision Regarding from Where to Extract

The rural landscape is a mosaic of land with different vegetation and different property regimes. Biomass extraction has an intrinsically spatial character.

We now consider the problem of which site the villager chooses to extract biomass from. To simplify matters, we will assume that there are only two villagers: A and B. They extract biomass (we assume only fuelwood), from private (own) land, indexed by O, and the park, indexed by P.

Let the distance of villager A from private land and the park be

$$d_O^A \text{ and } d_P^A$$

Let the target level of fuelwood extraction that A would like to collect be F^A, and assume the amount of fuelwood collected per trip is constant, f. Then the number of trips that A has to make to collect fuelwood are given by

$$T^A = \frac{F^A}{f} \tag{26}$$

During each trip the villager makes, there are three types of costs incurred: costs of going to and from the site, on-site collection costs, and costs of violating property rights.

The costs of going to and from the site are a function of the distance and are given by

$$2\mu^A d_O^A$$

for villager A going to private land, where μ represents the opportunity cost of time.

On-site collection costs (*OC*) are a function of the state of biomass at the site, and are given by

$$OC_P^A\ (x_P(t_P^A + t_P^B))$$

for the villager visiting the park. 'x' represents the biomass state and t represents the number of trips. On park land the state of biomass will be a function of the number of trips that both villagers make to the park. On private land, there will be no such externality—the state of biomass on A's land will only be influenced by A's trips to it.

The last category of costs, is represented by 'fine', and is the expected value of the fine the villager is likely to incur per trip to the park.

The villager aims to choose the number of trips to private land and the park in such a way that costs are minimized while realizing a target level of extraction of biomass.

The constraint facing the villager is

$$t_O^A + t_P^A \geq T^A$$

The Lagrange for the problem for villager A can be written as (maximizing negative of costs):

$$J_A = -[2\mu^A d_O^A + OC_O^A(x_O^A(t_O^A))]t_O^A - [2\mu^A d_P^A + OC_P^A(x_P(t_P^A + t_P^B)) + fine]t_P^A - \pi[T^A - t_O^A - t_P^A] \quad (27)$$

The Kuhn-Tucker conditions are as follows.

$$\frac{\partial J_A}{\partial t_O^A} = -2\mu^A d_O^A - OC_O^A(x_O^A(t_O^A)) - t_O^A \frac{\partial OC_O^A}{\partial x_O^A}\frac{\partial x_O^A}{\partial t_O^A} + \pi \le 0 \quad (= 0 \quad if \quad t_O^A > 0) \quad (28)$$

$$\frac{\partial J_A}{\partial t_P^A} = -2\mu^A d_P^A - OC_P^A(x_P^A(t_P^A + t_P^B)) - fine - t_P^A \frac{\partial OC_P^A}{\partial x_P}\frac{\partial x_P}{\partial (t_P^A + t_P^B)} + \pi \le 0 \quad (= 0 \quad if \quad t_P^A > 0) \quad (29)$$

We see that the household chooses that source of fuelwood (private or public land) which involves lowers costs. The shadow value of going on another trip to collect fuelwood is equal to the distance cost plus the fine plus the on-site cost plus the marginal on-site cost with respect to an additional trip.

Although we have formally only examined the case of private land versus park, the same logic holds for the choice among these two plus other land, i.e. t_{Other}^A. The share of the total fuelwood that is sourced from the park, θ_{FW}, is given by:

$$\theta_{FW} = t_P/(t_O + t_P + t_{Other}) \quad (30)$$

Similar considerations also apply to the share of total fodder and total grazing sourced from the park, θ_F, and θ_G, respectively.

Each of the components of the cost of extracting an additional unit of biomass in the year can be examined. The opportunity cost of labour will not remain the same throughout the year. During the peak season, sources of biomass (private, park or other) that are closer will be more attractive, *ceteris paribus*. In villages like Indala that are in the Park, the differences in distance between types of land (private or park) are very low. The fine on private land is zero, while that on park land will be some positive amount. Resource density is related to the number of trips taken by the household itself in the case of private land and will depend on the total trips taken by all households in the case of park and other land. For households that have low levels of private land, even a few trips can affect resource density sharply, forcing them to go to park or other land. In the case of collection of fodder and grazing, agricultural lands effectively have a resource density that closely follows the agricultural cycle. Following the harvest, fodder is available in the form of agricultural residues, and before sowing, cultivators may want animals to be on their fields so they leave dung behind.

Simultaneous Decisions

Imperfections in rural labour markets imply that household labour supply and demand are non-separable (Sadoulet and de Janvry 1995; Singh, Squire and Strauss 1986; Bardhan and Udry 1999). Markets for domestic fuels such as agricultural residue and dung are absent. As a result, households do not allocate resources recursively to production and then make consumption choices; rather, production and consumption decisions are made simultaneously. Therefore, independent reduced form equations can be specified (Sadoulet and de Janvry 1995; Heltberg, Arndt, and Sekhar 2000; Cooke 1998).

The quantities of extraction of biomass are determined by the allocations of labour that the household chooses. The households will make the decisions of how much and where to extract simultaneously. In other words,

$$\textit{Amount of biomass extracted from the park} = \textit{amount of biomass extracted} \times \textit{fraction of biomass extracted from the park} \quad (31)$$

In the case of fuelwood for instance, the amount of fuelwood extracted from the park = $q_E^{FW} \times \theta_{FW}$

Our analytical models have helped us understand interactions and derive the following reduced form equation that will guide the empirical analysis.

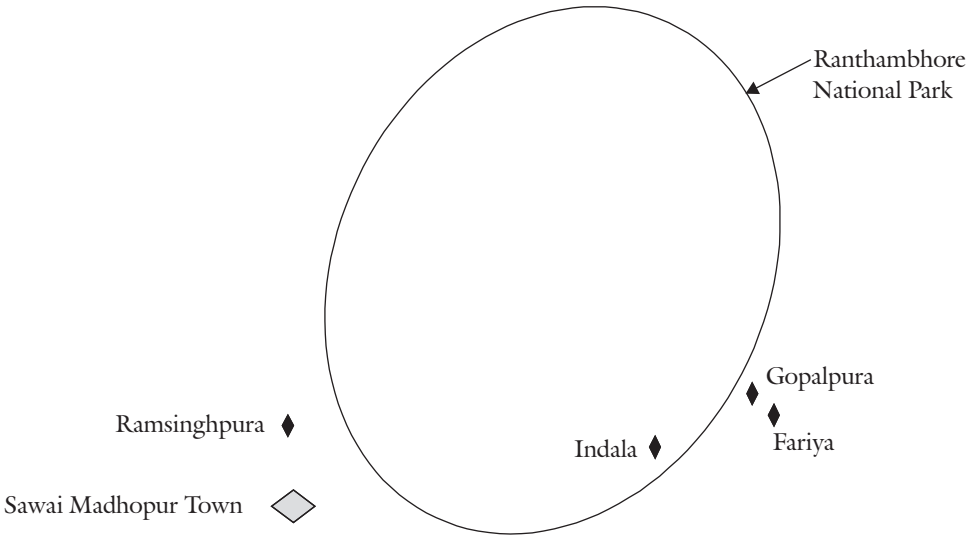
$$\textit{Biomass extracted } (\theta_{FW}, \theta_F, \theta_G, q_E^{FW} \text{ and } q_E^{FW} \times \theta_{FW}) \textit{ is a function of the exogenous variables (wage rate, distance, biomass conditions, enforcement, land owned, livestock owned, wealth, other household characteristics)} \quad (32)$$

Study Area and Survey

The Ranthambhore National Park lies in the south-east of Rajasthan in the district of Sawai Madhopur. The Ranthambhore National Park, consisting of 274.5 square kilometres of land is the 'core' of the Ranthambhore Tiger Reserve that spreads over an area of 1334.6 square kilometres (GoR 1999). The Ranthambhore National Park is rich in vegetation and wildlife, and has an overwhelming share of tiger population of the Ranthambhore Tiger Reserve.

A survey of 227 households was conducted in January 2002. The villages sampled—Fariya, Gopalpura, Indala, and Ramsinghpura—were in, or close to, Ranthambhore National Park. Figure 1 is a schematic showing the location of these four villages with respect to the park. These villages were chosen purposively for reasons of (1) location, (2) policies, and (3) contact with the WWF field office. Within three of the four villages, attempts were made (through repeated visits), to cover all the households. In Ramsinghpura, only about half the village households were surveyed. The presence of the WWF field worker greatly increased acceptability of enumerators and his detailed knowledge helped in minimizing non-sampling errors.

FIGURE 1
Location of the Four Villages Covered in the Survey with Respect to Ranthambhore National Park and Sawai Madhopur Town



These villages are different from each other in a number of ways. Fariya is the largest village and has a relatively diverse set of castes inhabiting it. Gopalpura is a smaller village close to Fariya (across the road in fact) but closer to the Park. Gopalpura was chosen because its residents used to be in the Park and were resettled outside. Gopalpura is quite homogeneous in caste composition. Indala is a small village in the Park, and quite cut off—villagers have to walk down a fairly long slope to contact the rest of the world. It has no source of irrigation. Ramsinghpura is a village close to the town of Sawai Madhopur, and is better off in terms of such indicators as the average agricultural wage rate and the diversity of employment of its inhabitants.

Econometric Analysis

As stated earlier, reduced form equations were used in which the variables of interest, related to biomass extraction, were regressed on exogenous variables (see equation 32). Also, a general to specific modelling approach was used, with a more general regression with more variables being tried in the first instance, and then very statistically insignificant variables were dropped.

In equation 31, we had the following exogenous variables: *wage rate, distance, biomass conditions, enforcement, land owned, livestock owned, wealth, other household characteristics.* We use dummies for village location (as do Pattanayak, Sills and Kramer 2004; and Cooke 1998) for the village Ramsinghpura and the village Indala. The village Indala lies in the park, and

therefore the residents there are surrounded by the park, which means they have access to abundant biomass. The village Ramsinghpura is close to the town of Sawai Madhopur and its residents have access to the employment opportunities in the town, and those that do engage in agricultural labour get a higher agricultural wage than the other villages. In other words, the village location dummies account for differences in distance of households from the park, biomass and labour market conditions. We do not observe enforcement. A measure of wealth is the type of house owned by the village, with pucca or more durable houses being owned by wealthier households. We examine the effects of cattle separately from goats and sheep, because cattle and sheep are quite different in their feeding requirements. The size of the household, i.e. the number of members (adult equivalents) and the fraction of males in the household are household characteristics. The household's caste is another household characteristic, and we use dummies for the Brahmin caste (as does Cooke 1998) and low caste (as do Heltberg, Arndt and Sekhar 2000).

Fraction of Fodder Collection, Fuelwood Gathering, and Grazing from Ranthambhore National Park

The dependent variable we now analyze is the fodder extracted from the Park by a household as a fraction of the total fodder extracted by the household, which we call 'fraction fodder' corresponding to θ_F.

$$\text{'Fraction fodder'} = \frac{\textit{fodder collected from park by household}}{\textit{total fodder collected by household}}$$

We use a double limit Tobit regression because our data is censored at lower and upper levels (zero and 1). With this and the following Tobit regressions, the standard errors are robust, i.e. they adjust for heteroskedasticity, if present.

Table 1 shows the results for the Tobit regression of the dependent variable 'fraction fodder' (θ_F). The variable village Indala was collinear with the constant, and so was dropped. In specification (1), the variables housetype, household size, fraction males, dummy for village Ramsinghpura, biogas and number of goats and sheep were statistically insignificant (joint test p value = 0.999). These were dropped, resulting in specification (2). In specification (2) the coefficient of the caste dummy for Brahmin, the number of cattle, and the quantity of land are statistically significant. The marginal effects of the variables were estimated (discrete changes in case of dummy variables; these are different from the values of the coefficients) keeping all other variables at their mean values. Households belonging to the Brahmin caste on average have a 'fraction fodder' (θ_F) that is lower by –0.23. An increase in a unit of cattle is associated with an increase in 'fraction fodder' (θ_F) equal to 0.009. An increase in a unit of land owned (pucca bigha) is associated with an increase in 'fraction fodder' (θ_F) equal to 0.007.

Table 2 shows the results for the Tobit regression of the dependent variable 'fraction fuelwood' (θ_{FW}). In specification (1), the variables housetype, household size, fraction males, dummy for low caste, dummy for village Ramsinghpura, number of cattle and number of goats and sheep were statistically insignificant (joint test p value = 0.847). These were dropped,

TABLE 1
Tobit Regression of Dependent Variable: Fodder Extracted by Household as Fraction of Total Fodder Extracted by the Household ('Fraction Fodder' θ_F)

	(1)		*(2)*	
	Coef.	*Robust Std. Err.*	*Coef.*	*Robust Std. Err.*
Housetype (1 = kutcha; poor)	0.036	0.214		
Household size (adult equivalents)	0.014	0.042		
Fraction males	–0.025	0.505		
Caste dummy (1 = Brahmin)	–3.829***	0.459	–3.868***	0.448
Caste dummy (1 = low)	–0.272	0.263	–0.248	0.264
Village dummy (1 = Ramsinghpura; close to town)	–0.064	0.230		
Biogas dummy (1 = have biogas)	–0.068	0.241		
Number of cattle (cattle units)	0.030	0.019	0.028**	0.014
Number of goats and sheep (cattle units)	–0.008	0.020		
Quantity of land (pucca bigha)	0.020	0.012	0.022*	0.011
Constant	–0.322	0.345	–0.272**	0.128
Log-pseudo likelihood		–106.744		–106.919
Number of observations		131		131
Left censored observations		74		74
Right censored observations		9		9

Note: *** denotes significant at 1%, ** at 5%, and * at 10% level of significance.

TABLE 2
Tobit Regression of Dependent Variable: Fuelwood Extracted by Household as Fraction of Total Fuelwood Extracted by the Household ('Fraction Fuelwood', θ_{FW})

	(1)		*(2)*	
	Coef.	*Robust Std. Err.*	*Coef.*	*Robust Std. Err.*
Housetype (1 = kutcha; poor)	0.144	0.559		
Household size (adult equivalents)	–0.033	0.108		
Fraction males	–0.806	1.294		
Caste dummy (1 = Brahmin)	10.860***	1.855	11.139***	1.856
Caste dummy (1 = low)	0.381	0.620		
Village dummy (1 = Indala; in park)	11.297***	2.070	11.070***	1.801
Village dummy (1 = Ramsinghpura; close to town)	0.609	0.625	0.455	0.567
Biogas dummy (1 = have biogas)	0.099	0.623	0.020	0.557
Number of cattle (cattle units)	–0.038	0.069		
Number of goats and sheep (cattle units)	–0.038	0.080		
Quantity of land (pucca bigha)	0.122***	0.061	0.103*	0.055
Constant	0.872	0.932	0.508*	0.304
Log-pseudo likelihood		–171.563		–172.722
Number of observations		181		181
Left censored observations		57		57
Right censored observations		94		94

Note: *** denotes significant at 1%, ** at 5%, and * at 10% level of significance.

resulting in specification (2). In specification (2) the coefficient of the caste dummy for Brahmin, dummy for village Indala, and the quantity of land are statistically significant. The marginal effects of the variables were estimated (discrete changes in case of dummy variables; these are different from the values of the coefficients) keeping all other variables at their mean values. Households that are of Brahmin caste on average have a level of 'fraction fuelwood' (θ_{FW}) that is higher by 0.32. The village Indala has an average fraction of fuelwood collection from the park that is higher by 0.40. An increase in a unit of land owned (pucca bigha) is associated with an increase in 'fraction fuelwood' (θ_{FW}) equal to 0.016.

TABLE 3
Tobit Regression of Dependent Variable: Grazing in Park as Fraction of Total Grazing by the Household ('Fraction Grazing', θ_G)

	(1)		*(2)*	
	Coef.	*Robust Std. Err.*	*Coef.*	*Robust Std. Err.*
Houetype (1 = kutcha; poor)	0.106	0.284		
Household size (adult equivalents)	–0.072	–1.270	–0.081	0.053
Fraction males	–0.604	0.628	–0.613	0.612
Caste dummy (1 = Brahmin)	–0.824	0.796	–0.803	0.785
Caste dummy (1 = low)	–0.125	0.397		
Village dummy (1 = Indala; in park)	1.106**	0.469	1.107**	0.464
Village dummy (1 = Ramsinghpura; close to town)	0.200	0.298	0.197	0.274
Biogas dummy (1 = have biogas)	–0.623**	0.241	–0.584**	0.237
Number of cattle (cattle units)	0.055**	0.027	0.053**	0.026
Number of goats and sheep (cattle units)	–0.020	0.027		
Quantity of land (pucca bigha)	0.005	0.024		
Constant	0.775*	0.460	0.888***	0.329
Log-pseudo likelihood		–150.344		–150.756
Number of observations		148		148
Left censored observations		45		45
Right censored observations		51		51

Note: *** denotes significant at 1%, ** at 5%, and * at 10% level of significance.

Table 3 shows the results for the Tobit regression of the dependent variable 'fraction grazing' (θ_G). In specification (1), the variables housetype, dummy for low caste, number of goats and sheep and quantity of land were statistically insignificant (joint test p value = 0.94). These were dropped, resulting in specification (2). In specification (2) the coefficients of the dummy for village Indala, dummy for biogas and number of cattle are statistically significant. The marginal effects of the variables were estimated (discrete changes in case of dummy variables; these are different from the values of the coefficients) keeping all other variables at their mean values. The village Indala has an average fraction of grazing from the park that is higher by 0.37. An increase in a unit of cattle owned is associated with an increase in 'fraction grazing' (θ_G) equal to 0.02. Households owning biogas have a 'fraction grazing' which is lower by 0.22 on average.

Is the spatial distribution of fodder, fuelwood and grazing related? Is the villager who is out grazing in the park likely to also collect fodder or fuelwood on the way back?

Figure 2 seems to confirm this. The lowess (locally weighted regression) curve of 'fraction fuelwood' against 'fraction grazing' shows a positive relationship. (In this figure the data has been 'jittered' to show different coincidental data points). There is a large cluster of observations in the (0,0)—no fuelwood from park, no grazing from park point—and the (1,1)—all the fuelwood from park, all the grazing in park—point. A positive relationship is seen in the lowess curve of 'fraction fodder' against 'fraction grazing' (Figure 3).

Levels of Wood Extraction

We have maintained in developing the analytical framework that the question before us is one of levels of extraction and distribution of that extraction across space. Unfortunately we do not have data for fodder or grazing on the quantity of biomass extracted. But for wood we have been able to estimate the following:

collection of wood from park

= collection of wood by household (q_E^{FW})* *fraction of extraction of wood from forest* (θ_{FW}). We now examine the determinants of the collection of wood and the collection of wood from the forest by the household.

FIGURE 2

Scatter Diagram and Lowess Curve of 'Fraction Fuelwood' (Fraction of Fuelwood Collected that is Extracted from the Park) against 'Fraction Grazing' (Fraction of Total Grazing Done in the Park)

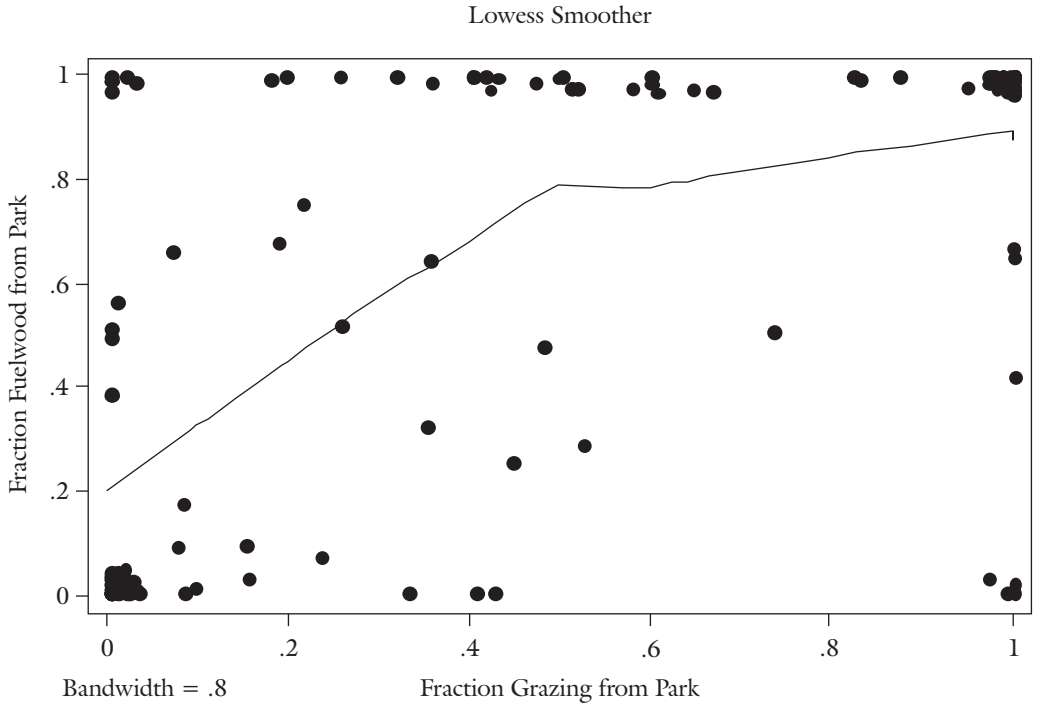


FIGURE 3
Scatter Diagram and Lowess Curve of 'Fraction Fodder' (Fraction of Fodder Collected that is Extracted from the Park) against 'Fraction Grazing' (Fraction of Total Grazing Done in the Park)

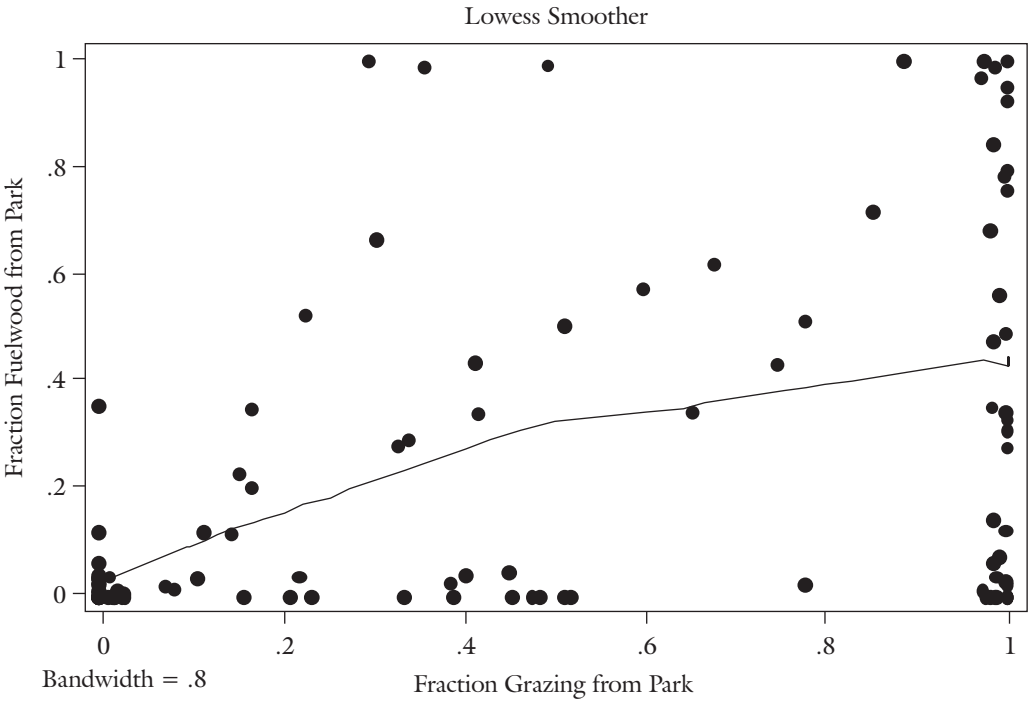


Table 4 shows the results for the Tobit regression of the dependent variable collection of wood (q_E^{FW}). In specification (1), the variables housetype, fraction of males, quantity of land and number of cattle were statistically insignificant (joint test p value = 0.99). These were dropped, resulting in specification (2). In specification (2) the coefficients of the dummy for Brahmin, dummy for village Indala, dummy for village Ramsinghpura, dummy for biogas and number of goats and sheep are statistically significant. The marginal effects of the variables were estimated (discrete changes in case of dummy variables; these are different from the values of the coefficients) keeping all other variables at their mean values. Households that are Brahmin collect 139 kg of wood per month less on average. Households in the village Indala collect 51 kg of wood per month less on average. Households in the village Ramsinghpura collect 56 kg of wood per month less on average. Households with biogas plants collect 58 kg of wood per month less on average. An increase in a unit of goats and sheep owned is associated with an increase in 5.6 kg of collected wood per month on average.

Table 5 shows the results for the Tobit regression of the dependent variable collection of wood from the park ($q_E^{FW} \times \theta_{FW}$). In specification (1), the variables household size, house type, fraction of males, low caste dummy and number of goats and sheep were statistically insignificant (joint test p value = 0.95). These were dropped, resulting in specification (2).

TABLE 4
Tobit Regression of Dependent Variable: Collection of Wood (q_E^{FW})

	(1)		*(2)*	
	Coef.	*Robust Std. Err.*	*Coef.*	*Robust Std. Err.*
Housetype (1 = kutcha; poor)	1.704	17.678		
Household size (adult equivalents)	4.996	4.658	5.325	4.863
Fraction males	–13.803	53.467		
Caste dummy (1 = Brahmin)	–183.441***	49.480	–186.336***	49.732
Caste dummy (1 = low)	17.986	24.222	16.101	23.766
Village dummy (1 = Indala; in park)	–57.800**	21.684	–56.082**	22.555
Village dummy (1 = Ramsinghpura; close to town)	–65.040***	17.957	–60.388***	16.869
Biogas dummy (1 = have biogas)	–66.328**	30.458	–63.952**	28.752
Number of cattle (cattle units)	1.185	3.090		
Number of goats and sheep (cattle units)	5.648**	2.549	5.841**	2.554
Quantity of land (pucca bigha)	–0.828	1.620		
Constant	155.484***	33.222	149.550***	22.297
Log-pseudo likelihood		–1080.34		–1080.59
Number of observations		192		192
Left censored observations		12		12

Note: *** denotes significant at 1%, ** at 5%, and * at 10% level of significance.

TABLE 5
Tobit Regression of Dependent Variable: Collection of Wood from the Park ($q_E^{FW} \times \theta_{FW}$)

	(1)		*(2)*	
	Coef.	*Robust Std. Err.*	*Coef.*	*Robust Std. Err.*
Housetype (1=kutcha; poor)	3.050	6.275		
Household size (adult equivalents)	19.182	28.379		
Fraction males	–34.618	75.512		
Caste dummy (1=Brahmin)	–178.523**	86.748	–175.587**	87.968
Caste dummy (1=low)	–3.458	34.858		
Village dummy (1=Indala; in park)	46.052*	26.386	43.500**	22.228
Village dummy (1=Ramsinghpura; close to town)	–48.924*	29.357	–48.744*	28.026
Biogas dummy (1=have biogas)	–37.524	37.800	–31.745	36.229
Number of cattle (cattle units)	–4.144	3.808	-4.025	3.371
Number of goats and sheep (cattle units)	–2.863	3.908		
Quantity of land (pucca bigha)	5.209*	2.070	5.117***	1.957
Constant	44.969	48.354	57.006***	17.814
Log-pseudo likelihood		–761.005		–761.627
Number of observations		183		183
Left censored observations		71		71

Note: *** denotes significant at 1%, ** at 5%, and * at 10% level of significance.

In specification (2) the coefficients of the dummy for Brahmin, the dummy for village Indala, dummy for village Ramsinghpura and land owned were statistically significant. The marginal effects of the variables were estimated (discrete changes in case of dummy variables; these are different from the values of the coefficients) keeping all other variables at their mean values. Households that are Brahmin collect 70 kg of wood per month less on average from the park. Households in the village Indala collect 30 kg of wood per month more on average from the park. Households in the village Indala collect 28 kg of wood per month less on average from the park. An increase in a unit of land owned is associated with an increase in 3.25 kg of collected wood per month on average.

Conclusions

A distinct feature of this paper is the careful examination of shares and levels of biomass extraction. This careful delineation is reflected both in the conceptual model and in terms of an empirical measure of the spatial aspects of extraction. Determinants of these measures, along with the quantity of wood collected totally and from the park, were examined through tobit regressions. There is a strong positive relationship between fraction of grazing in park and fraction of wood/fodder from the park. This indicates that the park management would have to tackle both animal and wood use of the park biomass.

Households in the village Indala that is in the park have a higher spatial dependence on the park—more of their fuelwood and grazing is sourced from the park. However, they collect lower levels of wood. In terms of collection of wood from the park, the households in Indala collect more wood from the park.

The village Ramsinghpura that is close to the town of Sawai Madhopur and has greater employment opportunities, has households that collect less wood and collect less wood from the park.

Forest degradation in developing countries is often attributed to population growth, poverty, and open access. Bluffstone (1998) argues that correcting these factors is difficult, and policy makers should use such instruments as improved cookstoves and substitute fuels to reduce fuelwood demand. One way of meeting villager needs while reducing pressures on park biomass is through installing biogas plants. It is negatively related to the fraction of grazing from the park. It is also negatively related to the collection of wood. Given its other well known benefits, most significantly providing clean and convenient fuel, there is a case for promoting it.

The role of caste continues to have importance in India's rural landscape. The dummy variable for households of the Brahmin caste was statistically significant in most regressions. Households of this caste extracted a lower fraction of fodder from the park, extracted a higher fraction of fuelwood from the park, collected less wood, and collected less wood from the park.

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Chapter 17

The Dream Machine: The Model Development Project and the Remaking of the State

Amita Baviskar

The greening of Jhabua, Madhya Pradesh, is the unlikely yet celebrated story of a model development project. Its success is attributed to the keywords currently in vogue in development circles: decentralization and integrated natural resource management. Embedded within this tale is another story, that of the state reinventing itself as a social movement. This paper follows these intriguing shifts to see how the development project scripts its own success through the critical acts of defining disciplined subjects, and excluding unruly people and awkward places. It examines how state actors attempt to manufacture consent through the public performance of spectacles and the purging of politics from the development project. The paper attempts to refine the debate on development by focusing on the heterogeneity of state actors and practices, especially those acts of subversion that compromise the coherence of a project of rule. The paper tries to delineate how state hegemony emerges as a contingent, unauthored process, that involves the reproduction and reinvention of government and non-government institutions.

> 'Today, Jhabua is truly a temple of modern India, to use Nehru's phrase, and I would add, a temple of 21st century India, which shows how poverty can be eradicated from its roots by empowering the local people to manage their environment. Jhabua today is a temple dedicated to the Goddess Earth whose architect is Digvijay Singh, Chief Minister, and which has thousands and thousands of tribal priests'.[1]

Such gushing praise is usually found in government promotional literature, purple prose accompanied by pictures of post-monsoon greenery and smiling tribal women. What makes

[1] Agarwal (*The Hindu*, Oct. 11, 1998). Also see cover story 'When Leaders Deliver: Power from the People' in *Down to Earth*, Dec. 31, 1998, and Agarwal et al. (1999: 33–56).

this encomium unusual is that it is written by Anil Agarwal, one of India's most respected environmentalists, the director of the Centre for Science and Environment (CSE), in a lead story in the Sunday edition of a national daily. Even more curious is the fact that Agarwal is writing about Jhabua district in central India, notorious in development circles as a disaster, a drought-prone moonscape from which people migrate in hordes in search of a livelihood. According to Agarwal, the ecological and social transformation of Jhabua has been effected by the Madhya Pradesh (MP) government's Rajiv Gandhi Mission for Watershed Management, a state initiative that has also become 'a massive people's movement'.

As a researcher familiar with Jhabua,[2] my curiosity struggled against skepticism. Agarwal is a widely respected activist; his opinion had to be taken seriously. Yet, my experience of the state in Jhabua was radically different. Jhabua has a history of a sharply fractured polity, where a bureaucracy dominated by caste-Hindus and a trading class dominated by caste-Hindus and Muslims have exploited a population of Bhil and Bhilala adivasis (Scheduled Tribes).[3] In this semi-arid, undulating terrain, adivasis customarily supplement the farm lands to which they have legal title with *nevad* (literally, new field) clearings in the forest. Since nevad is carved out of land held by the Forest Department, the state treats it as an encroachment. The illegality of nevad enables field-level forest officials to bully and extort money from farmers, enmeshing adivasis in an insecure, impoverished existence. Besides nevad, conflicts over dam-induced displacement and the failure of social welfare programmes in the district have also been central in shaping adivasi consciousness of the state. While some adivasis in southern Jhabua collectively mobilized in the form of a militant peasants and workers' union (Khedut Mazdoor Chetna Sangath) with the help of some middle-class activists, most adivasis have negotiated the adverse circumstances confronting them with their own limited resources. Unable to invest in making agriculture more productive, denied access to forest-based resources and deprived of state developmental inputs, these adivasis increasingly migrate in search of work to the booming industrial economy of Gujarat. From October, once the monsoon crop is harvested, entire villages empty out. The bus stop and the railway station are crowded with people on their way to Gujarat. Entire families—children, men and women, some nursing babies, huddle together with their small bundles of belongings—clothes, a tin of flour, a pan and a griddle, on their way to urban construction sites and irrigated fields. With the outward flow of people seems to ebb the life of Jhabua's barren land, the demise of the land-based economy in many ways a consequence of powerful state practices that regulate access to nature.

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[2] See Baviskar (1994, 1995, 1997).

[3] According to the 1991 census, 86 per cent of Jhabua's population belongs to the Scheduled Tribes. Statistics in the MP Human Development Report 1998 enumerate Jhabua's 'backwardness' thus: 75 per cent of Jhabua's population lives below the poverty line. The literacy rate for rural Jhabua is 14 per cent, with rural female literacy at 7 per cent. The infant mortality rate in rural Jhabua is 130 per thousand live births. The average life expectancy is 51 years. Only about 9 per cent of the district's agricultural land is irrigated (GoMP 1998a).

Then how had this state, which most adivasis view with hostility and suspicion, wrought this miracle: 'a massive people's movement'? In the short space of five years, without transferring resources on a grand scale, how had the state successfully transformed a dryland district into a fertile place, and taken an impoverished people to prosperity?[4] The key to this puzzle seemed to lie in the very design of the watershed mission itself, in its combination of two compelling concepts: integrated natural resource planning and decentralized management. Integrated natural resource planning adopts the watershed as a hydrological system as its unit of operation (OIKOS & IIRR 2000). Action is oriented towards regulating the movement of water through the ecosystem as rainfall, sub-soil and surface water, and as water stored in biomass. A watershed plan seeks to check the downhill flow of rainwater and increase its percolation into the soil. This prevents soil erosion and, in areas where rainfall is concentrated in a short season, makes water available for longer periods. Trenches are dug around the contours of hills, agricultural fields are bunded and gullies plugged with walls of stone. Since the roots of grasses and trees bind the soil and prevent rain from washing it away, afforestation and protection of hilly catchments are essential elements of the watershed approach. Check dams of various kinds, from low-cost stone structures to more elaborate stone and wire-mesh gabions to large concrete walls, are constructed across streams to prevent run-off and recharge ground water. Successful watershed work yields moist and stable soils, tree and grass-covered hills, perennial streams and wells brimming with water.

The transformation of the physical landscape is but one half of the watershed approach. Equal emphasis is laid on decentralized management (Kolavalli & Kerr 2002). Wherever NGOs had achieved notable progress in watershed development, they attributed their success to community participation (OIKOS & IIRR 2000). Attention to the felt needs of communities led NGOs to evolve an approach called 'watershed plus' that went beyond the technical treatment of watersheds to address the entire gamut of livelihood concerns of villagers. Strategies for promoting livelihood security include the formation of women's micro-credit groups, grain banks, cultivation of valuable tree and fodder crops—in short, integrated rural development. However, what makes Jhabua's watershed mission remarkable is that it goes far beyond NGO efforts to incorporate villagers' needs into programmes. The state government claims to have actually decentralized control into the hands of villagers. At the grassroots, an elected Watershed Development Committee (WDC), representing one to five villages, is free to decide and implement various activities. This committee receives funds

[4] According to the state government, the Watershed Mission had reached 150,470 ha, or 22 per cent of the district's land area by January 1999, affecting 374 villages in 249 watersheds. As reported by Agarwal, in 18 'best case' micro-watersheds, the irrigated area doubled during the project period, increasing agricultural productivity. Irrigation and increased soil moisture enable farmers to grow a winter crop and plant more remunerative crops like cotton and soya bean. In seven micro-watersheds, food availability increased from a minimum of one month to about four months. The dependence on migrant labour is also reported to have declined sharply.

directly from the Project Implementing Agency (PIA).[5] The tasks of planning and execution, and the finances that underwrite these, are vested with village-level bodies. The Committee is thus empowered, at least on paper, to determine how village common resources should be managed in the collective interests of villagers and to devise and implement context-specific plans. The micro-watershed level Committees form the base of a pyramidal three-tier structure that links village to district to state capital.

The combination of integrated natural resource planning and decentralized management in the watershed mission in MP appears to exemplify institutional learning on the part of the state. Watershed development is a distinct improvement over older government programmes for drought-prone areas (Rao 2000). Earlier relief schemes such as the Food for Work programme that set villagers to repair roads year after year, or the Integrated Rural Development Programme that gave individuals 'income-generating assets' (a milch cow, a sewing machine) without essential inputs or infrastructure, were criticized for failing to address the critical linkages between environment, assets, and institutions. This failure was attributed in part to the centralized manner in which these schemes were devised and imposed. The design of the watershed mission seems to respond to the inadequacies of earlier programmes by addressing the semi-arid economy in its entirety. Its adoption of the watershed, an ecological system, as the unit for analysis and action seems to exemplify the notion of sustainable development. In addition, the mission's decentralized management structure shows sensitivity to issues of local representation and control, and a willingness on the part of the state to divest power. According to Hanumantha Rao, 'the single most important factor accounting for the positive impact of watershed development under the government sponsored programme … is community participation and decentralization of programme administration made possible under the new guidelines. This has come about on account of political and bureaucratic commitment to the new strategy' (Rao 2000: 3945). The watershed mission seems to show a state that is responsive to the diverse critiques of NGOs, social activists and transnational funding agencies,

[5] Whereas NGOs have generally been the Project Implementing Agencies (PIAs) in watershed projects, in MP the state government has appointed government organizations and line departments (e.g. the Forest Department, the Narmada Valley Development Authority) to oversee the bulk of watershed work. While NGO PIAs are seen as more effective on a small scale, it is argued that only government PIAs have the institutional capacity to replicate the watershed mission across the entire state.

A WDC consists of elected members of whom at least three must be women and another three panchayat (village government) members, an appointed secretary (a local unemployed youth who is paid Rs 1,000 per month to maintain records and oversee the work), and a Project-in-charge from the PIA. One of the villagers is elected President of the WDC. The WDC is facilitated by a Community Organiser (CO), usually a social science graduate or a retired block development official, who is paid Rs 3,000 a month. The Project-in-charge is assisted by a PIA team that includes the CO, a member each from the Agriculture, Animal Husbandry, Health, Public Works, Public Health Engineering, and Forest Departments. The watershed mission uses central government funds provided under the Employment Assurance Scheme and the Drought-Prone Areas Programme.

a state that adopts ideas from the activist portfolio, and that draws inspiration from renowned NGO models such as Ralegan Siddhi.[6]

The activists that I met in Jhabua, from the Khedut Mazdoor Chetna Sangath (KMCS) and Lok Chetna Sangath, seemed to be baffled at this turn of events. By appropriating their vision of sustainable development and decentralized government, the product of years of struggle against the state, the watershed mission seemed to have taken the wind out of their sails. Their usually trenchant critique of state practice blunted, activists were uncertain about how to respond. They too had seen the glowing reports of the mission in the press. The villages that they worked in had not been selected for the mission, probably deliberately. Their long experience in dealing with the state convinced some of the activists that the watershed mission was a giant hoax, another scheme to defraud and delude poor adivasis in the name of development. Khemla, a KMCS activist, dismissed the 'Gandhi mission' angrily, '*laand mektala. Thagi-thagin, poyha khain, butbutya var bohin phirtala ne mota bangla bandhtala*' [It's all nonsense. By cheating, eating money, they zip around on motorcycles and build themselves big houses]. As Shankar Tadavla urged me, '*Amitabehen, dikha do ki ye fraud hai. Sarkar jhooth bolti hai aur akhbaarvaale chhaap dete hain*' [sister Amita, show that it is a fraud. The government lies and the press publishes it]. Shankar wanted an expose, an investigative study that would reveal the corruption around the watershed mission.

I shared Khemla and Shankar's cynicism about the state and also their curiosity about the 'truth' of the watershed programme in terms of what the state was up to. In the course of my study, I did find much corruption, no more or less than other government programmes, perhaps only distributed differently. But more than the fiscal corruption, the sordid tales of defalcation and embezzlement that stain most government transactions, my attention was drawn to the compromises and collaborations that the watershed mission created between the state and villagers, and between the state and metropolitan actors including environmental organizations like the Centre for Science and Environment. I was compelled to analyze the 'success' of the watershed mission, not only in terms of whether it increased water availability or improved rural livelihoods, but in terms of what Tania Li calls 'the accomplishment of rule' (Li 1999: 295), the process by which state legitimacy is created and contested. The watershed programme 'worked' in the sense that it achieved powerful effects, but these were not necessarily the articulated goals of the programme (cf. Ferguson 1990). The processes and structures created by the watershed programme forged new partnerships between state agents and villagers but these relations had a complexity that generally went unacknowledged. Following the course of the watershed mission in Jhabua, seeing the divergence between precept and practice, between the multiple perspectives of diverse state agents, NGOs and villagers, also made me reflect on the great seductive power of the watershed mission, how it seemed to be a 'dream machine' for development.

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[6] The village of Ralegan Siddhi in Ahmednagar district, Maharashtra, under the leadership of Annasaheb Hazare, became a celebrated model of watershed-based sustainable development (Pangare & Pangare 1992) which has been widely publicized by the CSE.

Understanding the Project of Development: Challenges and Compromises

In trying to understand the politics of the watershed mission, I have drawn upon recent theoretical and ethnographic literature that challenges the view of development embodied in the influential work of Escobar (1995) and Ferguson (1990).[7] Escobar describes development as a discourse that 'allows the systematic creation of objects, concepts, and strategies; it determines what can be thought and said' (1995: 40). Thus development constructs influential taxonomies, ordering the world hierarchically so that the 'Third World' is constituted as an object to which 'expert' knowledge emanating from the 'First World' can be applied. The argument about power/knowledge is further explicated in Foucault's discussion of 'governmentality' (Foucault 1982), the field of power most removed from the direct application of force. Using the principle of governmentality, development appears as a discourse that seeks to order identities and practices in the broadest sense, not only creating the 'Third World' as a target or object of development, but shaping relations between all 'men and things', creating *subjects*, including those who inhabit positions of power (Pigg 1992).

The intertwining of knowledge and power, suggested by the concept of governmentality, is also exemplified in Mitchell's (1991) analysis of the disciplinary power at work in creating the *structural effect* of the state as standing apart from the social world. Such an effect legitimizes characteristic state practices like policing national borders, framing laws and planning development strategies. Development is represented as a way of 'improving' society, such that specific areas, often taken to be outside politics, such as sanitation, agriculture or education, are made into targets for state intervention across the discursive divide between state/society. According to Mitchell, such disciplining seeks 'to work through the very language and process of improvement' (Mitchell 1988: 43). Improvement is projected as benign and apolitical, in the sense of being a transcendental goal shared by all, even as it is permeated with powerful asymmetries, creating developers and the objects of development, good subjects and practices and deviant ones.

Unlike Escobar, Ferguson provides an ethnographic account of how the effect of a state/society divide is overlaid with the divide between politics/development. Ferguson describes development as an 'anti-politics machine' that frames political questions of land, resources, jobs and wages as technical problems amenable to technical intervention, in the process 'performing almost unnoticed, its own pre-eminently political operation of expanding bureaucratic state power' (Ferguson 1990: xv). Both Escobar and Ferguson describe the discourse of development as a fusion of symbolic and material processes that produces meaningful and practical effects. However, their analysis is laden with a discursive determinism that leaves little room for 'the

[7] See Gupta (1995, 1998); Li (1999); Moore (1999); Mosse (1994, 1997).

heterogeneity of cultural practices that constitute development as well as the historical agency of social actors who shape and contest development's effects' (Moore 1999: 657).

Moore argues against a view of development as a monolithic machine engineered by governments and donors, which secures fixed outcomes. Instead, he describes development as a site of contestation, where history is shaped by heterogeneous groups struggling for their livelihood, sometimes invoking the same vocabulary of progress and justice to make claims upon the government, and at times challenging the state through acts of resistance (Moore 1999; also see Scott 1985; Baviskar 1995). As Li points out, rather than de-politicizing the countryside as Ferguson argues, 'development programmes may become a politically charged arena in which relations of rule are reworked and reassessed' (Li 1999: 297).

The relations of rule involved in development have generally been framed in terms of domination and resistance, and have not done justice to the complex and different practices forged in this 'crucible of cultural politics' (Moore 1999). Development may involve not only resistance on the part of its 'targets', but also compromise and collaboration (Li 1999). Studying these practices requires that we refine our analysis to not only incorporate the heterogeneity of what villagers do, but the heterogeneity of what the state does (Gupta 1995). At the same time, the global moorings of the development discourse demand that we widen our analytical gaze to not only encompass the grounded practices of a localized project, but also their relations to metropolitan NGOs, donors and scholars.

Following these insights, I examine the watershed mission as a product of, and embedded in, a landscape saturated with power. My analysis focuses on the multiple meanings and agendas that different actors bring to bear on the watershed mission, and how their competing constructions yield complex political effects through compromise and collaboration. In seeing the watershed mission as an assemblage of practices that are part of a project of rule, I am also concerned with the issues it evades and the concerns that it excludes. I trace the career of the watershed mission over several sites: travelling across Jhabua's undulating terrain; through spoken word and archival record; and by observing bureaucratic and NGO practices.

Through Landscapes of Power

One of the first images of Jhabua that one encounters on entering the office of the District Rural Development Agency in charge of the watershed mission, is a gigantic picture of the district as seen from outer space. The enlarged satellite photo, a glossy mosaic of reds, yellows and browns, captures the district's landscape, its sere hills and moister valleys, variations in slope and soils, vegetative cover and water courses. Such a mapping of the landscape is the first step in classifying Jhabua into watersheds and then further dividing them into micro-watersheds. The satellite image depicts the landscape as a differentiated physical and ecological system, and a watershed approach would prescribe appropriate management practices for each of the elements in this system. Thus, hills would be evaluated in terms of their ecological

role in regulating water flow and would need to be contour-trenched and planted with trees and grasses. The flow of water in the streams and gullies that transect the hills would need to be checked by building dams. Logically, watershed work must proceed from the topmost ridge down to the valley. The most ecologically degraded watersheds would have priority within the programme. The entire watershed would need to be treated as the unit for planning and implementation.

This view of the landscape as an ecological system that the watershed mission is supposed to adopt is invariably refracted through the optic of politics. There are considerations of bureaucratic convenience at work in rendering legible and manageable unruly ecological complexities (Scott 1998). State imperatives of control translate the ecological specificities of watersheds into standardized formulae for administrative ease. The first step is to assume a convergence between the boundaries of a micro-watershed and a revenue village. This step is crucial since village-level Committees are easier to operationalize for watershed mission work. In the process, however the integrity of the watershed as the appropriate unit of operation is destroyed. The assumed convergence of ecological and administrative categories, the micro-watershed and the village, may make the programme easier to administer, but it also creates contradictions. A village has little incentive to protect 'its' watershed (the part of a watershed within its administrative boundaries) if the benefits flow to a downstream village. Villages in the valley are sitting pretty, without needing to mobilize for watershed work, the beneficiaries of upstream villages' conservation efforts. Another standardized formula is the financial allocation at the rate of Rs. 4,000 per hectare (later reduced to Rs. 3,600) uniformly across the state, regardless of variations in the work required.

The choice of villages to be adopted for the watershed mission is also guided, not by ecological parameters, but by administrative expedience. Sites are chosen on the basis of accessibility—their proximity to the road—to enable official visits. Needless to say, the visibility of watershed work falls sharply as one travels into more 'remote' areas. Travelling by road, I often saw contour trenches, whitewashed to be conspicuous, and newly-painted sign-boards announcing watershed projects. In the villages not accessible by jeep, yet covered by the watershed mission, there is little sign of activity. An equally important parameter for selecting the villages where watershed work would be initiated is the political orientation of the villagers themselves. Rather than choosing areas where ecological degradation was the most intense, where lands needed the most soil and water conservation, the programme is extended to villages where villagers are likely to be willing partners with the state. This may in fact mean *avoiding* the people and places for whom the programme is designed, but whose actual involvement may in some way endanger the chances of securing programme 'success.' Thus the watershed mission carefully selects villages to ensure that 'trouble-makers' are left out. This means that villages mobilized by groups such as the Khedut Mazdoor Chetna Sangath that have a history of being critical of the state, protesting against state action rather than collaborating with it, are excluded. Over the last fifteen years, the Sangath has organized villagers to stake rights to cultivate forest lands, agitate against corruption in government programmes, and resist displacement by the Sardar Sarovar dam. Their history of militancy marks these villagers as

persons non grata in the eyes of the state. To outsiders, government officials explain that these villagers are wayward, unresponsive to the enlightened teachings of the welfare state. As one official tartly remarked, '*Aji, voh to hamara sunte hi nahin. Unse achchhi baat karne ka kya faida? Voh to kabhi sudharenge nahin*' [Oh, they just don't listen to us. What's the use of talking well/about good things to them? They will never improve.] Ironically, the villages with the greatest levels of political awareness and organization have the smallest chance of being selected for the watershed project. These villages are probably the most favourably endowed in terms of public participation, transparency and accountability to create viable democratic institutions for decentralized watershed development. But their very political strength is a liability from the point of view of the state. The imperatives of rule supersede the technical guidelines of watershed management, choosing manufactured consent over more open-ended democratic processes.

Even in the villages that are selected, the process of matching management practices to ecological characteristics is compromised yet again by the grounded history of conflicts over access to land. Watershed treatment demands a 'ridge to valley' approach, with soil and water conservation working its way downhill. In practice, wherever hill lands are contested terrain, the hills are left untouched. In villages like Bichholi and Puvasa, the poorer farmers cultivate hill slopes; only some of this land is legally owned, most of it consists of 'encroachments'. These villagers perceive state initiatives to undertake conservation measures on this land as an insidious attempt to reclaim/re-claim land, which would ultimately result in their being evicted. According to watershed ecological principles, the hills should not be farmed at all but planted with trees and grasses. However, any state attempts to change land use would be an uphill task, inviting instant opposition by farmers who stand to lose their access to food. Hill farmers also oppose the bunding of fields since it reduces the amount of cultivable land available and makes ploughing difficult. The poorest farmers who farm the most friable soils are thus unwilling to participate in the watershed programme. Rather than risk getting tangled in the thickets of disputed tenure, officials in charge of the watershed mission prefer the easier option of working in the valleys.

Government officials' tendency to violate the watershed principle by focusing on the valleys stems also from another imperative of state development projects, viz. that they *show* results—create visible, preferably dramatic, transformations. The success of the watershed mission is demonstrated through pictures such as the one in CSE's *Down to Earth* magazine that shows a proud adivasi holding aloft two large papayas, the produce from his newly improved land. According to the report, Richhiya of Bichholi village went almost overnight from growing *bajra* (pearl millet) to prize papayas that fetched him a handsome profit of Rs. 15,800 per crop. This narrative attributes success to the watershed mission's 'integrated approach' that supplied Richhiya with free papaya plants, fertilizers and pesticides from project funds. But this 'success' was not the result of soil and water conservation. Richhiya was already well-endowed with valley land irrigated by a well. Besides, as the Community Organizer, keen to claim this achievement as his own, told me, 'I took a personal interest in Richhiya's case.' With the security of the CO's support and assured inputs, Richhiya was able to grow papayas,

a capital-intensive crop with a long gestation period that is beyond the capacities of even well-to-do adivasi farmers.[8] Richhiya and his papayas are a powerful image associated with the watershed programme, but this photo cannot be copied across Jhabua's landscape. Richhiya is an exception, not the norm. Importantly, his prosperity stems not from the 'sustainable development' of his village but from pumping in critical resources to one individual. The need to show dramatic results: to project bosses, donors, metropolitan visitors and the media, means that officials tend to concentrate resources on those farmers whose lands lie in the valleys and who are already better-off in terms of their access to water. Their relatively privileged position within the village also ensures that resources gravitate towards these farmers. This partnership between relatively well-endowed farmers and state officials not only violates the principles of watershed management but also the programme's claims to social justice since it exacerbates the disparities between hill and valley cultivators. In addition, it makes the mission a self-fulfilling prophecy since many of the people it claims to transform already have the attributes expected as the outcomes of the transformation process (also see Li 1999: 309).

By fitting the ecological unit to the administrative, by judiciously selecting beneficiaries and villages most likely to collaborate with the state, and by concentrating on relatively fertile and moist lowland soils at the expense of hill slopes, the watershed programme strays far from the integrated ecological approach it is supposed to follow. Rather than confronting the contentious issues of land tenure, or dealing with recalcitrant 'trouble-makers' in the Sangath villages, government officials prefer to take shortcuts to 'success'. Yet the fact that Jhabua's undulating terrain is a landscape where power relations are writ large is not officially mapped or acknowledged, even though it is negotiated through the everyday practices of the mission. An ecologically rational view of the landscape, as a place void of power relations, prevails in project documents. Jhabua is presented as an ecological regime of inter-related land, water and biomass resources to be managed for 'sustainable' use. Ecological sustainability is linked to increased economic productivity and prosperity to create a vision of self-sufficient peasants on the bountiful land. The notion of the watershed as a 'natural' unit is sustained and promoted by environmentalist NGOs such as the CSE who fuse it with an equally organic vision of the village as a 'community' undifferentiated by hierarchies of power (Agarwal & Narain 1989).[9] The construction of this emancipatory environmentalist narrative and its passage back and forth between the pages of CSE publications and watershed project documents produced by the MP government is a significant issue, the implications of which I shall discuss later in this paper.

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[8] Growing papayas has a strong symbolic value because their cultivation is associated with economic power. In western MP, papayas are grown only by rich Patidar (dominant-caste) landowners in the adjoining plains of Nimar.

[9] It is important to note that metropolitan environmentalist NGOs like CSE, which do not directly execute watershed projects, have a different perspective from grassroots NGOs that have to negotiate with the nitty-gritty of politics around land, leading to a more nuanced appreciation of the conflicts and contradictions that practice entails (see OIKOS & IIRR 2000).

The Mission Approach

'*Meetingein raat-raat tak chalti theen*' [The meetings would go on late into the night], said a subdivisional officer in Jhabua at the district headquarters. He was reminiscing about the watershed mission meetings held in the Collector's office. 'We would work all hours to prepare the plans and to compile data about the progress of work in the area allotted to us. Everyone would be present: other department people, some village WDC presidents, NGOs. The atmosphere was very competitive, with us and the NGOs trying to outdo each other.'

The officer's memories of the watershed mission were nostalgic; at its high point when work was in full swing, the mission embodied a rare energy and momentum that contrasted vividly with the everyday inertia that marked government work. How did this transition come about? In national development circles, the MP administration has long suffered from an image problem. Terms like feudal, moribund, lacklustre were frequently applied to the administration, and were not only resented by the MP-cadre IAS officers who encountered them, but were a liability in terms of receiving development assistance. The goal of breaking out of this rut and fashioning a different, more dynamic administration received encouragement from the Chief Minister Digvijay Singh, who sought to build his own legitimacy within the state through decentralizing local government (panchayati raj) and within the Congress Party through donning the mantle of the late Prime Minister Rajiv Gandhi. The MP government adopted the Rajiv Gandhi Technology Missions in 1994 for the tasks of universal primary education, watershed management, control of diarrhoeal diseases, elimination of iodine disorders, rural industries and fisheries development. According to the government, 'The challenges of underdevelopment in these areas required unconventional and radical responses that hinged on concentrated action to make the state take rapid strides' (GoMP 1998b:1). A mission-mode entails 'clarity of strategies and objectives, action within a definite time-frame, fast-track procedures, committed team, intersectoral effort, collective action, close monitoring and transparent evaluation' (GoMP 1998b: 2). In the sphere of development, the mission approach was successfully used for controlling epidemics and for immunization. The mission approach is singularly suited for achieving *targets*, preferably single-point objectives that could be secured through rapid co-ordinated action that is centrally directed. Goals that are not supposed to be target-driven but where processual dynamics are important in themselves, where simultaneous monitoring and evaluation is critical for self-correction (cf. Mosse 1998), fit awkwardly into the mission approach.

To become a mission, the objectives of watershed development had to be re-cast into 'targets', measurable outputs to be achieved within a set time frame. The meeting of targets and deadlines dominated: How many WDCs formed? How many self-help groups? How many women's savings groups? How much money saved? How much money in the village account? How many grain banks? How many compost pits? How much area treated? How many trees planted? How much money disbursed? How many check dams built? How much fodder produced? In the absence of monitoring mechanisms, officials devote considerable

energy not to actually meeting these targets but to compiling data that would show that the targets are being met. If the District Collector happens to be a 'table Collector' rather than a 'touring Collector', the gap between the data and ground realities goes undetected. 'Table Collectors' hold long meetings at the district headquarters and officials do well if their papers are in order. Not only can the achievement of physical 'targets' be exaggerated, but even if the targets *are* achieved (as happens to be the case with some NGO implementing agencies), they do not indicate anything about the quality of work. While certain ecological changes can be measured (e.g. increased vegetative cover, the level of water in wells), the hard-to-measure social relations that create them are not examined.[10]

The mission approach failed to address the objectives of watershed development for another reason. Watershed development demands an integrated programme of management, something that the inter-sectoral task force of the mission would be well-suited to do. Yet the MP government launched missions even as it left intact the institutional structure of the administration with its rigidly defined boundaries between line departments and agencies. Cobbling together overarching structures without changing structures of control and accountability, of rewards and penalties, or of departmental loyalties, left most government officials cold. The only enthusiasts for the mission approach were the IAS officers who were 'above' departmental structures in the district. Other officials perceived no stake in adopting the mission approach. Thus the effort to generate enthusiasm, to show that 'there is considerable vitality within the government to be mobilized for collective action' (GoMP 1998b: 57), was internally resisted by the bureaucracy.

Spectacles and Show-places

In an effort to mobilize for collective action, internally as well as in relation to others, the state government had to organize events designed to whip up enthusiasm for the watershed mission. These events take the form of spectacles, yet rather different from the usual spectacles of power that states choreograph such as the Republic Day parades and Festivals of India. Instead of encapsulating and affirming the structure of state power in a straightforward manner, the spectacles organized around the watershed mission perform a curious inversion. Events generally are of the kind associated with social movements of protest. Thus the district administration launches the mission in a new village by organizing a rally where officials exhort people to shout slogans and sing songs composed by the administration, and arm them with

[10] This pre-occupation with enumeration is not unique to the mission approach but is central to what Appadurai calls 'the illusion of bureaucratic control' in which 'countable abstractions, of people and resources at every imaginable level and for every conceivable purpose, created the sense of a controllable indigenous reality' (Appadurai 1993: 317).

placards and banners painted by hired artists. After winding its way through the village, the rally culminates in a public meeting where villagers are encouraged to make speeches about the importance of watershed development. In keeping with the spirit of popular participation and partnership, senior government officials seat themselves on the ground with the villagers. Collectors eschew their official vehicle in favour of *padyatras*, the plebeian pedestrian mode popularized by Mahatma Gandhi and adopted by social movements. Through *sarkari* rallies, *yatras* and *melas* (fairs), the state tries to create and capture the collective effervescence of popular mobilization in order to harness it for a government programme. Yet the reversal of roles between officials and villagers is too fleeting to leave an enduring impression. When the Collector ends his humble padyatra, where he walked with folded hands from door to door, and climbs into his jeep, back to the office where villagers will be stopped at the gate by the sentry, the structure of power is firmly asserted. The discursive divide between state and society is thus deliberately blurred and then dropped back in place.

Like other spectacles organized by the state, those around the watershed mission depend for their success on collaboration, on the willing suspension of disbelief on the part of the audience. Collaboration may be secured by giving villagers a platform for their own agendas, such as giving the stage to a local *bhajan* (devotional songs) troupe. Local politicians are propitiated by giving them a prominent place in the proceedings of the event. The opportunity to display one's proximity to politicians or to collar the Collector and get some work done, are among the multiple attractions of mission-related spectacles for villagers (cf. Mosse 1997: 276). The parading of patronage is one of the many side-shows in progress.

The elements of collaboration are most clearly apparent in the show-places that the watershed mission has created. Kakradara is one such site/sight: on the Jhabua-Dahod state highway within easy reach of the district headquarters, this village has become blasé about VIP visits. Not only has it been visited by the Chief Minister, the Minister of State for Agriculture, MPs and MLAs, activists like Annasaheb Hazare and Anil Agarwal, among others, but, as the WDC President proudly informed me, '*Pichhle maheene Sonia Gandhi helicopter se aayi thi*' [Last month, Sonia Gandhi (the President of the Congress Party) had come here by helicopter]. While Kakradara is supposed to be a model watershed village, it is clear that its flourishing economy is due to a combination of existing favourable conditions and atypically assiduous state efforts. Kakradara is a prosperous village by Jhabua standards, with farmland irrigated by a seasonal river and several private dug wells. Land-holdings are large and include private patches of forest and pasture. The village had earlier received two community lift-irrigation projects in the early 1990s.[11] The watershed programme was thus not an entirely novel initiative, but part of a longer series of transactions between the bureaucracy and particular villagers (cf. Li 1999: 305–6). Kakradara's watershed programme is directly supervised by

[11] Like many such schemes in Jhabua, the one in Kakradara failed because of irregular and low-voltage power supply, leaving 41 households in debt. As one of the 'trust-building' entry-point activities in the watershed mission, the PIA arranged to have the debt written off and provided a diesel pump to the village.

the district Co-ordinator for the mission and receives the personal attention of the Collector. Every government department has invested exceptional resources to make the Kakradara watershed programme a success.

The figures of Jhetra, the Vice-President of the watershed Committee, and his wife, Badlibai, the leader of one of the women's savings groups in the village, epitomize state notions of the model adivasi man and woman. Both of them, articulate in Hindi, briskly dole out development talk on the virtues of saving money, forming groups, liquor prohibition and the abolition of brideprice. Jhetra and Badlibai have represented the successes of the watershed mission at the state capital Bhopal, in Delhi, and also at a conference in Europe. The open space in front of Jhetra and Badlibai's home is littered with out-of-order development handouts—hens and chicks peck for food around a rusting metal cylinder that was once a fuel-efficient stove; a cracked solar panel is propped against the wall; tangled wire for a telephone that was never installed lies in a heap with tractor accessories. The tractor was bought with the help of an IRDP (Integrated Rural Development Programme) loan taken out by Badlibai's eight-member women's savings group, who had raised the collateral by contributing ten rupees each week for the last four years.

When I visited Kakradara, Jhetra and Badlibai were busy supervising the construction of a shelter for the nursery they had started to prepare saplings for sale to the government. The watershed mission had brought much work their way: Jhetra has supervised the digging of three irrigation tanks in the village over the last three years. Clearly, he was deeply involved in the work of the watershed mission, but his perception of his role differed from the notion of decentralized participatory management envisaged in mission objectives. Jhetra complained that he was given a *theka* [contract] by the government to construct the tanks for which he was paid Rs 1.1 lakhs. During a VIP visit, he overheard government officials tell the Minister for Agriculture that the tanks had been built for Rs. 2 lakhs. Jhetra believes that the money was embezzled by government officials and that he has been cheated. When I asked the District Collector about this, he pointed out that the discrepancy between what Jhetra was paid and the amount mentioned to the minister was explained by the *shramdaan* [voluntary labour] that villagers are supposed to contribute to the project. The monetary value of the voluntary labour component was Rs. 90,000; if the project had been executed by the state, it would have cost them Rs. 2 lakhs.

The confusion around voluntary labour, Jhetra's proprietary attitude towards the tanks, his suspicions about corruption in the disbursement of funds, all reveal interesting glimpses of what the mission looks like from his perspective. According to Jhetra, he was awarded a 'contract' by the government to build the tanks. An employee of the Public Works Department, he is conversant with the award and implementation process of construction works. He sees himself as a *thekedar*, a private contractor bidding successfully to execute a project for the government upon payment. But tank construction and nursery plantation are supposed to be activities undertaken by the watershed Committee, jointly planned and executed by all the members. In Kakradara, the collective effort has been transformed into a private collaboration between government officials and one enterprising household, Jhetra and Badlibai's. As a contractor, Jhetra sees himself as employing wage labourers, not as part of a committee of equals.

In receiving funds from the state, Jhetra is sure that he has been shortchanged, but officials dismiss his suspicions by saying that he does not understand the modalities of accounting for voluntary labour. Yet the decision about how much labour is to be volunteered is not made by the *villagers* who would perform that work, but by the state. There are government rules about 'voluntary' labour in the watershed mission: if the work is on government lands, a portion of the minimum wage is deducted and deposited in a common fund. These rules are not negotiated; they are simply communicated from above. Ironically, villagers don't know that their labour was 'volunteered'; many of them complain that watershed work does not pay as much as other public works. This indicates that they perceive watershed work as yet another form of labouring for the state, and they have no sense of ownership vis-à-vis the project. Government officials who explain that wage deductions are because of 'voluntary labour' never ask villagers whether they are willing to forego their wages in this manner. The rules change and can confuse even project officials; villagers who cannot fathom them simply assume that this is another way in which they are being cheated. Yet, despite Jhetra's suspicions about corruption, he continues to play a key role in the watershed project. His participation ensures that work is done and visible effects created in the show-place that is Kakradara. For him, the Committee structure is a formality, its processes cosmetic. A perfunctory nod at 'community participation' is all that is necessary before getting down to the *real* business at hand, getting the tanks constructed and the profits shared.

Clearly the watershed mission creates opportunities for the material and symbolic advancement of entrepreneurs like Jhetra. A project that is supposed to be based on collective planning and implementation can become a vehicle for private profiteering. While elected representatives on the Committee get no official compensation for their work ('after all, it's a voluntary institution'), there is scope for 'adjustment' by fudging accounts of material and labour. As long as the paperwork is in order, rules can be subverted if officials co-operate. Villagers in the next hamlet allege that Jhetra made all the weekly contributions under the names of different women in his wife's savings group (all the members were his relatives) in order to get a loan for the tractor. The availability of soft loans for women's micro-credit groups could thus be exploited by someone who knew how to work the system. The potential for women's empowerment through the savings groups, which has been realized in some other villages, could be negated in Kakradara by the powerful alliance between state actors eager to secure spectacular effects and a male villager willing to supply them with shortcuts for private profit. These collaborations and compromises generally remain unspoken. When I asked the complaining Jhetra why he did watershed work, he replied, '*Gaon ke liye*' [For the village].

Participation and Implementation

'*Kaam sahi, par aadmi galat*' [The work's right, but the wrong people are doing it], a schoolmaster in Alirajpur remarked about the watershed mission. Behind this observation lies the notion that 'the right people' would be uncorrupt and uncompromising; they would

work sincerely to fulfil the stated objectives of the project, and that they would be 'above politics'. Yet this ideal remains unrealized because the watershed mission is, from its very inception, located within fields of power, and the people implementing it, villagers and state officials, bring to it the politics of their structural location. While appreciating that there is no place outside/beyond politics (cf Moore 1998), it is important to examine how the idea of apolitical agency is employed in the contestations around the watershed mission.

Decentralized management in the watershed mission is supposed to work through a divestment of state power and its transfer to institutions at the village level. Curiously, the mission creates an entirely new structure in the form of the watershed Committee rather than using the already existing elected government of the village, the panchayat. When asked about this, the district Coordinator of the mission explained: 'The panchayat is not participatory; the sarpanch (elected head) becomes a contractor. The panchayat is a delivery system. The watershed involves everybody. The panchayat is too political. The watershed committee should not be run by somebody who is popular'. This response shows the official's perceived tensions between the idea of decentralization as a process that could become 'too political' and watershed work as a project that needed to be kept away from politics. This perception echoes the schoolmaster's notion of the watershed mission as a development programme, where politics is seen as antithetical to development. State officials invoke concerns about keeping the mission 'free of politics' to justify the political move of separating the watershed Committee from the panchayat. In addition, the move towards decentralization is tightly leashed by ensuring that every proposed plan of the watershed Committee has to be scrutinized and sanctioned by a Technical Committee of government officials. Only then can villagers be paid for their work. Continued state control is justified on the grounds of safeguarding public welfare; the state represented as a bulwark against private appropriation and subversion. Yet the rules and procedures, designed to keep politics out, insinuate into the watershed mission state officials' agendas of gate-keeping and rent-seeking. Not only must watershed Committees follow stringent state specifications about the work that they undertake, even if they follow the guidelines to the letter, they cannot get plans and bills passed without paying off engineers, clerks etc. The notion that watershed work is apolitical introduces into the mission the politics of the state in several ways: it legitimizes bureaucratic control, it allows corruption, and it enables collaborations between state officials and particular individuals and social groups (cf Ferguson 1990).

The central tenet of decentralized management in the watershed mission is not only compromised by the stated imperative of maintaining bureaucratic control but also, paradoxically, by the very procedures established to ensure villagers' participation. The initial process of planning calls for Participatory Rural Appraisal, a collective activity. Government officials have devised an easier and quicker way of collecting information: in Kilora village, the project-in-charge summoned the sarpanch and collected the 'biodata' of the village. The rules of the mission mandate that decisions be taken in meetings of the watershed Committees, the proceedings of which must be recorded in writing. A decision can be taken only when there is a quorum of 1/3 members for the Committee meetings and 1/3 members for the gram sabha

[village body] meetings. In practice, meetings are not conducted thus nor are minutes recorded of the actual proceedings. Most Committee members are 'thumbs up'[12] and unfamiliar with the elaborate procedures mandated by the state. Meetings may be held informally between officials and a few village men, or not held at all. Since the president and the secretary of the Committee do not know how to conduct meetings as specified by the government, and since the 'decisions' are generally what officials suggest, the minutes of meetings are composed by the Community Organizer. The secretary of the Committee goes over to the Organizer's office and copies them out. The minutes of meetings in different villages will often be exactly the same, with only the names changed, as they refer not to actual meetings but only to the template created by the Organizer. In the village, the watershed Committee secretary goes from house to house and collects members' thumb impressions in a blank register, where future minutes will be recorded. Thus an instant record of 'participation', of decentralized village institutions at work, is created and authenticated for posterity. This fiction of one kind of villagers' participation, the kind specified by rules, is perpetuated through the bureaucratic record only through villagers' participation of another kind, viz. in the circumventions invented by state officials.

The overarching project of bureaucratic control is constantly undermined by the divergent understandings and interests of state officials themselves. For the field staff that implements the project, the watershed mission is an imposition. The work is unrewarding: there are no incentives for functioning effectively and the '*oopar ki kamai*' ['earnings over and above', commissions] is not larger than in other public works. In addition, they are saddled with regular duties in their parent line departments as well. Field staff is expected to spend long hours travelling and holding meetings with villagers. Considerations of comfort, control and status combine to make the mission unattractive to the field staff. As a forest guard put it, '*yeh to haath-jodu kaam hai. Hum to lathi chalaane ke aadi hain*' [This is work with folded hands. We are used to swinging lathis]. Bureaucratic foot-dragging is generally the norm in the mission.

An exception to the overall bureaucratic apathy towards the mission is its leadership. The watershed mission is an avenue for dynamic IAS officers to rise to prominence. As I studied the mission, field staff always referred me to particular heroes: 'You must talk to so-and-so who used to be Jhabua Collector; he really pushed the mission forward.' The mission is identified with particular IAS officers. These officers have shaped most metropolitan visitors' impressions of the mission, through their production of reports and promotional literature in English, and by personally escorting VIPs on tours of mission villages. Most visitors come away enthused, '*Srivastava saab bade young hain, par barhia kaam kar rahe hain*' [Srivastava sahib is very young, but he's doing excellent work]. As a 'remote' and 'backward' district, relatively free from the intervention of elected state representatives, Jhabua provides opportunities and relative autonomy for junior IAS officers to experiment with development projects. The projects, however, depend greatly on the 'vision' and the enthusiasm of an individual

[12] Officials' colloquial term for '*angootha chhaap*' [illiterate, someone who signs with a thumb impression].

Collector who is soon transferred and promoted to a posting elsewhere. With the departure of the Collector, his pet project also dwindles. The structure of IAS mobility means that the rewards for successful watershed work lie outside the district, in the goodwill accrued with the Chief Minister, in the favourable attention received in the media and in the eyes of metropolitan audiences, and in the potential for plum postings. For these rewards, the creation of a record of a particular kind is crucial, a record that is legible to outside audiences. Not only must there be spectacles and show-places, their existence must be reported and disseminated through the media. A considerable effort is thus put into the production of glossy booklets, photographs and videotapes, of the mission at work. There are also official reports of the project, with more 'data' in the form of the enumeration of targets achieved, but the information is selected to substantiate the claim that the mission is working as planned. Government officials not only censor and screen the information that they disseminate to diverse audiences, they also guard access to their archives. Such censorship seemed to be critical for creating the narrative of a miraculous transformation. After seeing the official records of the watershed mission, I was able to trace the origins of the story produced in the press by Anil Agarwal and the CSE in Delhi. The creation of records for the consumption of a literate audience, through the media and through marks on the landscape—the whitewashed bunds, the freshly painted roadside boards, is a crucial ingredient in conjuring up a persuasive account of progress. As I have tried to show in this section, the divergent ways in which state actors relate to the 'success' of the project shape the contours of the watershed mission, its collaborations in the creation of material and symbolic effects.

Legitimacy and Collaboration

I began by asking what the watershed mission means in terms of 'the accomplishment of rule', the process by which state legitimacy is created and contested. By 'rule', I mean the project of disciplining people and places, in order to reproduce structures of inequality. The accomplishment of rule requires state practices that invite *collaboration*; hegemony is not merely consent, nor a 'project of a singular and coherent state, but a terrain of struggle and, more prosaically,… the routine and intimate compromises through which relations of domination and subordination are lived' (Li 1999: 316; also see Moore 1999: 659; Gupta 1995: 393–4). Following this Gramscian insight, I have tried to present the watershed mission at the conjuncture between a trans-local discourse of 'sustainable development' and a grounded micro-politics of state actors and villagers. My account highlights the multiple ways in which the mission is appropriated and reshaped by the situated knowledges and orientations of these actors. An ecologically-rational rendering of the mission is superseded by the tricky tasks of negotiating with tenurial conflicts, troublemakers, and administrative tenets. The imperative of producing visible effects, communicable to metropolitan audiences and political bosses, drives the mission in the direction of spectacles and show-places. Their different locations

within fields of power often leads IAS officers and the field staff to divergent practices, even as these officials come together to present a unified image of the mission before outsiders. Yet the exertions of the state would not succeed without the complicity of particular villagers, who bring to the project their own ideologies, interests and experience of dealing with the state. This account shows that state capacity 'to fashion or present itself in its chosen terms and to implement the projects that are designed to embed relations of rule' must not be overestimated (Li 1999: 315).

Li emphasizes the fragility and contingency of rule, and the continuous effort required to produce and maintain its relations (1999: 298). The state's influence on audiences, collaborators and its agents, is always tenuous. Thus we see state actors constantly reinventing themselves, adopting a new vocabulary, emulating social movements, seeking legitimacy in novel ways through partnerships with villagers and NGOs. Particular state actors, the Chief Minister and IAS officers, attempt to show donors and metropolitan audiences that the state is learning and reforming; this is the condition on which funds and symbolic support are made available. The structure of legitimacy and accountability is thus transnational, and contingent upon rendering new accounts, narratives and representations. Yet simultaneously, in the grounded micro-politics of Jhabua, this fragile consensus is being subverted by the varied agendas of enterprising villagers and state officials, individually and collectively.

This brings me to a consideration of the project of legitimacy as shaped not by the state alone, but in collaboration with significant others, especially metropolitan audiences. I have called the watershed mission a 'dream machine' that different groups want to engineer to their specifications, and ride to their own destiny. Not getting to ride generates a sense of deprivation and resentment (cf. Gupta 1998) that shapes the struggles for and against the mission. The convergence of different dreams gives the watershed mission its particular discursive power and also enables its subversion. So far, what has gone unremarked, is the power of the watershed model, its seductive strength in soothing metropolitan, middle class anxieties around environmental degradation and development. The CSE plays a crucial (unfortunately, not critical[13]) role in constructing environmental utopias. The Centre's earlier focus on 'green villages' has now been modified by the recognition that state power is essential for creating transformations on a grand scale. According to Agarwal, 'activists have always criticized the government; we must now show that success is possible.' The need to show 'success', to offer prescriptions, is a pressure felt by NGOs whose funding is often linked to their ability to produce narratives of progress. Inexplicable to me is CSE's absolute suspension of all critical faculties; their accounts of Jhabua's watershed mission are not based on independent investigation, have no in-depth analysis, not a single word of critique or correction. Successes must surely be celebrated, but is the Jhabua mission a success at all? The MP government and the CSE collaborate in the construction of a particular success *story*, a narrative that garners them legitimacy, even as critical voices and the questions they ask are marginalized.

[13] Curiously, no independent study is cited in support of the claims about the achievements in Jhabua. Agarwal (1999) quotes a GoMP study of results from 18 'best case' micro-watersheds.

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Section IV
Population and Health

Chapter 18

Fertility, MCH-Care and Poverty in India: Simultaneous Structural Analysis

S.C. GULATI

I. Introduction

Theoretical and empirical literature highlights linkages amongst fertility, mother and child health care (MCH-Care) utilization, and extent of poverty, usage of contraception, marriage-age patterns, and some selected socioeconomic and cultural factors. The present study highlights such interlinkages through factor analysis. The factor analysis further facilitates formulation of the simultaneous structural system through selection of the interwoven structural variables. The analysis facilitated the formulation of the simultaneous structural system with fertility, MCH-care utilization and poverty as endogenous variables while nine socioeconomic and demographic variables like contraception usage, marriage age patterns, female literacy and employment, availability of health functionaries, extent of rural-road network, etc. as exogenous variables in the system. It has often been argued that poverty; social backwardness and ill-health status often trap poorer persons in a vicious circle. These aspects of interlinkages also get highlighted in the present study through factorial investigations and structural formulation of the model.

The parametric estimates of the structural model also facilitate highlighting the strength of linkages and also facilitate in prioritization of socioeconomic and demographic factors towards containment of fertility and increasing MCH-care utilization, which are important for quickening the process of population stabilization in the long run. A comprehensive population policy for cost-effective achievement of the short, medium and long run policy objectives such as provision of quality health-care, informed choice of contraception, fertility reduction, and population stabilization, ought to have such linkages in sight.

II. Objectives

This study purports to highlight interlinkages amongst basic socioeconomic and demographic variables through factorial investigation and thereby formulate a simultaneous structural system to highlight often brought out vicious circles or circular linkages between fertility, MCH-care, poverty, contraception, women's education and empowerment, etc. Thereby the structural estimates by the system method of estimation of three stage least squares (3SLS) would facilitate highlighting the strength of the linkages. The parametric estimates of the structural linkages are based on the district level data on relevant parameters from alternate sources like DLHS-RCH District Level Household Survey-Reproductive and Child Health, (IIPS, 1999), CMIE (2000), Census of India (2001), and Population Commission (2001). These estimates would be utilized to elicit the partial and total effects of the exogenous or predetermined socioeconomic, contraception usage, marriage age patterns, health and education infrastructure variables, etc. on the endogenous variables in the structural system. The structural estimates and the effects would facilitate prioritization of the alternate socioeconomic and demographic factors to be focused upon towards a cost effective achievement of the population policy objectives.

III. Methodology

The interlinkages amongst selected variables under the purview of the present study are highlighted through factorial investigations. Formulation of the simultaneous structural system and thereby parametric estimates of the structural coefficients are elicited using the 3SLS system method of estimation. Thereby partial and total effects of the predictor or predetermined variables on the endogenous variables are elicited from the reduced form of the structural system.

III. 1 Simultaneous Structure Model

A General Notation for Linear Simultaneous Equations Model is as follows:

$$\gamma_{11}y_{t1}+\gamma_{21}y_{t2}+\cdots+\gamma_{M1}y_{tM}+\beta_{11}x_{t1}+\cdots+\beta_{k1}x_{tk}=\varepsilon_{t1},$$

$$\gamma_{12}y_{t1}+\gamma_{22}y_{t2}+\cdots+\gamma_{M2}y_{tM}+\beta_{12}x_{t1}+\cdots+\beta_{k2}x_{tk}=\varepsilon_{t2},$$

$$\vdots$$

$$\gamma_{1M}y_{t1}+\gamma_{2M}y_{t2}+\cdots+\gamma_{MM}y_{tM}+\beta_{1M}x_{t1}+\cdots+\beta_{kM}x_{tk}=\varepsilon_{tM},$$

There are M equations for M endogenous variables, denoted $y_1, \ldots, y_M$. There are K exogenous variables, $x_1, \ldots, x_K$. The first element of x_t will usually be the constant i.e. 1. Finally,

$\varepsilon_{t1}, \ldots, \varepsilon_{tM}$ are the structural disturbances. The subscript t will be used to index observations, $t = 1, \ldots, T$.

In matrix terms, the system may be written

$$\begin{bmatrix} y_1 y_2 \cdots y_M \end{bmatrix}_t \begin{bmatrix} \gamma_{11} & \gamma_{12} & \cdots & \gamma_{1M} \\ \gamma_{21} & \gamma_{22} & \cdots & \gamma_{2M} \\ & & \vdots & \\ \gamma_{M1} & \gamma_{M2} & \cdots & \gamma_{MM} \end{bmatrix} + \begin{bmatrix} x_1 x_2 \cdots x_k \end{bmatrix}_t \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1M} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2M} \\ & & \vdots & \\ \beta_{k1} & \beta_{k2} & \cdots & \beta_{kM} \end{bmatrix} = \begin{bmatrix} \varepsilon_1 \varepsilon_2 \cdots \varepsilon_M \end{bmatrix}_t$$

or

$$y_t'\Gamma + x_t'B = \varepsilon_t'.$$

The solution of the system of equations determining y_t in terms of x_t and ε_t is the reduced form of the model would be as follow:

$$y_t' = \begin{bmatrix} x_1 & x_2 & \cdots & x_k \end{bmatrix}_t \begin{bmatrix} \pi_{11} & \pi_{12} & \cdots & \pi_{1M} \\ \pi_{21} & \pi_{22} & \cdots & \pi_{2M} \\ & & \vdots & \\ \pi_{k1} & \pi_{k2} & \cdots & \pi_{kM} \end{bmatrix} + \begin{bmatrix} v_1 \cdots v_M \end{bmatrix}_t$$

$$= -x_t'B\Gamma^{-1} + \varepsilon_t'\Gamma^{-1}$$

$$= x_t^{'}\Pi + v_t^{'}.$$

The reduced-form parameters, coefficients of π, measure the total effect, direct plus indirect, of a change in the predetermined variable on the endogenous variable, after taking account of the interdependence among the jointly dependent endogenous variables, while a structural coefficient indicates only the direct effect (Koutsoyiannis, 1977).

IV. Data Base of the Study

District level database of the study is drawn from alternate sources such as most of the fertility, contraception usage, MCH-care indicators, are drawn from the DLHS-RCH surveys conducted by several consulting organizations monitored by the International Institute for Population Sciences. District level data on female literacy and employment, extent of urbanization, percent Muslim population, etc. has been drawn from Census reports of 2001 census. Data on health infrastructure and health functionaries are drawn from CMIE, 2000. District level

development and mother and childcare composite indices have been drawn by factor analytical techniques. The details of the selected variables and sources of information are provided in the Appendices.

Development being a multi-dimensional phenomenon is difficult to be captured even by a catchall variable like per capita income, which is also not available at the district level in India. The causal factors for poverty in different regions could be different. Numerous possible factors could be difficult terrain, adverse soil conditions like desert or infertile soil, non-conducive agro-climatic factors like scarcity of water, scanty rainfall, non-availability of irrigational sources, inaccessibility to technological innovation, etc. for lack of agricultural development. Similarly, sectoral aspects of development for agricultural, industrial or tertiary level sectors may also entail factors like lack of infrastructure facilities such as roads, railways, electricity, banking sector network, telecommunications, etc. Even income inequality in a region could also be a causal factor for widespread poverty in the region. Thus, sectoral as well as overall economic developmental aspects at the district level had been elicited using a factor analytical technique in an earlier study using these sectoral aspects of development (Gulati, 1996). Furthermore, the percent population below poverty level for districts has also been utilized in the study to reflect the extent of socioeconomic backwardness at the district level (CMIE, 2000).

V. Linkages Amongst Fertility, MCH-Care, Poverty and Other Socioeconomic Factors

The following Table 1 provides the Varimax rotated factor structure of the selected variables in the study. Perusal of the Table 1 reveals that fertility (PBO3+), contraception usage (PCUFPM), marriage age patterns (PGMB18), mother and child health care (MCH3)[1] utilization, female literacy (LITF) and women's empowerment indices (FMLITRAT)[2] are depicted to be strongly interconnected as the factor loadings of all the variables on the first factor are relatively much higher. The direction of linkages is also consistent with the general expectations such as districts with higher utilization of MCH-care and higher utilization of contraception usage depicts lower fertility. Furthermore districts with lower age at marriage patterns or higher ratios of females marrying less than 18 years of age also depict higher fertility. Female literacy and female empowerment depict negative association with the fertility and marriage age patterns, and positive linkages with contraception usage and mother and child heath care utilization. Overall

[1] The district level MCH3 indices are the factor scores based on the Principal Component Analysis of three RCH indices viz. %women with pregnancies over last three years using antenatal care using antenatal care, percent deliveries over last three years in health institutions and percent children between 1–3 years with complete immunization. The component's weights were .931, .907 and .896 for the three RCH components, respectively.

[2] Ratio of female to male literacy is hypothesized to capture the extent of women empowerment.

TABLE 1
Varimax Rotated Factor Structure of the Selected Variables

Variable	*Factors*				*Communality*
	I	*II*	*III*	*IV*	
PBO3PN	**–.865**	–.175	.034	.195	.818
PGMB18	**–.618**	–.235	–.324	–.147	.564
PCUFPM	**.832**	.055	–.092	–.209	.747
MCH3	**.808**	.346	–.025	–.134	.791
PFLIT	**.694**	.492	.088	.055	.734
FMLITRAT	**.653**	.537	.140	.091	.742
PFWMAIN	.251	**.866**	.022	–.164	.841
PFWMAR	–.133	**–.888**	–.020	.162	.840
HADBEDS	**.436**	.350	.124	.318	.429
PHCS	–.018	–.087	.223	**.594**	.411
ANM	.402	**.452**	.440	.132	.577
PVNCPR	**–.510**	–.218	.395	–.147	.486
PVELEC	.276	.286	–.259	–.249	.287
PPBPL	–.287	.029	**.663**	.055	.525
DDIO	**.567**	.429	–.115	.166	.546
PURB	.301	**.669**	–.129	.105	.566
PFSRTI	–.288	.034	**–.696**	.032	.570
PMUS	–.064	–.012	–.364	**.702**	.630
Eigen-value	4.733	3.374	1.713	1.283	

Note: Description of the Variables is provided in Appendices.

economic development (DDIO)[3] also depicts relatively stronger linkages with demographic and MCH-care utilization factors.

Second factor structure depicts that female employment viz. percent woman as main workers (FWMAIN) and marginal workers (FWMAR) depict close linkages with female literacy, MCH-care utilization and extent of urbanization at the district level. Furthermore female employment in the category of main workers seems to be higher in urban compared to rural areas. Furthermore, availability of health functionaries like Auxiliary Nurse Midwife (ANM) also depicts positive association with mother and child health care utilization.

Perusals of the third and fourth factor structures reveals that lower age at marriage patterns are positively associated with higher incidence of Reproductive Tract Infection/Sexually Transmitted Disease (RTIs/STDs), amongst females. Interestingly, districts with better health infrastructure characterized by higher number of ANMs and better road connectivity (PVNCPR) depict lower incidence of reproductive tract infections amongst women.

The last column of communalities reveals that most of the socioeconomic and demographic variables under the purview of the present study can be well represented by the four factors.

[3] DDIO is an overall economic development index for each district based on 14 sectoral aspects of development viz. agricultural, industrial and tertiary sectors; elicited in an earlier study (Gulati, 1996).

Furthermore, the semi-quantitative insights into the interlinkages facilitate formulation of the structural model in the following section.

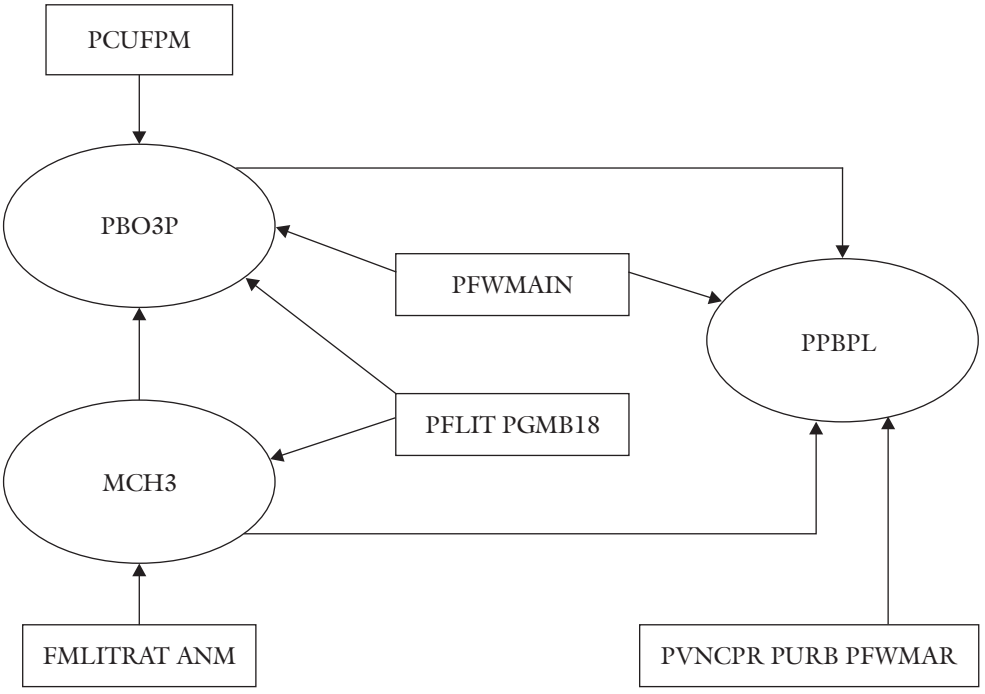
VI. Structural Formulation of the Model

The functional forms of the three structural relations for the three endogenous variables viz. fertility (PBO3), mother and child health care utilization (MCH-3) and extent of poverty (PPBPL); become clear from the following Flow Chart in Figure 1. The nine exogenous variables in the system are usage of contraception (PCUFPM), marriage age (PGMB18), female literacy (LITF), and female employment as main and marginal workers (FWMAIN and FWMAR), number of ANMs per lakh population (ANM), rural-road networking (PVNCPR) and extent of urbanization (URBP).

The first structural relation depicts that fertility (PBO3P) is affected by the utilization of MCH-care, usage of contraception, marriage age patterns, female literacy and employment.

The second structural relation depicts that Utilization of mother and child health care (MCH3) is affected by extent of poverty and availability of health personnel like ANMs.

Figure 1
Flow Chart of the Simultaneous Structural System



Furthermore, the utilization also depends upon extent of female education and empowerment. Still further we expect the marriage age patterns also affect the utilization.

The last structural relation depicts that extent of higher fertility also contributes to higher incidence of poverty. The cause and effect relationship between poverty and fertility has drawn lot of attention over the recent past (Srinivasan, 2006). Furthermore, lack of female employment in the category of main as well as marginal workers also contributes towards lack of economic development or incidence of poverty. Still further, the extent of rural infrastructure development in terms of road connectivity and extent of urbanization also affects the levels of poverty.

VII. Parametric Estimates of the Structural Coefficients of the Model

The parametric estimates of the structural coefficients of the simultaneous equation system by the three stage least squares system method is provided in the following Table 2.

Perusal of the parametric estimates of the structural coefficients of fertility (PBO3P) in Table 2 reveals that utilization of the MCH-care, which was based on the extent of utilization of antenatal institutional-delivery care and children's immunization; depicts significant inhibitive impact on fertility. Alternatively, the MCH-care obviously affects maternal and child mortality

TABLE 2
The 3SLS Estimates of the Structural Coefficients of the Model

	PBO3P		*MCH3*		*PPBPL*	
Variable	*Structural Coeff.*	*Significance*	*Structural Coeff.*	*Significance*	*Structural Coeff.*	*Significance*
Constant	**50.596**	0.00	**7.454**	.00	**40.346**	.00
PBO3P					**.330**	.00
MCH3	**–9.162**	.00				
PPBPL			**–.145**	.00		
Exogenous						
PGMB18	**.037**	.03	–.001	.22		
PCUFPM	**–.264**	.00				
PFLIT	**–.079**	.02	**.023**	.00		
FMLITRAT			**.015**	.02		
PFWMAIN	–.002	.94			**–.057**	.02
PFWMAR					–.009	.71
ANM		.001	.81			
PVNCPR					**.025**	.02
PURB					.005	.29
N = 593						

and which in turns has often been viewed to be important determinants of fertility. Thus, accessibility and affordability of MCH-care would certainly facilitate fertility reduction. Furthermore, we find that proximate determinants like higher marriage-age patterns and contraception usage also depict significant inhibitive impact on fertility. Still further we find that female literacy also depicts significant inhibitive impact on fertility.

The parametric estimates of the second structural relation reveals that the extent of poverty (PPBPL) in the region significantly affects utilization of MCH-care (MCH3) in a district. Thus, alleviation of poverty being an ideal goal by itself as a welfare measure for the society also helps in better utilization of MCH-care, which in turn was found to have significant inhibitive impact on fertility. Thus poverty alleviation not only helps towards better health of women and children but also lowers fertility. An interesting document by UNFPA elaborated on the strategy towards alleviation of poverty through utilization of RCH care, United Nations Fund for Population Activities (UNFPA, 2003). Possibly the cause and effect relation between RCH-care and poverty alleviation would be difficult to establish, but certainly the two; alleviation of poverty and RCH-care or MCH-care utilization; seems to reinforce each other. Furthermore, we find that female literacy (PFLIT) as well as female empowerment (FMLITRAT) depicts significant positive impact on the MCH-care utilization.

The last structural relation estimates reveal that the extent of fertility depicts significant positive impact on the incidence of poverty in a district. Alternatively, fertility reduction in a region indirectly helps people in poverty reduction too. Furthermore, we find that female employment whether in the category of main or marginal workers, helps towards poverty alleviation. However, female employment in the category of main workers is discerned to help significantly in poverty reduction. Still further, we find that rural road no-connectivity (PVNCPR) also enhances the poverty in the region.

VIII. Partial and Total Effects of Predetermined Variables on Endogenous Variables

The direct or partial effects of the predetermined variables have been highlighted earlier while discussing the parametric estimates of the structural coefficients of the Model in the earlier section. Furthermore, the total effects of the predetermined variables elicited through estimated reduced form parameters are presented in the following Table 3.

It may be of interest to mention that total effects elicited out of the reduced form of the model depict that all the total effects of significant exogenous variables in each structural relation has come out to be much more pronounced compared with their partial effects. Such as the total effect of marriage age patterns (PBMB18) on fertility has gone up from .037 to .082, almost more than double. Similarly, we find that total effect of contraception usage on fertility has enhanced to –.470 compared with its partial effect of –.264. Total inhibitive effect of female literacy on fertility has increased tremendously from just .079 to 1.782. Also we find that the total effects of female education and female empowerment are much higher compared with

TABLE 3
Partial and Total Effects of Exogenous Variables on Endogenous Variables

	Endogenous Variable					
	PBO3P		*MCH3*		*PPBPL*	
Endogenous Variable	*Partial*	*Total*	*Partial*	*Total*	*Partial*	*Total*
PGMB18	**.037**	**.082**	–.001	–.005		.027
PCUFPM	**–.264**	**–.470**		.022		**–.155**
LITF	**–.079**	**–1.782**	**.023**	**.108**		–.588
FMLITRAT		**–.245**	**.015**	**.027**		**–.081**
FWMAIN	–.002	**–.138**		.015	**–.057**	**–.103**
FWMAR		–.021		.002	–.009	–.016
ANM		–.016	.001	.002		–.005
PVNCPR		.059		–.006	**.025**	**.045**
URBP		.012		–.001	.005	.009

their partial/direct effects on mother and childcare utilization. Still further, we find that total effect of rural road networking on extent of poverty is also much more pronounced compared with its partial/direct effect. Thus, overall we find that because of the circular linkages amongst the endogenous variables in the system the total effects of almost all the exogenous variables on the endogenous variables have increased substantially.

Interestingly, we find that female literacy seems to have all pervasive effects and turn out to be most important towards fertility containment, mother and childcare utilization and poverty alleviation. Furthermore we find that usage of contraception depicts much stronger impact on fertility reduction compared with female employment or empowerment. Toward prioritization of alternate predictor variables under the purview of the study we find that female education, contraception usage, female employment and then marriage age play important role towards fertility reduction.

Coming to mother and child health care (MCH3) we find that female literacy and female employment empowers them to make decisions towards availing of the MCH care, which certainly helps towards improvement in their well-being and also fertility curtailment.

Towards poverty alleviation we find that female education and employment in the category of main workers helps towards reduction in the extent of poverty. Also we find that improvement in the rural road infrastructure also helps in economic development or poverty alleviation. It may be of interest to mention that even the usage of contraception depicts relatively much higher total effect towards poverty reduction. Possibly, usage of contraception reduces the family size and thus with limited resources better living standards can be provided because of higher allocation towards the welfare of the limited family members and thus poverty alleviation objective can also be met indirectly.

It may be of interest to look into the joint effects of contraception and mother and childcare utilization on fertility reduction as often it is being debated that provision of quality RCH care and its utilization would automatically motivate people to adopt contraception for limiting their family size.

IX. Interaction Effects of Contraception and MCH-Care on Fertility

Possibly it is high time to get into debate over interaction effects of family planning programme efforts and socioeconomic development process towards population control and accelerated population stabilization goals. There are enough theoretical and empirical evidences which depict that informed choice, availability, accessibility and affordability of quality contraception can also lead to improvements in the living standards, education of children and health of all family members and serve as a catalyst to accelerate economic growth and poverty reduction and thus fertility reduction and population stabilization. Success of family planning programs in Thailand, Indonesia, Colombia, and most recently in Bangladesh, the family planning community came to realize that contraception itself might be the most effective means of improving maternal and child health (Harvey, 1996). One can't deny the benefits of contraceptive usage resulting into limited family and thus substantial reproductive and general health benefits provided to small family size members by head of the household even with limited resources available for the purpose. One can get into the issues of interactions between lower fertility, higher usage of contraception, better health and childcare facilities, lowered infant and maternal mortality and morbidity, higher economic productivity, better standards of living, etc.

Parametric estimates of the multiple regression equation for fertility (PBO3P) on contraception usage, marriage age patterns, mother and childcare utilization and other crucial socioeconomic variables are provided in the following Table 4.

Perusal of parametric estimates of Model 1 in Table 4 reveals that almost all the coefficients pertaining to contraception usage, marriage age patterns, mother and childcare utilization,

TABLE 4
Parametric Estimates of Multiple Linear Regression Models for PBO3P

Predictor Variable	*Model 1*			*Model 2*		
	Coeff.	*Standardized Coeff.*	*Significance*	*Coeff.*	*Standardized Coeff.*	*Significance*
Constant	52.976		.00	49.781		.00
PCUFP	–.276	–.348	.00	–.199	–.251	.05
PGMB18	.042	.061	.01	.075	.109	.09
MCH3	–7.982	–.600	.00	–4.633	–.348	.00
PFLIT	–.112	–.130	.02	–.134	–.157	.12
FMLitRatio	–.094	–.090	.09	–.049	–.047	.38
PPBPL	.053	.058	.00	.043	.048	.02
PCUFPM*PGMB18				–.001	–.053	.38
PCUFPM*MCH3				–.071	–.251	.01
PCUFP*PFLIT				.001	–.138	.41
R-Square		.793			.801	

female literacy, and percent population below poverty line depict significant effects on fertility and in expected directions. In order of priority of the significant variables towards their impact on fertility we can observe from the standardized coefficients that utilization of MCH-care (MCH3) and contraception usage play most roles towards fertility curtailment. Next in terms of priority we find that female education and marriage age play important roles in fertility reduction.

Coming to Model 2 in Table 4 we find that interaction effects of contraception together with utilization of mother and childcare depict much stronger inhibitive impact on fertility. The magnitudes of the standardized regression coefficients reveal that apart from significant inhibitive effects of contraception usage and mother and childcare utilization we find that their joint/interaction effect (PCUFPM*MCH3) turns out to be highly significant. Clearly the joint effect of MCH quality care and usage of contraception would bring about faster pace of decline in fertility and thus would accelerate the process of population stabilization in India. Thus, relegating contraception to the back burner compared with RCH-care would slow down the process of fertility reduction and population stabilization in India.

National and international situations provide sufficient evidence to such interactions where contraception coupled with alternate socioeconomic factors have played crucial role toward fertility regulation. Hitherto, the usage of contraception along with alternate combinations of socioeconomic and political factors like health and education, women empowerment, political commitment, better governance, etc. have played important role towards fertility reduction and population stabilization process in different regions/states of India. Thus, we need to adopt a holistic approach on according equal importance to contraception together with other socioeconomic and RCH-care utilization programme efforts for accelerating the population stabilization process in India.

X. Summary and Concluding Remarks

The simultaneous structural model comprising three structures pertaining to three endogenous variables viz. fertility (PBO3P), MCH-care (MCH3) and poverty (PPBPL); together with nine exogenous variables viz. contraception usage, marriage age patterns, female literacy and empowerment, extent of female employment in the categories of main and marginal workers, availability of health functionaries, no rural road connectivity and extent of urbanization; has been formulated based on the semi-quantitative insights drawn from the factor analysis of much larger set of variables under the purview of the present study. The parametric estimates of the structural coefficients are elicited by system method of estimation of 3SLS based on data for 593 districts of India from alternate sources like DLHS-RCH, CMIE, Planning Commission, author's earlier studies.

Strong inter-linkages between fertility, MCH-care utilization and poverty got reflected in the factorial investigation and linkages with other crucial variables like contraception usage, marriage age patterns, female literacy and employment, availability of health functionaries like

ANMs, rural road infrastructure, etc. also got discerned. Thereby formulation and estimation of simultaneous structural system facilitated highlighting partial and total effects of the exogenous variables on the endogenous variables of the system and thus facilitated prioritization of alternate factors towards fertility reduction, MCH-care utilization and poverty alleviation.

It may be of interest to mention that total effects elicited out of the reduced form of the model depict that all the total effects of significant exogenous variables in each structural relation has come out to be much more pronounced compared with their partial effects.

Towards fertility reduction we find female literacy and contraception usage depict much stronger impact compared with other variables under the purview of the study. Thereby we find female employment and empowerment also play crucial role towards fertility reduction. Coming to mother and child health care (MCH3) we find that female literacy and female employment empowers them to make decisions towards availing of the MCH care, which certainly helps towards improvement in their well-being and also fertility curtailment. Female education and employment in the category of main workers reduce the extent of poverty in a district again. Also we find that usage of contraception also helps indirectly towards poverty alleviation due to reduced fertility. Alternatively, usage of contraception reduces the family size and thus with limited resources better living standards can be provided because of higher allocation towards the welfare of the limited family members. Better road connectivity of villages in India also helps towards poverty alleviation objectives.

The joint effects of contraception together with utilization of mother and childcare depict much stronger inhibitive impact on fertility. Clearly the interaction effect of MCH quality care and usage of contraception would bring about faster pace of decline in fertility and thus accelerate the process of population stabilization in India.

Appendices

TABLE 5
Description of the Variables under Study

Variable's Abbreviation	*Description of the Variable and Source of Data*
PBO3PN	Percent Births of Order 3 plus (DLHS-RCH, 2002)
PGMB18	Percent Girls Married Before Age 18 (DLHS-RCH, 2002)
PCUFPM	Percent couples using family planning method (DLHS-RCH, 2002)
MCH3	Mother and Childcare index based on 3 indicators (Gulati, 2005)
LITF	Percent Females Literate (Census of India 2001)
FMLITRAT	Female to male literacy ratio (Census of India 2001)
FWMAIN	Female Main Workers (Census of India 2001)
FWMAR	Female Marginal Workers (Census of India 2001)
HADBEDS	Hospital Beds Per Lakh population (CMIE, 2002)
PHCS	Primary Health Centers (CMIE)

(*Table 5 continued*)

(*Table 5 continued*)

Variable's Abbreviation	*Description of the Variable and Source of Data*
ANM	Auxiliary Nursing Midwives (CMIE)
PVNCPR	Percent Villages not connected by pucca road (CMIE, 2002)
PVELEC	Percent Villages Electrified (CMIE, 2002)
PPBPL	Percent Population Below Poverty Line (Gulati, 1998)
DDIO	District's Overall Development Index (Gulati, 1996)
URBP	Percent Urban Population (Census of India 2001)
PFSRTI	Percent Female Suffering from RTIs/STDs (DLHS-RCH, 2002)
PMUS	Percent Muslim Population (Census of India 2001)

TABLE 6
Descriptive Statistics of the Selected Variables

Variable	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
PBO3PN	1.90	73.7	44.25	13.31
PGMB18	0.00	84.00	35.60	19.25
PCUFPM	1.70	83.70	44.78	16.79
MCH3	–1.74	2.19	0.00	1.00
LITF	18.49	96.06	53.14	15.53
FMLITRAT	39.49	109.94	69.47	12.63
FWMAIN	13.22	94.79	55.20	16.78
FWMAR	5.21	89.25	46.30	17.06
HADBEDS	7.66	366.98	74.50	50.75
PHCS	0.52	34.91	2.84	1.58
ANM	3.37	456.53	101.84	63.35
PVNCPR	0.00	89.62	36.75	27.21
PVELEC	10.57	156.96	87.51	13.59
PPBPL	7.00	99.00	32.15	14.65
DDIO	–1.10	4.00	0.01	0.59
URBP	1.20	100.00	24.21	19.47
PFSRTI	0.10	86.50	28.45	12.50
PMUS	0.04	94.31	10.74	10.92

N = 593

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Chapter 19

Obstetric Risk and Obstetric Care in Central India

ALOK RANJAN CHAURASIA

Introduction

Central India comprises of the States of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, Uttar Pradesh and Uttaranchal. Before 1 November 2000, the state of Chhattisgarh was part of Madhya Pradesh; the state of Jharkhand was part of Bihar, and the state of Uttaranchal was part of Uttar Pradesh. These States also constitute what is known as the Hindi-speaking belt of the country. They account for approximately 45 per cent of the population of the country according to the 2001 population census. Selected indicators of population and development for central India and for its constituent States are given in Tables 1 and 2. Both the tables highlight the contrast between central India and rest of India in terms of demography and development. The proportion of population 0–6 years to the total population in central India is substantially higher than that in the rest of India indicating relatively higher fertility. The same is the case with the proportion of scheduled castes and scheduled tribe population. Similarly, the population sex ratio is relatively more unfavourable to females in central India than in rest of India.

In terms of social and economic development, central India lags far behind the rest of India. Literacy rate is substantially lower in central India and, in case of female literacy, there is a whopping gap of almost 19 per cent. Similarly, the proportion of main workers to the total population in central India is substantially less than that for the rest of India which reflects the relatively poor state of the economy. Most of the economy of this part of the country depends upon the primary sector of the economy which has got limited potential for growth.

The health and family welfare situation in this part of the country is also not satisfactory. There is a contrasting difference between the population and health scenario in central India

TABLE 1
Population and Development in Central India

Country/State	*Population 2001* *million*	*Population (0–6 Years)* *per cent*	*Sex Ratio* *1000F*	*Child Sex Ratio* *1000F*	*Scheduled Castes* *per cent*	*Scheduled Tribe* *per cent*
India	1028.61	15.93	1072	1078	16.20	8.20
Bihar	83.00	20.25	1037	1061	15.72	0.91
Chhattisgarh	20.83	17.06	1011	1026	11.61	31.76
Jharkhand	26.95	18.40	1063	1036	11.84	26.30
Madhya Pradesh	60.35	17.87	1088	1073	15.17	20.27
Rajasthan	56.51	18.85	1086	1100	17.16	12.56
Uttar Pradesh	166.20	19.03	1114	1092	21.15	0.06
Uttaranchal	8.49	16.02	996	1102	17.87	3.02
Central India	459.13	18.53	1076	1076	17.48	9.21
Rest of India	569.48	13.82	1069	1081	15.17	7.38

Source: Calculated from the information available from the 2001 population census—final population totals.

Remarks: Population and population (0–6 years) as enumerated at 0.00 hours of 1 March 2001.
Population sex ratio and child sex ratio are measured in terms of males per 1,000 females.
Scheduled castes and scheduled tribes are presented as proportion to the total enumerated population.

TABLE 2
Population and Development in Central India

	Literacy Rate			*Work Participation Rate*		
Country/State	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
India	64.84	75.26	53.67	30.43	45.13	14.68
Bihar	47.00	61.46	32.10	25.37	41.45	8.69
Chhattisgarh	64.66	77.38	51.85	33.86	45.28	22.31
Jharkhand	53.56	67.30	38.87	23.92	36.98	10.05
Madhya Pradesh	63.74	76.06	50.29	31.65	44.70	17.46
Rajasthan	60.41	75.70	43.85	30.86	43.65	16.97
Uttar Pradesh	56.27	68.82	42.22	23.67	39.21	6.36
Uttaranchal	71.62	85.41	58.14	27.36	38.70	16.06
Central India	57.22	70.49	42.95	26.65	41.30	10.88
Rest of India	70.64	78.91	61.81	33.48	48.22	17.72

Source: Calculated from the information available through the 2001 population census.

Remarks: Literacy rate is defined as the number of persons who can read and write with understanding for every 100 people with at least 7 years of age.
Work participation rate has been defined as the number of main workers for every 100 population. Main workers mean those workers who have worked for at least 6 months during the reference year.

vis-a-vis rest of the country, especially south India. It is argued that the population and health scenario that prevails in central India is largely responsible for the unacceptable population and health situation for the country as a whole. Information available from the sample registration system suggests that both fertility and mortality levels are highest in the central Indian states

as compared to other states of the country (Table 3). Information available from the sample registration system also suggests that the states constituting central India have always ranked amongst the poorest five since 1970 in terms of birth rate, death rate and infant mortality rate. There has been some improvement in the demographic and health scenario of this part of the country, but improvements in the demographic and health situation have not resulted in any significant change in the relative ranking of these states vis-a-vis other states of the country.

TABLE 3
Birth and Death Rates in Central India, 2002

	Birth Rate			*Infant Mortality Rate*		
Country/State	*Total*	*Rural*	*Urban*	*Total*	*Rural*	*Urban*
India	24.8	26.4	19.8	60	66	38
Bihar	30.7	21.6	23.4	60	62	49
Chhattisgarh	25.2	26.8	22.5	70	77	55
Jharkhand	26.3	28.5	18.9	51	54	34
Madhya Pradesh	30.2	32.1	22.5	82	86	55
Rajasthan	30.3	31.6	24.0	75	78	53
Uttar Pradesh	31.3	32.2	26.6	76	79	55
Uttaranchal	17.2	18.9	16.0	41	62	21

Source: Government of India (2005).

The poor population, health and development scenario in central India is associated with an orthodox society characterised by very strong caste and kinship structure. Females have got a low family and social status in the prevailing social and cultural milieu which is very well reflected in terms of an unfavourable sex ratio for females, very low female age at marriage, low female work participation rate and wide gap between male and female literacy. The relative disadvantage of females in the family and society in this part of the country is very well reflected in higher female infant mortality as compared to the male infant mortality. In the rural areas, this gap between female and male infant mortality rate further widens (Government of India 2004).

Obstetric Risk in Central India

Two indicators—maternal mortality ratio and the life time risk of a maternal death—are commonly used to measure the obstetric risk in women. The maternal mortality ratio is the most widely used indicator. It is the probability of a maternal death associated with a live birth. The World Health Organization defines a maternal death as the death of a woman while pregnant or within 42 days of pregnancy, irrespective of duration and site of pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental or incidental causes (WHO, 2004). The maternal mortality ratio, as defined by the World Health Organization, takes into consideration only live births. It excludes pregnancy outcomes other than live births. This exclusion is due to operational considerations rather than any theoretical

relevance. The life time risk of maternal death, on the other hand takes into consideration both the probability of getting pregnant and the probability of dying as the result of the pregnancy which are accumulated across a women's reproductive years. The life time risk of a maternal death is basically a cohort measure of the obstetric risk.

Estimates of the maternal mortality ratio and the life time risk of a maternal death for India and its constituent states have been obtained by a number of authors using different techniques (Bhat, et al. 1995; Bhat 2002; Ranjan 2005; Devraj, et al. 1994; Government of India 1999; Ranganathan and Rode 1994; Ranjan 1998). These estimates suggest that the risk of death due to complications of pregnancy and childbirth in India varies widely across the states of the country and women in the states constituting central India have highest obstetric risk in the country. It is estimated that except the state of Uttaranchal, the maternal mortality ratio in all the states of this part of the country was more than 400 maternal deaths per 100 thousand live births in the year 1999 (Ranjan 2005). In Madhya Pradesh (including Chhattisgarh), the maternal mortality ratio is estimated to be 498 maternal deaths per 100 thousand live births around the year 2002 which is well above the national average of 330 maternal deaths per 100 thousand live births (Ranjan 2005). In the year 2002, women in Madhya Pradesh faced highest risk of a maternal death during their entire lifetime in the country. The situation in other states of this part of the country is no better as may be seen from Table 4.

In terms of the lifetime risk of a maternal death, the situation in central India seems to be even poorer. In India, one in every 90 women faced the lifetime risk of a maternal death in the year 2002 (Ranjan 2005). Against this national average, in Madhya Pradesh, one in every 47 women had a lifetime risk of a maternal death. In other states of central India also, the lifetime risk of a maternal death is estimated to be well above the national average. The estimated very high lifetime risk of a maternal death in these states is the result of both high fertility and high maternal mortality ratio.

Another important feature of obstetric risk in central India is some very strong social and economic differentials in the maternal mortality ratio (Table 6). These differentials suggest

TABLE 4
Maternal Mortality Ratio in Central India, 2002
Maternal deaths per 100 thousand live births

		2002		
Country/State	*1999*	*Total*	*Rural*	*Urban*
India	396	330	402	135
Bihar	448	357	379	187
Jharkhand	517			
Madhya Pradesh	605	498	573	187
Chhattisgarh	548			
Rajasthan	503	465	515	215
Uttar Pradesh	604	402	447	190
Uttaranchal	343			

Source: Authors calculations.

TABLE 5
Life Time Risk of Maternal Death in Central India, 2002
Odds of maternal death in the entire reproductive period

	2002		
Country/State	*Total*	*Rural*	*Urban*
India	90	68	295
Bihar Jharkhand	62	56	165
Madhya Pradesh Chhattisgarh	47	37	187
Rajasthan	49	47	148
Uttar Pradesh Uttaranchal	53	45	144

Source: Authors calculations.

TABLE 6
Socio-economic Differentials in Maternal Mortality Ratio in Central India, 1998–99

	Bihar	*Madhya Pradesh*	*Rajasthan*	*Uttar Pradesh*	*India*
Education of mother					
Illiterate	626	775	641	837	593
Literate<middle	342	514	394	475	282
Middle complete	203	321	143	449	195
High School+	154	97	134	185	107
Religion					
Hindu	520	636	558	726	434
Muslim	528	381	430	526	331
Caste					
SC	645	708	677	854	498
ST	690	803	667	652	591
OBC	522	588	525	820	412
Others	351	371	456	534	313
Standard of living					
Low SLI	704	816	775	940	610
Medium SLI	367	646	579	675	380
High SLI	181	204	225	305	155

Source: Authors calculations.

Remarks: Bihar includes Jharkhand
Madhya Pradesh includes Chhattisgarh
Uttar Pradesh includes Uttaranchal.

that the risk of death associated with the complications of pregnancy and delivery is strongly influenced by the social and economic environment. This means that low to very low levels of social and economic development in all states of central India may also be a major impediment to an accelerated reduction in maternal mortality.

Obstetric Care in Central India

Efforts to develop a framework through which a maternal death can be linked with a set of proximate and background variables are rare. Fathalla (1987) has described 'the road to death' a woman follows. This road to death starts with underlying social and economic conditions facing women and includes demographic and health related factors including attention and care at the time of pregnancy. Thaddeus and Maine (1990), on the other hand, have developed the three delays framework that examines various factors that influence delays in deciding to seek care, in reaching a place where appropriate care is available, and in actually receiving appropriate care. Similarly, McCarthy and Maine (1992) have developed a framework for analysing the determinants of maternal mortality which is similar to the proximate determinants of fertility and child survival (Davis and Blake 1956; Bongaarts 1978; Mosley and Chen 1984). McCarthy and Maine argue that the first and the closest to maternal mortality is the pregnancy and pregnancy related complications. This means that availability of, access to and use of appropriate obstetric care services are critical to reducing the obstetric risk.

The appropriate obstetric care necessary for reducing the obstetric risk can be divided into the following five components:

- Fertility regulation primarily through the use of family planning methods,
- Prenatal check during pregnancy—ante-natal examination, tetanus toxoid vaccination, iron-folic acid, vitamin A, etc,
- Modern care at the time of labour and during pregnancy,
- Avoidance of harmful traditional practices, and
- Prevention of illegal induced abortions.

Information about the first three components of the appropriate obstetric care is available from the rapid household survey carried out under the Reproductive and Child Health Project on a national basis (International Institute for Population Sciences *no date*). This survey provides information on key indicators of obstetric care at the state and at the district levels. For the states constituting central India, this information is presented in Tables 7 and 8 along with the unweighted average that represents the situation in central India as a whole. It may be seen from these tables that the state of obstetric care in central India is grossly inadequate and the reach of obstetric care services is extremely limited. The poor state of obstetric care services in central India can be judged from the fact that less than 15 per cent the women in the reproductive age group surveyed had received full antenatal care comprising of at least three antenatal check ups, two doses of tetanus toxoid and iron supplementation; less than one fifth of the deliveries were institutional deliveries and less than one third of the women surveyed reported that either they or their husbands were using one or the other type of family planning method to regulate fertility. The seriousness of the situation can be judged from the observation that out of the 186 districts in central India at the time of the survey, in only four districts, more than 45 per cent women surveyed reported to have received full antenatal

TABLE 7
Obstetric Care in Central India, 1998–99

	Contraceptives Prevalence Rate (%)	*Prevalence of Sterilization* (%)	*Women Receiving at least One Antenatal Care* (%)	*Women Receiving Full Antenatal Care* (%)	*Safe Deliveries* (%)	*Institutional Deliveries* (%)
Central India	31.3	26.5	47.0	13.8	25.5	19.3
Bihar	22.4	20.2	26.1	7.8	19.0	15.0
Madhya Pradesh	42.6	37.9	52.8	19.3	28.7	23.5
Rajasthan	38.1	32.3	62.0	16.6	33.4	22.5
Uttar Pradesh	22.0	15.6	47.0	11.4	20.7	16.2

Source: International Institute for Population Sciences (no date).

Remarks: Bihar includes Jharkhand
Madhya Pradesh includes Chhattisgarh
Uttar Pradesh includes Uttaranchal.

TABLE 8
Obstetric Care in Districts of Central India

	Coverage Rate (%)				
State	*<15*	*15–30*	*30–45*	*>=45*	*All*
Contraceptive Prevalence Rate					
Central India	3	77	68	38	186
Bihar	1	37	4	1	43
Madhya Pradesh	0	3	18	24	45
Rajasthan	0	4	21	5	30
Uttar Pradesh	2	33	25	8	68
Full Antenatal Care					
Central India	118	56	7	4	186
Bihar	38	2	3	0	43
Madhya Pradesh	20	18	4	3	45
Rajasthan	10	20	0	0	30
Uttar Pradesh	50	16	1	1	68
Institutional Deliveries					
Central India	88	81	14	3	186
Bihar	29	11	3	0	43
Madhya Pradesh	16	22	4	3	45
Rajasthan	8	18	4	0	30
Uttar Pradesh	35	30	3	0	68

Source: International Institute for Population Sciences (no date).

Remarks: Bihar includes Jharkhand
Madhya Pradesh includes Chhattisgarh
Uttar Pradesh includes Uttaranchal.

care while in only three districts, the proportion of institutional deliveries to total deliveries was more than 45 percent. Similarly, in only 38 of the 186 districts of central India, the contraceptives prevalence rate was found to be more than 45 per cent. It is also clear from Table 7 that there are substantial differences among the four states in all indicators of obstetric care.

Table 7 also speaks of the poor efficiency of the available obstetric care services in central India. This is reflected from the fact that there is a wide gap between the proportion of women receiving any antenatal care and the proportion of women receiving full antenatal care. Similarly, the fact that there are very few safe deliveries in out of hospital settings also suggests that the reach of the health care delivery system is limited as far as appropriate obstetric care is concerned. On the other hand, the practice of contraception in this part of India is literally confined to female sterilization only. This shows that practice of family planning is not oriented towards reducing the obstetric risk and improving the health of the women.

Within state variations in obstetric care are also remarkable for their strength and persistence. The indices of inter-district inequality in three measures of obstetric care—full antenatal care, institutional deliveries and contraceptive prevalence rate—are given in Table 9 for the four states. This index varies from 0 to 1; a value 0 indicates that there is no inequality in obstetric care across the districts of the state whereas an index of 1 indicates that there is perfect inequality in the sense that all obstetric care services are concentrated in one district only. The table suggests that there is a high level of inequality across the districts as far as obstetric care is concerned. This means that coverage of obstetric care is very high in selected districts, a fact that is reflected from Table 8 also. It is also clear that inequality in obstetric care varies by different components of obstetric care and across the states also. This is so when a normative approach is applied for the development of health care services, including the obstetric care services, throughout the country and according to this normative approach, the availability of obstetric care services is more or less same in all states and in all districts. This implies that the observed inequality in the coverage of obstetric care is either due to inter-district and inter-state variations in the efficiency and quality of obstetric care services or due to exogenous factors affecting the use of available services or both.

Given the poor coverage of obstetric care in central India, there has been some investigation about the factors and determinants of the prevailing situation. An analysis based on the information available through the National Family Health Survey has suggested that women

TABLE 9
Inter-district Inequality in the Coverage of Obstetric Care Services in India

Obstetric Care Service	*Bihar*	*Madhya Pradesh*	*Rajasthan*	*Uttar Pradesh*
'Full' prenatal care	0.743	0.677	0.372	0.685
Institutional deliveries	0.606	0.542	0.377	0.467
Contraceptive prevalence rate	0.267	0.213	0.264	0.317

Source: Ranjan Alok [Chaurasia] (2004).

Remarks: Bihar includes Jharkhand
Madhya Pradesh includes Chhattisgarh
Uttar Pradesh includes Uttaranchal.

with poor and uneducated backgrounds and with at least one child are most unlikely to receive antenatal care in Madhya Pradesh, one of the constituent states of central India (Pallikadvath, Foss, Stones 2004). The study indicates substantial limitations of the health care services delivery system in overcoming social, economic and cultural barriers to access to obstetric care.

Similarly, Matthews and Johnson (2004) have observed that the increase in the institutional deliveries in central India has almost exclusively been confined to the private sector and it remains very inequitable—with a very significant bias in favour of the rich. As the result there has emerged a big gap between good quality and poor quality private provision of obstetric care services. The quality of private care accessed by the rich is likely to be considerably higher than the quality of private care accessed by the poor. The authors argue that a two tier private health care delivery system is likely to manifest in future in the absence of any effective system of regulating these services.

Emergency obstetric care plays a very crucial role in reducing the obstetric risk. It has been found that most of the maternal deaths are due to obstetric emergencies that suddenly erupt at the onset of labour or immediately after labour and that cannot be predicted in advance. It has also been found that the strategy of identifying high risk pregnancies during the antenatal period is not very effective in preventing deaths from obstetric emergencies. The reason is that women who show no high risk symptom during pregnancy has a relatively significantly higher probability of developing complications at the onset of the labour and immediately after it as compared to those women who are classified as high risk during the prenatal stage. As such, management of obstetric emergencies requires specialised services which are commonly termed as emergency obstetric care (EmOC) services. Universalization of the availability of emergency obstetric care services has been identified as one of the critical component of any strategy of reducing the risk of death associated with the complications of pregnancy and delivery.

Availability of EmOC services in central India, however, is highly deficient as is evident from the limited information available for Madhya Pradesh. A survey done in five districts of Madhya Pradesh indicates that comprehensive emergency obstetric care services are available only at the district hospital level (Ranjan, Gulati, Upadhyaya 2004). Comprehensive emergency obstetric care services were not available in any of the civil hospitals and community health centres in the five districts surveyed. On the other hand, basic obstetric care services were available in about two thirds of the community health centres and in less than 20 per cent of the primary health centres. More or less, a similar situation appears to prevail in Rajasthan.

The very fact that comprehensive emergency obstetric care services are available only at the district level is very well reflected from the fact that there was no cesarean section below the district hospital level in any of the five districts surveyed. At the community health centre, the average annual obstetric admissions were 680 which amounts to less than 2 admissions per day on average. Below the community health centre level, there was virtually no use of whatever emergency obstetric care was available; one reason may be that emergency obstetric care services below the community health centre are grossly inadequate.

If the evidence from Madhya Pradesh and Rajasthan is any indication then it is clear that the availability of emergency obstetric services in central India is highly inadequate and little

serious thought appears to have been given to universalize the availability of these services in the prevailing socio-economic and cultural environment. As the result, the reach of the emergency obstetric care services is extremely limited. The official approach to universalize the availability of these services is to promote institutional deliveries and develop community health centre as the first referral unit to provide emergency obstetric care but there is little wisdom about making available these services below the community health centre level. It is doubted that this strategy will have any significant dent on the problem of maternal mortality as majority of deliveries in this part of the country take place at home in a distant village, far away from a community health centre or a district hospital and where time and money cost of travelling to a first referral unit is unacceptably high. At the level of the community, most of the deliveries are attended either by traditional birth attendants—trained as well as untrained—or by members of the family who are neither skilled nor competent to handle obstetric emergencies. The situation may be addressed more effectively by evolving a more comprehensive, community-based approach that may ensure universal availability of emergency obstetric care services right up to the village level. There is little progress in this direction.

Universalizing Obstetric Care in Central India

Experiences and evidence from different countries of the world in addressing the prevailing maternal health issues and concerns provide important lessons that can be useful in universalizing obstetric care in central India. These experiences are:

(a) To be effective, programmes and activities directed towards improving the obstetric care must reach everyone in the community. Ensuring appropriate obstetric care is critical to reducing the obstetric risk. If obstetric care services are beyond the reach of the common people, they will contribute little to addressing their obstetric problems. There is now ample evidence to suggest that the medical technology has the potential of reducing the obstetric risk by at least 70 to 80 per cent if this medical technology can be made available and accessible to all sections of the community at an affordable cost. Unfortunately, the current capacity of the health care delivery system in central India—public as well as private—appears to be very limited in this regard. At the same time, the helth care delivery system is not able to overcome the economic, social and cultural barriers and attitudes to obstetric care that are so pervasive in this part of the country. Moreover, the public health care delivery system and the private health care delivery system compete with each other in a manner that does not promote public health, especially in the context of reducing the risk of death associated with the complications of pregnancy and delivery. This competition often aggravates the social, economic and cultural inequalities to obstetric care and obstetric risk. Universal availability of a basic set of essential obstetric services is crucial to the efficiency and effectiveness of obstetric care services.

(b) Practice of family planning is one of the essential requirements for addressing the maternal health problems but family planning alone is not sufficient to ensure a reduction in maternal morbidity and mortality. In view of the fact that practice of family planning plays a crucial role in lowering maternal risk, promotion of family planning must be an integral component of obstetric care services.
(c) Prenatal care is linked to improved maternal health but prenatal care alone is not enough to ensure a reduction in maternal risk. To be effective, prenatal care must be backed-up by efficient and institutional services of high quality.
(d) Community access to emergency obstetric care must be ensured in order to reduce the toll of death from unpredicted and unpredictable complications associated with pregnancy and delivery.
(e) Maternity care in pieces will not work. It is important that there must be a continuum of care, moving from the community to skilled medical back-up.
(f) Community-based obstetric care services can help educating people about safe delivery practices, how to recognize complications and where to go when complications arise. Success of the community-based approach depends upon the availability of and access to services that can treat the complications arising out of arise pregnancy and delivery.

These evidence suggest that universal availability of and access to appropriate obstetric care is critical to reducing the obstetric risk. If obstetric care services are beyond the reach of the common people, they will contribute little to addressing their obstetric problems. There is now ample evidence to suggest that the medical technology has the potential of reducing the obstetric risk by at least 70 to 80 per cent if this medical technology can be made available and accessible to all sections of the community at an affordable cost. Unfortunately, the current capacity of the health care delivery system in central India—public as well as private—appears to be very limited in this regard. At the same time, the health care delivery system is not able to overcome the economic, social and cultural barriers and attitudes to obstetric care that are so pervasive in this part of the country. Moreover, the public health care delivery system and the private health care delivery system compete with each other in a manner that does not promote public health, especially in the context of reducing the risk of death associated with the complications of pregnancy and delivery. This competition often aggravates the social, economic and cultural inequalities to obstetric care and obstetric risk.

Any attempt to universalize obstetric care in central India must begin at the level of the community as majority of the births in this part of the country take place in out of hospital settings. The first requirement in universalizing obstetric care, therefore, is to build up the community capacity to provide obstetric care which is largely absent at present. At the same time, it must be recognized that not all obstetric care can be provided at the community level. The community obstetric care must be supported by an efficient and effective institutional support mechanism. Like all health related issues, obstetric care is also hierarchical in nature. Majority of the obstetric care needs can be addressed at the primary level and only a few require very advanced level of care.

Based upon the above considerations, a model of universalizing obstetric care in central India is proposed in Figure 1. This model divides appropriate obstetric care into four categories according to the tier at which they can be delivered—obstetric first aid, basic obstetric care, expanded basic obstetric care and comprehensive obstetric care. The model also identifies the service providers who can provide different category of obstetric care services at different tiers of the health care delivery system. This model provides a comprehensive, system-wide approach of universalizing obstetric care services.

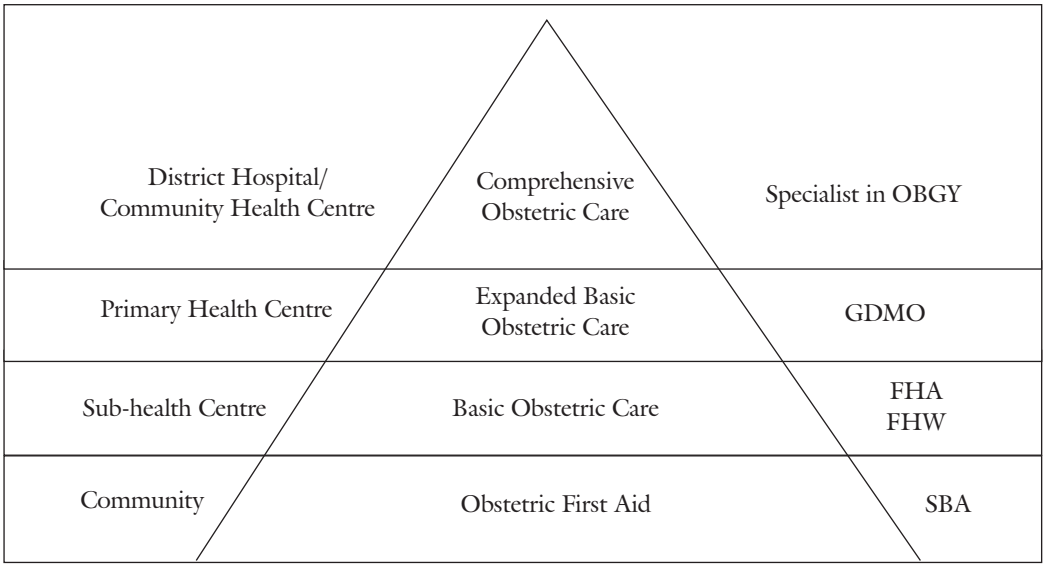
The emphasis in the model proposed for in Figure 1 is on universal availability and access to obstetric first aid at the level of the community at an affordable cost. This is possible by ensuring the universal presence of the skilled birth attendant in the community. The context is that the skilled birth attendant must have skills, knowledge and competence to conduct a normal delivery in out of hospital settings. At the same time the skilled birth attendant must also be able to recognize obstetric emergencies at an early stage, take appropriate precautionary measures and refer the women to referral institution at the earliest possible so that the woman in distress reaches the referral facility in a manageable condition. This is critical for the survival of the woman in distress. The recently launched National Rural Health Mission envisages presence of an Accredited Social Health Activist (ASHA) as the focal point of organizing Mission activities at the community level. In the context of obstetric care, it is important that this Accredited Social Health Activist is trained as skilled birth attendant also. This is a major challenge as the training facilities for community level obstetric care providers do not exist at present. The current structure, scope and coverage of training in obstetric care are basically designed in the context of delivering obstetric care in hospital settings only.

Conclusions

Central India accounts for nearly half of India's population. Therefore, the risk of death associated with complications of pregnancy and delivery and fertility that prevails in this part of the country has a major influence on maternal mortality and life time risk of a maternal death for the country as a whole. This part of the country shares the maximum burden of reproduction related morbidity and mortality of women. Reduction in maternal mortality and life time risk of maternal death in India, therefore, depends largely upon the reduction in maternal mortality and life time risk of a maternal death in central India.

The available evidence indicates that maternal mortality and the life time risk of a maternal death in central India is well above the national average and is a major impediment to an accelerated reduction in the risk of maternal death in the country. One reason appears to be the grossly inadequate availability of obstetric care services, especially the emergency obstetric care services. One implication of the inadequacy of emergency obstetric care services is that whatever limited obstetric care services are there they remain grossly underutilized. If this is so then universalizing the availability of obstetric care services may be necessary for addressing the obstetric care needs of the people. The framework suggested in this paper may be a beginning in this direction.

FIGURE 1
Universalization of Obstetric Care



Obstetrics first aid	• Limited identification of the problem
	• Bimanual massage
	• Fluids by mouth
	• Oxytocin
	• Referral
Basic EOC	• Identification of the problem
	• Bimanual massage
	• Oxytocin
	• Manual removal of retained placenta
	• Suturing perineum (up to 3rd degree)
	• Initial treatment of sepsis with injectable antibiotics
	• Management of preeclampsia and eclampsia through
	• initial doses of diazepam and MGS
	• Referral
Expanded Basic EOC	• Basic EOC, and
	• Suturing cervix
	• Abortion (incomplete and elective)
	• Vacuum extraction
	• Essential newborn care, resuscitation
Comprehensive EOC	• Expanded Basic EOC, and
	• Surgical obstetrics, anaesthesia and safe blood
	• Medical treatment of shock, sepsis, eclampsia
	• Safe abortion
	• Essential newborn care, resuscitation

Source: Ranjan and Gulati (2004).

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Chapter 20

Informal Sector, Networks and Intra-City Variations in Activities: Findings from Delhi Slums[1]

ARUP MITRA

1. Introduction

Notwithstanding the difficulties involved in defining the urban informal sector, the term has been used extensively, particularly in the empirical literature. Its relative size in India is quite large, and it is highly heterogeneous in nature, rendering it more difficult to suggest any uniform policy for improving the living standards of the workers located in this sector (Mitra, 1994). By and large the informal sector is seen to absorb residually in low productivity activities the surplus labour relative to the demand in high productivity activities, and those who cannot afford to remain unemployed for long. In other words, there are considerable overlaps among informal sector employment, poverty and slum dwelling. However, these informal sector workers form their own strategies to cope with poverty and overcome uncertainties relating to employment, consumption, health and housing. Informal institutions and networks have been developed over the decades to access information pertaining to the job market, enhance earnings and help experience upward occupational mobility over time. Based on a micro survey of slum households in Delhi, this paper highlights the role of networks in the context of occupational choice and earnings. The organization of the paper is as follows. Section 2

[1] With the financial support from the World Bank (V. Rao and M. Woolcock, Development Research Group, Washington D.C.) the survey was carried out in Delhi slum households by the Institute of Economic Growth under the World Bank sponsored project, urban poverty, social capital and risk management.

presents the analytical framework, section 3 describes briefly the methodology and section 4 focuses on the empirical analysis. The major findings are summarized with policy implications in section 5.

The database of the study is drawn from the survey carried out for 802 households in 30 slum clusters in Delhi, in the year 1999–2000, over a period of six months. In order to select the 802 sample households from 30 clusters we have used a three-stage stratified random sampling framework.

2. Analytical Framework

Studies on urban labour market have confirmed extensively the role of contact in accessing information pertaining to jobs in both formal and informal sectors. Banerjee's work (1986) on urban labour market and migrant households in Delhi brings out the importance of rural based search for urban jobs through contacts. These contacts operate through relatives, friends, members of own caste groups and co-villagers. About half of his sample of migrants seems to have migrated only after prearranging a job or after receiving assurance of employment from an urban-based contact. As job expectations were guided by information received from urban-based contacts, migrants were in general successful in obtaining their desired employment in the first instance. And informal non-wage workers were no more likely than formal sector entrants to keep searching for jobs (Banerjee and Bucci, 1994). It is interesting to note that migrants whose contact persons were engaged in unskilled manual occupations were informed about the same job more frequently than those whose contacts worked in non-manual and in skilled manual occupations (Banerjee, 1986).

Another major feature of these studies on labour market is that caste, income from first job, land ownership and sector of ownership are quite important in explaining the job search by rural migrants though among urban migrants they are not so important (Banerjee and Bucci, 1994). Scheduled caste migrants displayed a greater propensity than non-scheduled caste migrants for job search in the formal sector but not in the informal sector. This is primarily due to the reservation policy applicable to the scheduled castes in the formal sector.

On the whole, the assumptions of the probabilistic models that job search is entirely an urban based activity and that employment in free-entry activities is a means of financing the search for high income or high productivity jobs have been challenged, unfolding the importance of contact variables in rural-urban migration and rural based search for urban jobs, which could be largely in the informal sector also, instead of being confined to the formal sector alone. Below we deal with some of these points with greater details.

Ever since the advent of probabilistic models, issues of rural-urban migration in developing countries have invited both theoretical and empirical research. As mentioned above, it is by now widely acknowledged that rural migrants access information on the urban labour market through various informal channels, and tend to experience an upward income mobility by

migrating to the urban areas. However, one missing area of research has been the segmented nature of the urban labour market due to specialisation of activities in different areas (zones) within a city. Segmentation along the lines of caste, skill and education has of course drawn adequate attention of the scholars, but the physical segmentation of the labour market is an issue, which has received relatively less attention. By physical segmentation, we mean inaccessibility of certain kind of jobs by certain group of individuals, primarily because of the distance factor within a city (high income jobs may be available in a particular locality, but its physical distance from the place where one specific group of migrants reside in the city could be so enormous that such jobs may remain inaccessible to them). Even inexpensive (intra-city) transport for commutation need not eliminate these labour market barriers, especially in developing countries. Hence, occupational choice is greatly determined by the narrow spectrum of jobs available within the geographic area where the migrants reside, rather than by what they are capable of pursuing. Contact-based migration tends to end up in providing jobs in close neighbourhoods of their residence: the early settlers help their relatives, friends, members of the same caste groups and co-villagers to migrate to the city, by providing information on job and space to settle down, which is often in the same gamut of space and activities that they themselves have access to. As a result, occupational choice is more or less supply-driven, though from the macro point of view—keeping the entire city in the perspective—the equilibrium choice of occupation would be the outcome of both demand and supply side factors. It is also in sharp contrast to the popular interpretation of informal sector employment, namely the supply (of labour) push phenomenon. This perception gets further substantiated by the fact that intra-city differences (across space) in terms of development, infrastructure, and activities are too significant to be ignored. The present paper aims at capturing part of this aspect while analysing the occupational pattern of low-income households in the city of Delhi.

As already emphasised, the work of Banerjee and Bucci (1994) based on labour market in Delhi evidenced rural-based search for urban jobs. It confirmed that about one half of the rural migrants moved after fixing a job or after receiving assurances of employment from those with whom they have had a contact in the urban areas. This proportion was almost the same in both formal and informal sector entrants, indicating that informal sector jobs also act as pull factors for migration, rather than offering only a stopgap arrangement as the probabilistic models would hold. On the whole, the contact factor plays a crucial role in obtaining the desired employment within a short time span.

Further, we argue here that migrants in low income households prefer to reside near the work place and that the role of contact is not confined to merely information on jobs. It often provides shelter in the initial stages and helps in settling down. The co-villagers, relatives, kiths and friends have a strong tendency to live in the vicinity of the early settlers primarily because the jobs obtained through contacts are quite similar to those of the contact persons, particularly in the case of manual and unskilled jobs as also observed by Banerjee (1986).

The urge to reside near the work place is determined by a large number of factors, some of which could be traced to the very nature of activities the migrants perform. The self-employed workers in petty manufacturing and repairing activities often have their enterprises within the

household premises (see Sethuraman, 1976). Similarly the self employed and wage labourers in trading activities are required to use their work place for residential purposes as well, from security point of view. Sometimes their encroachment on public land poses the threat of demolition, and their constant vigilance of the unit of operation may be essential. At other times they are engaged by their employers outside the working hours to check burglary. This enables them to reduce their expenditure on rent thus reducing their cost of living in the city. Besides, community latrine and provision of drinking water in the market place attract many of them to reside close to the work place.

Another reason to stay in the vicinity can be identified in terms of multi-jobs that the members of the low-income migrant households usually take up. Women, who combine their household activities with jobs outside home (for example, domestic maids) are engaged in similar kind of jobs but in a large number of households, and prefer to have the place of work and place of residence close to each other. Even if the total income earned from all jobs is less than the income which could have been earned from the job available at a distant place, the former would be preferred as long as the cost of commuting and the opportunity cost of the time spent on commuting are large enough to reduce the potential earnings than the actual earnings. Perhaps this could be a reason of why Banerjee (1986) observed in Delhi that even a majority of informal wage sector entrants, who are believed to be the vulnerable lot relatively speaking, did not continue search after joining the first job.

The reason to reside in the neighbourhood of their relatives and friends or co-villagers deduces its roots from—other than economic factors—sociological and political factors also. With wide regional diversities in cultural background of the migrants in the face of their difficulties to adapt themselves to an urban cosmopolitan culture of the upper income groups, their urge to keep alive and enjoy in the city their cultural identity induces them to reside in close proximity to each other. In India, the multilingual and multiethnic identities of its citizens make such phenomenon even more important. Thus, the more heterogeneous culturally and ethnically an area/country is, the more likely it is that migrants would seek to settle in and around the areas of their brethrens. Besides, as mentioned above, activities of the contact persons (early entrants) and the late entrants being mostly similar, sharing of family or individual endowment in their pursuit of economic goals becomes almost inevitable. Efforts to delay demolition programmes planned by the city administrators, and attainment of quasi-permanent residential rights in the city are realised only through collective efforts which help secure the political patronage in exchange of their promise to operate as vote banks.

After mentioning the importance of contact in securing jobs and the urge to reside in groups formed on the basis of caste-kinship-co-villager bonds, and the preference of the low-income migrant households to locate near the work place, we now turn to the development of various nodes (centres) within the city, each characterised by specialised activities. As the literature on agglomeration (particularly the localisation) economies suggests, firms conducting similar activities tend to locate close to each other so as to reap the economies of scale (Henderson, 1988). Extending this argument—usually made at the inter-city level to explain the differences in activities that cities specialise in—to the intra-city level, the heterogeneity across space even

within a specific city can be noted. In other words, not all areas would conduct all activities—each would be responsible for the growth of a predominant activity depending upon the availability of resources required for its generation. Thus different centres within a city would have specialised activities, though from the overall city point of view all activities would appear to exist within its territory, thus creating the myth of a vast labour market. Empirically also, the heterogeneity of the city structure across space has been documented: the study by Dupont and Mitra (1995) divided the city of Delhi into several small units—census charges—and observed wide inter-spatial variations of socio-economic characteristics and activities. Further, they also found an incidental matching of these socio-economic variables with geographic zones of the city: while certain attributes were more conspicuously present in certain zones, others were absent in other zones.

3. Methodology

In this paper we examine specifically the role of informal networks used in accessing employment, and the geographical disparity within a city in terms of the availability and nature of employment propounded by the workers' choice factor as well. The methodology adopted for this is as follows. First, we have tried to bring out certain characteristics like the level of education, duration of migration, zone-wise location of the workers in different occupations based on bivariate tables. This is followed by a multinomial logit model, which relates variations in occupations to the differences in the nature of accessing information and their geographic presence, other than several household/individual specific variables.

As explained below we have considered 11 occupational groups, $j = 0, \ldots 10$.

The multinomial logit model for occupational choice is

$$\Pr ob\,(Y = j) = \frac{e^{\beta_j' x}}{\sum_{k=0}^{10} e^{\beta_k' x}} \tag{1}$$

The set of parameters β reflect the impact of changes in **x** on the probability.

However, there is an indeterminacy problem in the multinomial logit model and to overcome this problem the parameters of one group ($j = 0$ for example) are set equal to zero. The probabilities are, therefore,

$$\Pr ob\,(Y = j) = \frac{e^{\beta_j' x}}{1 + \sum_{k=0}^{10} e^{\beta_k' x}} \tag{2}$$

$$\Pr ob\,(y = 0) = \frac{1}{1 + \sum_{k=0}^{10} e^{\beta_k' x}} \tag{3}$$

As the parameters of one group are set equal to zero, the coefficients for all other groups are difficult to interpret. Since the coefficients are conditional upon the fact that for one group they are zero, they reveal the relative impact rather than the absolute effect. Therefore, we need to calculate the marginal effects of the regressors on the probabilities:

$$\frac{\partial P_j}{\partial X_j} = P_j(1 - P_j)\beta \tag{4}$$

$$\frac{\partial P_j}{\partial X_k} = -P_j P_k \beta \tag{5}$$

4. Empirical Analysis

The questionnaire contained information pertaining to the nature of employment such as self-employment, casual employment and regular salaried employment, and also the exact description of occupations that they are engaged in. Based on this detailed description about eleven categories of occupations have been formed: (i) specialised jobs in which workers are somewhat educated, (ii) sales, (iii) trading, (iv) personal service, (v) manufacturing, (vi) commercial service, (vii) transport, (viii) tailoring, knitting etc., (ix) construction, (x) security workers and (xi) repair workers. These groups are formed keeping in view some of the important categories that population census of India follow. Needless to add that during the survey the detailed occupational description was recorded, which ran into nearly 200 varieties. From this detailed listing 11 broad categories were formed keeping in view certain commonalities that they shared (details given in Mitra, 2003). Activities are so diverse in nature that they cease to be meaningful if we try to collapse the categories further.

It may be noted from Table 1 that construction and manufacturing account for more than 30 per cent of the total workers from slum households. Next to these are trade, sales and services (both personal and commercial) which together account for around 50 per cent of the total workers (Table 1). About 40 per cent of the workers are found to be illiterate, and a large majority of them are engaged in construction, personal services, sales and trade (Table 1). Next to the illiterates the second largest group is formed by those who studied between class 6 to 9. The occupational structure of these workers does not seem to be much different from that of illiterates except the fact that commercial services engaged a little larger percentage of workers in this group than the illiterate workers. Though only 7 per cent of the workers seem to have acquired an education of more than secondary level, their occupational pattern appears to be very different from those of the illiterates. Specialised jobs, sales and trade activities account for more than 80 per cent of the workers who attained an education of more than secondary level.

Table 2 gives the distribution of non-migrants and migrants by duration of residence across various occupational categories. It is noted that the incidence of all-duration migration in

TABLE 1
Occupational Distribution and Educational Background of Slum Workers

Occupation Groups	*Illiterate*	*Literate*	*Studied up to Class 3*	*Class 4 and 5*	*Class 6 and 9*	*Secondary*	*Above Secondary*	*Total*
Professional	2.8	0.0	6.3	3.4	5.5	8.6	21.3	5.5
Sales	14.5	12.0	10.9	12.9	12.5	9.3	11.2	12.8
Trade	11.7	28.0	14.1	14.3	15.1	16.4	21.3	14.7
Personal Service	19.9	14.0	23.4	10.2	9.6	2.1	4.5	13.4
Manufacturing	8.0	8.0	9.4	15.6	8.7	12.9	4.5	9.3
Commercial Service	9.9	6.0	9.8	9.5	13.3	13.6	12.4	10.9
Transport	2.4		1.6	2.7	4.1	5.0	2.2	3.2
Tailoring, Knitting	1.0	6.0	3.1	2.7	3.0	7.9	1.1	2.7
Construction	27.6	12.0	20.3	25.2	20.7	19.3	13.5	22.9
Security	0.0	2.0	0.0	0.7	1.5	0.7	3.4	0.8
Repairing	2.2	6.0	3.1	2.7	6.6	4.3	4.5	3.8
Total	100	100	100	100	100	100	100	100
	(39.5)	(4.00)	(5.11)	(11.7)	(21.5)	(11.1)	(7.1)	

Note: Figures along the column add up to 100 per cent. Figures within the parentheses along the last row add up to 100 per cent.

TABLE 2
Migration Status and Occupational Distribution

Occupation Groups	*Non Mig.*	*Mig. up to 1 Year*	*2–3 Years*	*4–5 Years*	*6–7 Years*	*8–10 Years*	*11–15 Years*	*16–20 Years*	*20 Years & above*
Specialised Jobs	8.1	18.2	3.4	9.8	5.8	4.9	4.9	4.2	2.5
Sales	13.1	0.0	10.3	34.1	11.5	17.6	12.0	11.5	9.4
Trade	9.6	27.3	10.3	12.2	17.3	12.7	19.1	13.0	21.3
Personal Service	16.7	9.1	17.2	7.3	13.5	9.8	10.7	14.9	11.9
Manufacturing	8.7	0.0	13.8	7.3	9.6	9.8	11.6	9.6	7.4
Commercial Service	15.2	9.1	10.3	0.0	7.7	4.9	5.8	12.6	13.4
Transport	4.2	0.0	0.0	2.4	5.8	2.9	3.1	3.1	2.0
Tailoring, Knitting	0.6	0.0	10.3	2.4	5.8	2.0	3.1	3.8	3.0
Construction	18.2	27.3	24.1	24.4	15.4	29.4	26.7	21.5	26.2
Security	0.3	0.0	0.0	0.0	1.9	2.0	1.3	1.1	0.0
Repairing	5.4	9.1	0.0	0.0	5.8	3.9	1.8	4.6	3.0
Total	100	100	100	100	100	100	100	100	100
	(26.6)	(0.87)	(2.3)	(3.3)	(4.1)	(8.1)	(17.9)	(20.7)	(16.10)

Note: See Table 1.

the total number of workers in our sample is more than 70 per cent. Around 55 per cent of the workers are reported to be long duration migrants, that is, more than 10 years of duration, and short duration migrants (that is, up to 3 years) comprise only 3 per cent of the workers. Employment in certain activities seems to change significantly with duration of residence. Manufacturing, for example, does not employ any of those who migrated in last one year or so.

Its share shoots up to around 14 per cent among those who migrated in last 2 to 3 years; thereafter it varies more or less between 7 to 9 per cent. This is indicative of the fact that jobs in activities such as manufacturing are available only when migrants develop access to information after they continue to reside in the urban areas. On the other hand, trading attracts both very short and very long duration migrants (20 years and above), because of different reasons though. Those who migrated in last one year or so are employed in this activity possibly due to the lack of entry barrier and low skill requirement. On the other hand, those who have worked in this sector for a considerably long period of time have possibly moved up the ladder by operating and expanding their own enterprises or so. Hence in understanding the occupational choice of the slum workers, duration of migration needs to be considered as an important variable. It is interesting to note that many of the long duration migrants have been residing in the city for more than 20 years or so. This is suggestive of strong rural-urban links, which are not merely of transitory type. Hence demolition of slums/ or eradication of informal sector activities from the city must not be perceived as a solution to the problems of city growth. Not because that it involves the question of livelihood of a large number, several activities conducted by them are conducive to the economic growth of the cities. Mobility that has taken place over the years as a natural response to economic opportunities, cannot be scraped unless development disparities between the place of origin and the place of destination are eliminated.

Distribution of workers by employment categories reveal that more than 40 per cent of them are engaged as casual labour; and the share of self-employment is also quite high (more than 27 per cent). This implies that a large number of slum households are susceptible to uncertainties in the job market and hence fluctuations in incomes. Those who are self-employed may not face labour market uncertainties but in terms of earnings they experience instability due to climatic, seasonal and other kinds of variations in the demand for their products.

For a better understanding of the distribution of slum households across the city we divided all the 30 sample clusters into seven zones in Delhi: (i) South, (ii) central, (iii) north-west, (iv) west, (v) east, (vi) north-east, and (vii) north. It may be noted that different regions seem to specialise in different activities. For example, in east and north-east Delhi commercial services account for about 23 and 24 per cent of the workers in these zones. Manufacturing is significant in north and north-west Delhi. South zone shows a larger share of personal services than all other zones. Trade is of course almost uniformly spread out in all zones. The percentage of workers engaged in this activity is mostly between 15 and 18 per cent except in south and north zones. The share of construction is highest in west Delhi (31 per cent) followed by central, south and north- west zones. Some of these patterns provide us insight to model the occupational choice.

Econometric Modelling of Occupational Choice

We noted large variations in occupations across zones, age groups, sexes, levels of education attained and migration status. These variables are, therefore, included in specifying the model

for occupational choice. The appropriate specification in this context is multinomial logit model as the dependent variable is qualitative. As parameters for all the sub-groups cannot be estimated, the occupation group 8 has been used as the reference category, that is, parameters for this group have been set to 0.

As mentioned above eleven occupational groups have been formed from a detailed list of around 200 occupational descriptions. These broad groups are broadly consistent with the categories followed by the population census of India. Further collapsing of groups does not seem to be justified on analytical grounds. However, even if we pursue it, the estimated values of the parameters in terms of significance do not improve adequately to provide any justification to the exercise.

Other variables introduced in the model are caste, household size, asset and network. Variables like age (AGE), household size (HHSZ) and duration of migration (DMIG) are taken in terms of their actual values. The rest of the variables are taken mostly in the form of dummies. GEND is the gender dummy, representing 0 for males and 1 for females. There are seven zones for which six zone dummies (zone 1 to zone 6) have been introduced. CAST1 takes a value of 1 for scheduled caste and tribes, and for the rest of the population it is represented by 0. The dummy for education (EDUC1) makes a distinction between illiterates (0) and literates (1) including those who have attained higher levels of education. The dummy, ASSET represents if households have cultivable land and/or house, with a value of 1, 0 otherwise.

In accessing jobs, as noted both in our survey as well as the surveys done by other researchers (Banerjee, 1986), networks are of great importance. These networks operate through various channels such as relatives, co-villagers, neighbours, friends, members of the same caste groups and so on. In order to capture the impact of networks we have introduced three dummies. NETWORK1 takes a value of 1 for individuals who got help from relatives (immediate relatives, spouse's relatives and general relatives) and 0 for the rest; NETWORK2 captures the impact of help received from co-villagers, members of the same caste groups, community fellows and friends, taking a value of 1 for them and 0 for the rest; NETWORK3 makes a distinction between individuals who received help from employers, NGOs, private companies and leaders and the rest, with values of 1 and 0 respectively. Those who did not receive any help from anyone and mostly depended on their personal efforts to find a job are taken as the reference category in specifying these network dummies.

It may be noted from Table 3, that for specialised jobs (OCCPZERO) both household size and duration of migration have a negative effect. Workers from larger household size (HHSZ) are perhaps less endowed with skills to graduate to better jobs. The coefficient of EDUC is positive and highly significant implying that literates and educated ones are more likely to get these jobs. Besides, women have a higher probability of getting these jobs. NETWORK1 and NETWORK3 representing the impact of relatives and NGOs etc. respectively are highly significant indicating the existence of both informal and formal flow of information pertaining to the job market. Interestingly scheduled caste/tribes are not found to show a higher probability of being located in these jobs. Zones 2, 3 and 4 are less likely to conduct such activities, or in other words these zones are less likely to have slum dwellers working as employees in specialised jobs.

Among sales workers (OCCP1), CAST shows a negative impact and only NETWORK1 plays a significant role in accessing jobs. Zones 2 and 4 show a lower probability of having sales workers. Women have a higher probability of joining trading activities (OCCP2). Age plays a negative role meaning that older workers are less expected to participate in these jobs. CAST again takes a negative coefficient and EDUC turns out to be positive and highly significant. Relatives again provide an important support in accessing jobs, i.e., (NETWORK1), and among various zones, Zone 4 shows a lower probability of locating workers in these activities.

TABLE 3
Occupational Choice Function (Estimate: MLE) Multinomial Logit Model

	OCCP0	*OCCP1*	*OCCP2*	*OCCP3*	*OCCP4*
EDUC1	1.37	0.05	0.85	0.62	0.72
	(4.02)*	(0.25)	(4.00)*	(2.29)**	(2.88)*
HHSZ	–0.14	0.08	0.07	–0.18	0.02
	(–1.87)**	(1.47)***	(1.33)***	(–2.67)*	(0.39)
DMIG	–0.13	–0.05	0.02	–0.08	–0.01
	(–2.58)*	(–1.36)***	(0.58)	(–1.84)**	(–0.24)
CAST	–0.50	–0.94	–0.76	–0.12	–0.37
	(–1.76)**	(–4.41)*	(–3.74)*	(–0.46)	(–1.58)**
GEND	1.34	0.17	0.73	4.40	1.40
	(2.78)*	(0.39)	(1.90)**	(12.77)*	(3.68)*
AGE	0.005	–0.01	0.03	0.03	0.003
	(0.28)	(–0.83)	(2.96)*	(2.57)*	(0.23)
ASSET	0.68	0.23	0.15	0.04	–0.13
	(1.60)***	(0.79)	(0.55)	(0.13)	(–0.43)
NETWORK1	1.31	1.19	1.32	1.61	1.45
	(3.59)*	(4.34)*	(5.05)*	(4.68)*	(4.60)*
NETWORK2	–1.13	0.29	–0.18	0.89	0.69
	(–1.47)***	(0.92)	(–0.54)	(2.44)*	(1.97)*
NETWORK3	1.20	0.04	–0.27	0.61	1.26
	(3.19)*	(0.11)	(–0.76)	(1.59)***	(3.87)*
ZONE1	–0.75	–0.67	–0.53	0.89	–1.66
	(–1.38)***	(–1.64)***	(–1.24)	(1.48)***	(–3.81)*
ZONE2	–2.01	–0.95	–0.73	–0.05	–1.84
	(–2.54)*	(–1.90)**	(–1.43)***	(–0.07)	(–3.32)*
ZONE3	–1.11	–0.59	–0.45	0.08	–0.74
	(–1.81)**	(–1.34)***	(–1.00)	(0.12)	(–1.71)***
ZONE4	–1.53	–1.04	–0.85	0.16	–1.95
	(–2.49)*	(–2.41)*	(–1.88)**	(0.25)	(–4.08)*
ZONE5	0.03	–0.88	–0.16	0.70	–1.37
	(0.06)	(–1.79)**	(–0.33)	(1.04)	(–2.71)*
ZONE6	–0.34	–0.35	0.05	–0.001	–1.06
	(–0.43)	(–0.58)	(0.09)	(–0.001)	(–1.65)***
CONSTANT	–1.25	0.22	–2.02	–3.20	–0.64
	(–1.34)***	(0.34)	(–3.09)*	(–3.55)*	(–0.89)

(*Table 3 continued*)

(*Table 3 continued*)

	OCCP5	*OCCP6*	*OCCP7*	*OCCP9*	*OCCP10*
EDUC1	0.80	0.65	1.82	20.76	1.02
	(3.25)*	(1.69)***	(3.51)*	(0.004)	(2.70)*
HHSZ	–0.007	0.14	0.04	–0.01	–0.06
	(–0.13)	(1.74)***	(0.39)	(–0.44)	(–0.70)
DMIG	–0.07	–0.06	0.13	0.004	–0.02
	(–1.75)***	(–0.90)	(1.65)***	(0.03)	(–0.29)
CAST	0.55	–1.16	1.24	0.16	–0.37
	(2.19)*	(–3.14)*	(–3.14)*	(0.24)	(–1.12)
GEND	1.70	–0.65	1.46	–30.09	0.10
	(4.69)*	(–0.62)	(2.34)*	(0.001)	(0.13)
AGE	0.05	0.004	0.001	0.06	–0.02
	(3.93)*	(0.18)	(0.03)	(1.52)***	(–1.20)
ASSET	–0.23	–0.21	1.07	18.63	–0.70
	(–0.84)	(–0.48)	(1.64)***	(0.003)	(–1.72)***
NETWORK1	1.63	0.90	0.69	1.19	1.87
	(5.28)*	(2.04)*	(1.42)***	(1.29)	(4.69)*
NETWORK2	0.72	–0.03	–32.09	1.78	0.22
	(1.90)**	(–0.05)	(0.0001)	(2.28)	(0.39)
NETWORK3	1.56	0.17	0.29	–30.55	0.72
	(5.06) *	(0.32)	(0.51)	(0.0001)	(1.38)***
ZONE1	0.73	–0.43	–0.45	0.85	–1.73
	(0.92)	(–0.59)	(–0.62)	(–0.68)	(–2.83)*
ZONE2	0.82	0.06	–1.17	–0.46	–1.70
	(0.96)	(0.08)	(–1.18)	(–0.35)	(–2.31)*
ZONE3	0.58	–0.87	–32.57	–1.52	–1.18
	(0.69)	(–1.04)	(0.0001)	(–1.02)	(–1.89)**
ZONE4	0.60	–0.97	–0.65	–0.78	–0.74
	(0.73)	(–1.22)	(–0.84)	(–0.63)	(–1.32)
ZONE5	1.89	0.21	0.62	–31.53	–1.62
	(2.31)*	(0.28)	(0.79)	(0.0001)	(–2.20)*
ZONE6	1.92	–0.88	–0.03	–31.53	–2.04
	(2.18)*	(–0.71)	(–0.03)	(0.0001)	(–1.76)**
CONSTANT	–4.56	–2.08	–4.32	–43.20	–0.02
	(–4.60)*	(–1.90)**	(–3.24)*	(0.0001)	(–0.02)

Note: OCCP8 is the comparison group. Figures in parentheses are t-ratios. *, **, and *** represent significant at 5, 10 and 20 per cent levels respectively. Chi-Square value is 905.38, which is significant at 1 per cent level. Pseudo R-square is 0.17. No. of Observations = 1258.

It is incorrect to believe that illiterates are more likely to be engaged in personal services (OCCP3). Similarly, it is not right to suggest that workers from larger households are hard pressed to find a job and hence they land up in personal services as entry barriers are mostly absent in these activities. Women, as expected, have a higher probability of being engaged in these jobs. Corresponding to manufacturing (OCCP4), literates relative to illiterates, and women workers show a higher probability. All the three network dummies are highly significant. Zones 1, 2, 4 and 5 are less likely to have workers in manufacturing.

In the case of commercial services (OCCP5) EDUC, CAST and GEND and AGE all have a positive impact. Relatives and NGOs etc. represented by NETWORK1 and NETWORK3 respectively are highly significant. Zones 5 and 6 seem to have a higher probability of locating these workers. It is interesting to note that jobs in activities like personal services are usually not available to lower caste individuals whereas commercial services are less affected by such factors.

In transport (OCCP6) scheduled castes are less likely to be employed. The role of relatives in getting these jobs again turns out to be significant. Tailoring and knitting (OCCP7) have a higher probability of employing women than men. Scheduled castes/tribes are less likely to be engaged in these jobs too possibly because of the lack of skill. Literates have an edge over the illiterates in joining these occupations. Security workers (OCCP9) mostly access jobs through friends and co-villagers and repairing workers (OCCP10) through relatives. Being literate places with a higher probability to find a job in repairing activities. Zones 1, 2 and 5 are less likely to house the repairing workers.

As already mentioned above, the parameters in a multinomial logit model are estimated with reference to parameters of a particular category being set to 0. Hence, interpretation is not invariably unambiguous. Therefore, marginal effects have been calculated to confirm the interpretation made on the basis of the estimate of the parameters. The marginal effects reported in Table 4 are more or less in conformity with what has been suggested above. For the construction activity (OCCP8) for which parameters were set to 0, observations can be made on the basis of the marginal effects. Illiterates seem to have a high probability of joining these occupations. NETWORK2 plays a positive role whereas help from relatives show a negative marginal effect. Zones 2 and 3 seem to be more concentrated by construction workers.

Apart from the eleven occupational groups, three employment categories have also been considered to run the multinomial logit model. Self-employment (EMP2) category is the comparison group. Corresponding to casual employment (EMP0) a large number of variables are found to be significant. With an increase in household size the probability of joining the casual employment falls. Long duration migrants are less likely to be in casual employment—with a rise in the duration of stay they manage to acquire more information on the job market, and hence move out of the domain of casual employment category. Scheduled castes show a larger probability of joining the casual employment as compared to the non-scheduled class category. Similarly women workers show a higher probability of taking up these jobs compared to men. Both NETWORK2 and NETWORK3 play a positive role in accessing this category of employment. All the six zone specific dummies have positive coefficients and they are significant (Table 5).

In the case of regular wage/salaried employment (EMP1), it is surprising to note that literates have a lower probability of getting such employment. This is possibly because of the fact that these jobs are in the lower spectrum of the income ladder, and hence literates/educated ones have a lower preference for these jobs. Women are less likely to get regular wage employment. The age factor also reduces its probability. Scheduled castes show a greater possibility of

TABLE 4
Marginal Effects: Occupational Choice Model

Exp.Variables	*P0*	*P1*	*P2*	*P3*	*P4*	*P5*	*P6*	*P7*	*P8*	*P9*	*P10*
EDUC	0.035886	–0.0852	0.0197	–0.0128	0.0002	0.0090	–0.0022	0.0298	–0.1664	0.1603	0.0115
HHSZ	–0.007237	0.0110	0.0111	–0.0234	0.0029	0.0002	0.0049	0.0012	0.0020	–0.0007	–0.0020
DMIG	–0.005652	–0.0027	0.0075	–0.0074	0.0018	–0.0045	–0.0009	0.0044	0.0067	0.0003	0.0003
CAST	–0.00939	–0.0770	–0.0624	0.0284	–0.0036	0.0962	–0.0265	–0.0246	0.0762	0.0040	–0.0026
GEND	0.076909	0.0296	0.1172	0.5982	0.1365	0.1927	–0.0187	0.0411	0.0147	–0.2402	0.0062
AGE	–0.00047	–0.0030	0.0026	0.0028	–0.0010	0.0037	–0.0003	–0.0003	–0.0031	0.0004	–0.0013
ASSET	0.026218	0.0037	–0.0075	–0.0212	–0.0307	–0.0470	–0.0129	0.0235	–0.0455	0.1474	–0.0342
NETWORK1	0.012734	0.0147	0.0367	0.0720	0.0352	0.0605	–0.0056	–0.0105	–0.2463	0.0009	0.0302
NETWORK2	–0.026897	0.1178	0.0667	0.2042	0.1230	0.1478	0.0194	–0.8490	0.1456	0.0193	0.0325
NETWORK3	0.054753	–0.0206	–0.0692	0.0547	0.0985	0.1485	–0.0008	0.0024	–0.0453	–0.2460	0.0198
ZONE1	–0.026978	–0.0531	–0.0400	0.1538	–0.1303	0.1084	–0.0054	–0.0053	0.0593	–0.0047	–0.0559
ZONE2	–0.081616	–0.0543	–0.0295	0.0638	–0.1222	0.1464	0.0188	–0.0174	0.1204	0.0005	–0.0446
ZONE3	0.002806	0.0737	0.1042	0.1663	0.0728	0.1898	0.0093	–0.8480	0.2659	–0.0029	–0.0007
ZONE4	–0.05571	–0.0670	–0.0482	0.0910	–0.1327	0.1216	–0.0144	–0.0035	0.1189	–0.0021	–0.0084
ZONE5	0.015582	–0.0805	0.0136	0.1270	–0.1039	0.2325	0.0149	0.0234	0.0569	–0.2503	–0.0525
ZONE6	–0.00241	–0.0064	0.0520	0.0400	–0.0711	0.2420	–0.0186	0.0073	0.0685	–0.2484	–0.0662
CONSTANT	0.032736	.2643	–0.0255	–0.1819	0.1124	–0.2956	–0.0075	–0.0670	0.4229	–0.3308	0.0694

Note: P0 to P10 stand for probabilities for each of the occupations OCCP0 to OCCP10.

TABLE 5
Employment Choice Function (Estimate: MLE)

Exp. Variables	*EMP0*	*EMP1*
EDUC	0.03 (0.16)	–0.83 (–4.98)*
HHSZ	–0.09 (–2.41)*	0.05 (–1.23)
DMIG	–0.12 (–4.40)*	–0.04 (–1.43)***
CAST	0.68 (4.37)*	0.33 (2.00)*
GEND	1.53 (6.71)*	–0.37 (–1.35)***
AGE	–0.009 (–0.11)	–0.02 (–2.45)*
ASSET	0.34 (1.68)***	0.10 (0.45)
NETWORK1	0.14 (0.77)	–1.18 (–5.74)*
NETWORK2	0.96 (3.71)*	0.25 (0.96)
NETWORK3	1.91 (6.78)*	0.43 (1.40)***
ZONE1	1.63 (4.74)*	0.45 (1.57)***
ZONE2	1.59 (3.90)*	0.53 (1.42)***
ZONE3	1.46 (4.01)*	0.37 (1.20)
ZONE4	1.04 (2.89)*	0.27 (0.91)
ZONE5	1.20 (3.29)*	–0.19 (–0.57)
ZONE6	1.82 (3.98) *	0.05 (0.11)
CONSTANT	–1.13 (–2.19)*	1.48 (3.11)*

Note: EMP2 is the comparison group. N = 1258. Figures in parentheses are t-ratios. *, **, *** are significant at 5, 10 and 20 per cent levels, respectively. The Chi-Square value is 371.76 which is significant at 1 per cent level. Pseudo R-square is 0.14. No. of Observations = 1258.

getting into regular jobs. NETWORK1 is highly significant but it is negatively related to EMP1. NETWORK3 takes a positive coefficient though it is significant only at 20 per cent level. Across space Zone1 and Zone2 are indicative of a higher probability of holding these salaried or regular wage jobs.

Having asset in terms of cultivable land and/or own house is also an important determinant of occupational/employment choice. For example, in the equations for OCCP0 and OCCP7, ASSET takes a positive coefficient though it is not highly significant. However, in repairing work, people with asset are less likely to join. In the equation for EMP0 also it is positive and significant indicating that with asset people rather dare to take up employment of unstable type.

On the whole, findings tend to support our hypothesis that the urban labour market is highly segmented in nature and a great deal of information on the urban job market flows through informal channels. Different regions within the city offer different work opportunities, and workers depending upon their location and information base access these jobs through various networks. In this sense a mismatch between supply of and demand for labour does exist across activities and across regions: though jobs at a higher wage may be available in a specific area, job seekers may not avail of them if their contact person(s) did not happen to be employed in these regions (and activities). However, the brighter side of the story is that outcomes in the absence of informal networks would have been much worse than the existing situation. The informal networks in the face of the diverse economic structure of the city are indeed the coping mechanisms for the low income households.

5. Conclusion and Policy Issues

In this paper we have focussed on questions relating to occupational choice, networks and physical segmentation of the labour market. Our analysis is indicative of associations among occupation categories (employment categories) and several individual attributes like education, migration status, asset, networks and the preference to reside near the work place. Certain occupations (or employment categories) are typically characterised by the presence of certain groups of individuals, indicating the significance of factors like gender and/or caste in the urban labour market. Two important findings relate to the significance of network dummies and the zone specific dummies in the equations for occupational choice.

The interconnections between network (and the nature of the network), and occupation type are noteworthy. While certain occupations are accessed through relatives (NETWORK1) certain others are acquired through co-villagers, friends etc. (NETWORK2) and certain others are secured through more formal contacts like NGOs etc. (NETWORK3), though more than one networks in certain occupations do operate simultaneously. On the whole, occupation, and network, are all in relationship governed by the factors like caste, gender, migration status, education depending on which the nature of contact and the access to information pertaining to the job market get determined. However, in our analysis the networks are treated as exogenously given. Although it is not uncommon to note that the informal networks play a major role in securing employment in the urban informal sector, the intricacies and the subtle forms of mechanism that operate in the urban labour market are of significant interest—without an understanding of these existing modes of operation policy suggestion for the betterment of the urban poor would be incomplete and may be misleading too. In suggesting policies for the urban poor or the informal sector workers, the importance of the informal institutions need to be recognised which have been in operation as a matter of social and cultural practices. By recognising these coping mechanisms policy interventions can be suggested which would be supportive in nature, and such policies are more cost effective compared to direct interventions.

The contours of associations as mentioned above, however, need to be understood in the perspective of the diverse nature of activities across space reflecting the heterogeneity of the socio-economic structure of the city. In other words, interconnections between individual endowment, preference for occupation type and its ultimate selection reflect themselves in the intra-city variation in population concentration, dwelling structure and congestion, given the spatial variation in the nature of economic activities conducted within the city. Our second finding relating to the zone specific dummies are suggestive of such tendencies. That workers only in certain activities are located in certain areas and not all, is indicative of strong differences in the city's socio-economic structure across space, broad overlaps between the place of work and the place of residence of these low income households, and thus the physical segmentation of the urban labour market. That not all slums are of the same type, and hence the problems they face could be quite diverse in nature are borne out by such

patterns. Policy measures for the improvement of the slum dwellers, however, do not seem to have considered these aspects.

The policy directives need to recognise efforts that are initiated and pursued by the slum dwellers themselves. This would not only reduce the burden on the public exchequer but also deal with the problems of slums, basic amenities and poverty more efficiently. Instead of the government being always directly involved in the process of employment generation in the informal sector on a large scale, measures, which are protective and supportive to the efforts made by the low-income households can be pursued to enable them to attain their goals (Mitra, 2003).

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Chapter 21

Arresting Out-Migration: Some Policy Considerations for Uttaranchal

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I. Introduction

It is by now a well-established fact that for Uttaranchal, also known as Uttarakhand or Hill Region[1] in Uttar Pradesh, out-migration and underdevelopment form part of a vicious circle, one being both the cause and effect of each other. This is a typical case of a region where its general backwardness acts as an important push factor in the out-migration of able-bodied working males, which in turn makes it difficult to implement developmental programmes in the region. This aspect needs particular attention, now that the region is going to acquire statehood. Presently, it is characterized by long distances and permanent or semi-permanent migration of skilled and unskilled manpower. Development programmes carried out in the region have not succeeded so far in restraining out-migration from the region. The appropriate development policies for the region should, therefore, aim at reducing the income and employment differentials between the hill and plain areas, so that long distance migration could be contained and diverted within the region. In this paper we focus on the policy and programmes for various sectors of the economy aimed at raising income and employment

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[1] The hill region of Uttar Pradesh initially comprised eight districts, among which Almora, Pithoragarh and Nainital fall under the Kumaun division and Chamoli, Dehradun, Pauri-Garhwal, Tehri Garhwal and Uttarkashi fall under the Garhwal divison. Between 1996 and 1998 these eight districts were rearranged to create four more districts, namely, Udham Singh Nagar, Champavat and Bageshwar in Kumaun divison and Rudraprayag in Garhwal divison. Now the proposed Uttaranchal state would comprise of 13 districts including Haridwar district.

opportunities and thereby reducing the negative impact of out-migration. However, before discussing these policies and programmes, it would be worthwhile to understand the causes and consequences of out-migration.

II. Causes and Consequences of Out-Migration

A hill region is generally characterized by high population pressure on limited land, lack of income-earning opportunities, poverty and general backwardness of the economy, all of which have turned out to be the major causes of migration. If all the hilly districts are taken together excluding the plain areas of Dehradun and Nainital districts, out-migration exceeds in-migration (Census of India, 1961; 1981a and 1991a). Micro village studies disclose that three-fifths of the households have at least one male out-migrant; one-third of the total hill population (including migration of households) and between 60 to 75 per cent of the workers had already migrated out (Bora, 1996; Khanka, 1988; Dhyani, 1994; Dobhal, 1987). What is more, the younger generation is also eager to migrate, primarily due to economic difficulties, which seem to constitute the predominant push factor. Similarly, of the total migrant workers from the villages of the hill region, about 89 per cent were reported to have migrated out for these reasons. By and large while push factors motivated 70 per cent of the migrant workers, pull factors did so in the case of only about 19 per cent workers. The remaining 11 per cent migrated out for purely personal reasons (Bora, 1996). At the village level, uneconomic holdings of cultivators, extremely low level of household income and lack of local employment were identified as the main push factors behind the decision to migrate. Specifically, the prime motive to move out is to alleviate the pressure of poverty in the households (Dhyani, 1994; Khanka, 1988; Dobhal, 1987).

It merits mention here that the state, has generally disregarded the hill region's development, which has fostered concentration of industrial infrastructure in big cities and towns in plain regions. With few avenues of local employment, the region has emerged as a supplier of manpower to the rest of the economy, turning it into, what in popular parlance is called a 'post office' economy, in which people survive on the remittances of those employed elsewhere.

In terms of demography, migration has caused a reduction in population growth and fertility in general (Bhat, 1996). Remote villages have experienced even a negative growth of populaton. A relatively higher rate of male migration has resulted in a very high sex ratio (in favour of female workers) in the working age group of 15–59 years, which is as high as 1,560 females per 1,000 males in remote villages (Bora, 1996). As a consequence there is a comparative shortage of males in the productive age groups.

Now it is being strongly realized that the out-migration process, instead of creating conditions of development has, in fact, created a vicious circle of underdevelopment and further out-migration. The lack of employment opportunities for the migrants who wanted to return, accounts for the low percentage of returning migrants. Significantly, nearly 50 per cent of the returned migrants were those who had retired from the defence services and were in the

age-group ranging between 35 and 50 years. Many of the returning migrants, therefore, become potential migrants, being still in the working age group.

The individual migrants do indeed benefit from out-migration by acquiring jobs, which are better in terms of status and salaries than what they could ever hope to get in the hills. With their success in acquiring high salaried jobs in urban destinations the hill migrants face a heavy burden of dependency. Thus, workers constitute only 30 to 35 per cent of the migrants. Inspite of their relatively higher earnings, the urban migrants remit on an average only 5 to 7 per cent of their income to their village home (Bora, 1996; Dobhal, 1987).

It is widely believed that remittances induce significant changes in the socio-economic conditions at the area of origin. In reality, however, remittances could not induce changes because of (i) low economic base of the hill region, and (ii) low and infrequent remittances. In the hills, since farmers with small holdings have little access to credit, technology and social infrastructure, remittances from migrants hardly make any visible developmental impact. The available estimates revealed that an average household's annual income in the U.P. hills was Rs. 5692, in which the share of remittances was 26 per cent (Bora, 1996). Although, this constitutes a substantial share it goes mainly into consumption expenditure. This also suggests that income generation opportunities within the village and within the local economy at commuting distances are limited. Thus, Uttaranchal needs a conscious intervention to ensure that the remittances are used in sustainable developmental activities.

While evaluating the cost-benefit effects of out-migration in the hill region, Bora (1996) shows that the region suffers a net loss due to out-migration. An average household with out-migrants had foregone Re. 1 (earned locally) for receiving 98 paise, received in the form of remittances and pensions from its out-migrants. Considering that remittances are the only benefit from the current migrants, an average household had foregone Re. 1 of local earning for receiving 89 paise as remittances. However, for households which had at least one out-migrant and returned migrant, the net benefit (per household) due to out-migration was positive, because the returned male workers were available to these households to earn some income locally and thus contribute to the household income apart from pensions and remittances sent by the out-migrants. Similarly, in the case of social benefit (regional society) when the pensions were kept out of benefits, the ratio fell below one[2] This comparative picture indicates that *out-migration from the U.P. hills is not only motivated by the remittances that are received from current out-migrants but also by the pensions that flow in the future when the migrants have returned*. The above findings reveal that the out-migration of males is mainly motivated by expectations of higher earnings in urban areas and in the defence services, in comparision to the low earnings within the region obtainable from agriculture. Had there been substantial

[2] While taking into account the time factor the present value of benefits from out-migration from the hills was lower than the present value of costs in the form of foregone earnings. For every Re. 1 of present value of foregone earnings, the present value of benefits received in the form of remittances and pensions ranges between 90 to 99 paise when the period of out-migration is as long as 40 years. If the average period of out-migration is 14 years, the latter comes down to 83–87 paise. Thus, the net result is that out-migration is not beneficial to the U.P. hill region (Bora, 1996).

opportunities of earning higher income necessary for a decent livelihood within the region, the out-migration of males to urban areas would not have occured on a large scale.

III. Policy Implications

Though the hills have the lowest population growth among all the regions of Uttar Pradesh, there is an acute population pressure on net cultivated land. With few exceptions, the hill region is economically overpopulated. Increasing population pressure coupled with adverse factors such as heavy dependence on low-productive agriculture, industrial backwardness, lack of social services, inadequate infrastructure and harsh geographical features characterise the region. As a consequence, employment opportunities are scarce. The overall development of the region is practically negligible as can be seen from Table 1. In respect of almost all economic activities, be it agriculture, manufacturing, industry or services, the six hilly districts are the least developed in the state. In fact, the index of development in all the six hill districts has registered negative growth.

As we have seen, while migration solves the unemployment problem to some extent, it decisively makes the regional economy dependent on outside income and as a result impedes growth. It is increasingly being realized that if out-migration continues unabated, it would result in permanent underdevelopment or backwardness of the region. The drain of skilled and unskilled manpower together tends to make investments in the region less attractive, thus hampering the prospects for future development. Under these circumstances major development activities have to be initiated, so as to provide work to the workers, thereby containing the tide of migration. This can be possible by encouraging new economic activities in the agricultural and non-agricultural sector. Naturally these activities depend greatly on the state's role in the development of the region so that the "push" factors of migration are eliminated or their influence is reduced. The policy implications in this context are discussed in the following section.

IV. A Policy Perspective

In the effort to boost the development of the hill region, policy initiatives need to be taken in certain key areas. These are discussed below:

1. Agricultural Diversification

Overdependence on agriculture is a mark of economic backwardness. If all the hill districts of Uttar Pradesh are taken together, agriculture is the mainstay of 70 per cent of the workers

TABLE 1
District-wise Levels of Development in Uttaranchal

Items	*Almora*	*Chamoli*	*Dehra-dun*	*Garhwal*	*Nainital*	*Pithora-garh*	*Tehri Garhwal*	*Uttar-kashi*	*U.P*
Relative index of Development	46	38	142	51	132	55	40	47	72
% of urbanization	6.40	8.91	50.26	11.86	32.66	7.44	5.67	7.20	19.84
Growth of urban population:									
1981–1991 (% change)	–0.34	21. 84	38.19	32.58	59.87	56.02	60.53	29.23	39.0
Levels of agricultural development									
Value	–0.38	–0.64	–1.10	–0.62	0.87	–0.45	–0.52	–0.38	0.48
Rank	296	330	364	329	47	308	318	294	–
Levels of development in manufacturing									
Value	–1.17	–1.06	0.70	–1.16	0.16	–1.34	–1.70	–1.43	–0.62
Rank	337	321	89	335	145	353	366	358	–
Levels of development in services									
Value	–0.60	–0.51	1.59	–0.45	0.27	–0.71	–0.72	–0.49	–0.56
Rank	227	205	16	195	81	255	258	202	–
Levels of development in Industrialization									
Value	–0.65	–0.66	0.54	–0.65	0.44	–0.76	–0.86	–0.65	–0.24
Rank	317	323	63	318	79	342	351	319	–

Note: CMIE (1993) for Relative Index of Development and percentage of urbanization. The sectoral levels of development are from Gulati (1992). To highlight the aggregate and sectoral aspects of development at the district level, a total of 369 districts in India have been included in this study.

(CMIE, 1993). Micro village-level studies have shown that about 80 per cent of the working population in the remote hill villages are engaged in crop agriculture and animal husbandry. Despite a very high cropping intensity, the value of own produced food (cereals, pulses, oilseeds, etc.), out of the total expenditure on food, was only 39 per cent. The balance 61 per cent of the food required is imported from other regions (Bora, 1996). This speaks of an agriculture characterised by poor productivity, low income and stagnation.

What is needed is to reform the present mode of cropping in agriculture and the animal husbandry sector. Almost all the plan documents of the Uttar Pradesh Government lay emphasis on the region's great potential for generating high income per unit of land by diversifying agriculture. The variation in climatic conditions strongly favour diversifying agriculture into horticulture, namely, fruits, cut flowers, mushroom and exotic and off-season vegetables. Also, efforts need to be made to develop ancillary horticultural activities like floriculture, apiculture, mushroom production, etc., in areas suitable *for* the particular activity. This will of course require infrastructural support in the form of soil and water conservation measures, irrigation facilities, and credit and marketing support. Except in a few localities, these measures have so far not been implemented due to lack of institutional support, scarce local capital and chronic backwardness.

The districts of Himachal Pradesh, which have diversified into vegetables and fruit farming have attained higher levels of growth in aggregate output of crop and per capita income. This has also increased opportunities for non-farm employment in those districts (Azad, 1988; Chand, 1995). They also found the value of output per unit area from vegetables and fruits in the hill areas are many times higher than from traditional crops.

In Uttaranchal a two-fold agricultural strategy is required. Where conditions are suitable for food-grain production, the stress must be on changing from low-yielding coarse cereals and pulses to high-yielding rice and wheat. In other lands, the effort must be to shift from food-grains to high-value crops, such as vegetable and fruits. The twin measures would go a long way towards solving the multiple problems of food production and income and employment generation. As the hill economy gets diversified and commercialized through these measures the wage and income earning opportunities are enhanced within the area, or at com-muting distances, thereby reducing forced migration. Having similar geographical conditions, the neighbouring state of Himachal Pradesh, has achieved considerable success through agricultural diversification, which has also increased opportunities of non-farm employment (Azad, 1988; Chand, 1995). The central message of the above discussion is that Uttaranchal needs to move away from an attitude of benign neglect to careful policy planning, taking advantage of Himachal's experience. The adoption of these measures would reduce the rate of out-migration considerably.

2. Generation of Non-farm Employment

Due to the underdeveloped agriculture, non-farm occupations in Uttaranchal are also scarce. While between 75 and 82 per cent of the workers in the hill area (excluding plain portion)

work in the primary sector, village-level studies show that only about 10 per cent of the rural workers are engaged in non-agricultural occupations like small trade, government service and other professions as their main occupation. In the case of unskilled workers wage earning opportunities are limited to only 7 per cent of the total workers. And even these are available only in villages located near the urban centres. In the primary sector, females of all ages (even those below 15 years and above 60 years) have joined the work force, mainly because of the absence of male members from the household. *On an average, the number of female workers per household is almost double than that of male workers. In the absence of adequate wage and income earning opportunities, about half of the resident workers, both male and female, are under-employed, there is no productive work for them for periods ranging from one to seven months (Bora, 1996; Khanka, 1988)*.

Various studies have shown that the higher the degree of agricultural diversification, the lower is the direct employment of the family work force in agriculture. Vegetable and fruit cultivation creates greater manpower demand for grading, processing, packaging, transportation, marketing and management operations. The Himachal experience shows that vegetable cultivation has brought improvement in income, and a higher percentage of workers joined farm-related service sector. Local employment in trade and business activities is invariably higher in areas where diversification has taken place.

The linkage between farm and non-farm activities is the key to progress. Farm-related activities such as horticulture, animal husbandry, pisciculture, piggery, fishery, poultry are all supposed to open up non-farm employment avenues and, additionally, lead to the growth of small and cottage industries. The employment opportunities, thus created will absorb most of the local labour in the region or within commuting distance. The resulting growth of local towns and service centres will in turn give a boost to manufacturing activities (Oberai, 1981). To facilitate this developmental process, public policy should aim at providing basic infrastructure like roads, communication networks and market yards in the hills.

3. Land Development Activities

The success of diversification and modernization of agriculture depends to a considerable extent on the size of land holding, since the owners of marginal holdings generally shy away from making investments for introducing changes. In the hills the average landholding per household is just half a hectare, which includes rocky and fragmented parts of the holding (Government of Uttar Pradesh, 1990). Only 13 per cent of the geographical area of the region is under cultivation, while vast areas of barren land have wrongly been classified as being, 'under forest cover'. According to the Forest Survey of India, forest cover in the hill region of Uttar Pradesh is only 43 per cent as against 54 per cent of the geographical area as given in revenue records (Kadekodi, 1997; GBPIHED, 1992). *If the vast unused, barren and uncultivable lands which are wrongly classified as forest lands are properly developed and utilised, they can become an important source of wealth for the hill region. Newly developed land could be leased out to the local people*. If the spatial location technology and crop production technology are applied

with the appropriate cropping at the right places, sustainable development will take place. Instead of migrating, potential migrants will then have access; locally available employment opportunities this will be form of rural to rural migration.

4. Integrated Rural Development

While the hill region is relatively well endowed with natural resources, it has not been able to develop and utilize them for the benefit of its people. This is because it is at a great disadvantage in the provision of basic infrastructural facilities and services such as all weather roads, link roads, schools, drinking water, electricity, hospital and medical facilities, and transportation and communications (Government of Uttar Pradesh, 1990). *Not only are the public facilities and amenities in rural areas, where most of the population of the hill region reside inadequate, but they are also very poorly organized and undependable*. This also suggests that the national norms laid down by the Government of India for minimum needs programme do not suit the hill areas due to their sparsely/thinly populated settlements. All these factors are inducing negative changes in economic and social attitudes.

About 92 per cent of the population in Uttaranchal (excluding the plain parts) live in rural areas (Census of India, 1991b) and, therefore, rural development implies overall development of the hill region. The benefits of the development of social and economic infrastructure in the rural areas tended to accrue to the better-located places rather than the entire rural hills. In addition, there is a considerable degree of public fund leakages in the delivery system.

Given the dismal socio-economic scenario of the hill region, people migrate to towns not only for employment but also for better education, health and housing. The improvement in living conditions in the rural areas would have a significant effect on internal migration. Despite the large number of rural development programmes in the hills, their impact on restraining migration through income and employment generating activities has not been perceptible. Programmes like Training of Rural Youth for Self-employment (TRYSEM), Development of Women and Children in Rural Area (DWACRA) and Drought Prone Area Programme (DPAP) need to be implemented in full measure. However, the success of a scheme like TRYSEM depends critically on the demand for the particular services in which the youth is trained. The training imparted needs to be relevant to rural areas, so that self-employment opportunities are opened up for the unemployed rural youth. In view of the imperative need to assure jobs in the hill region, so as to prevent the drain of human resources to the urban areas, a scheme similar to the Employment Guarantee Scheme (EGS) in rural Maharashtra would be best suited for the region. This scheme guarantees at least 90 to 100 days of employment per person and has been able to significantly reduce unemployment in rural areas (Planning Commission, 1992). Also, land development, horticultural development and agricultural diversification activities suggested earlier could be taken up under EGS scheme. This can be performed individually or collectively by men and women at the village level.

It is felt that for the successful implementation of rural development programmes, the local people must serve as watchdogs, but in the case of the hill regions, due to the migration of educated people from

the villages, creating such watchdogs among the locals become difficult. Therefore, there is a need to impose strict administrative and legal controls on the Panchs, Sarpanchs (chief representative) and Gram Sachives (village secretaries). Clearly in order to ensure sustainable development a change in attitude and approach to development is required. At the outset to reduce the migration flow from the hills, the rural development programme will have to be revamped in order to make it more effective, more productive and more reflective of rural needs. More than just achieving targets, which is generally the government's criterion *for* assessing a programme, what is needed is sustained follow-up action, better maintenance, provision of manpower and cooperation between various agencies and local people (Mishra, 1984).

5. Promoting Industrial Development

Employment opportunities in a region are positively associated with the relative index of development. In Uttaranchal this association is quite poor, with only two districts, Dehradun and Nainital, being among the more industrialized districts—their index of industrialization being 0.54 and 0.44, respectively, as compared with the all-India average of 0.38 (CMIE, 1993; Gulati, 1992). The index of industrialization of the other six hill districts in the region (Table 1), however, is negative, ranging from –0.65 to –0.86. In relative terms, the share of the manufacturing sector in total net output at current prices in 1986–87 was only 11 per cent-the lowest among all the regions of Uttar Pradesh (Government of Uttar Pradesh, 1990). The income and employment generating activities of registered factories and household industries in the region are also almost negligible. This state of affairs is mainly attributed to the neglect of the development of industrial and manufacturing sectors until the Fourth Plan (Government of Uttar Pradesh, 1977).

Keeping in view the rich natural resources of hill areas such as forest, minerals, water, livestock and agro-climatic conditions, the region has great potential for industrial development. It is also characterized by high literacy, and a high proportion of skilled (returned) and potential return migrants, which can provide a stimulus to a industrial activity. For financing investment, apart from obtaining institutional assistance, earnings from migration could be channelised for giving a boost to development.

A strong agricultural base can contribute to the rapid development of other sectors in the economy. In Uttaranchal, agricultural development through diversification can lead to considerable industrial activity, by providing raw material for agro-industry, agro-forestry and livestock-based industries. The limited availability of cultivable land, however, limits the scope for further expansion of agriculture. The region, however, offers good scope for industrialization. To meet the needs of industrial investment, initial efforts ought to be focused on promoting family-run, jointly run and individually run factories and enterprises. Entrepreneurial development programmes with a focus on industries best suited for the region, may be launched. To begin with, immediate emphasis will need to be given to the development of resource-based industries, such as tea, leather processing and leather goods, dairy products,

horticulture and forest-based products. Estates could be developed for promoting tourism, industrial development, information technology, horticulture, goat and sheep rearing and forestry. Large scale development of winter and summer sports complexes is another possibility. Traditional crafts have a great export potential, which could be tapped by providing infrastructural support in terms of training programmes, marketing and export promotion services. Once these activities are started within the region, the surplus and underemployed labour force will get absorbed. As a result instead of out-migration, return and in-migration will take place, on an increasing scale.

6. Regional Urbanization

In Uttaranchal, towns are scarce. There is not a single class-I and class-II city in the six hilly districts. Almora, Kotdwar, Pauri, Pithoragarh and Tehri are class-III cities. Even some of the district headquarters have so far not achieved the status of a class III city (Bose, 1994). It may be seen from Table 1 that the pace of urbanization in all the six hill districts is very slow. The disparity in urbanization is quite marked across the districts. Even during the decade, 1981–91, the increase in urban population was well below the state average of 39 per cent, particularly in Almora, Chamoli, Uttarkashi and Pauri-Garhwal. The negative growth of urban population in Almora district reflects a neglect of the strategy of expansion of old towns and establishment of new local towns. Rural-urban links between the district headquarters and other small towns are quite poor, being mostly limited to administrative matters.

The extent of urbanization is positively related to the pace of developmental activities. In the six hill districts only about 8 per cent of the population live in urban areas (Table 1), whereas in two of the districts (Dehradun and Nainital) the concentration of non-agricultural economic activities has given rise to a high percentage of urban population. It has been observed that given a choice, migrants prefer shorter-distance to longer-distance migration. It has also been noted that the presence of towns and cities in the hills tends to reduce long-distance out-migration from the surrounding villages considerably (Bora, 1996).

In a hill setting, where the population is scattered and overall density is low, the census definition of an urban area is inappropriate. A more suitable definition of such an area for the hills would be agglomerations that have a minimum population of 2,000 (instead of 5,000 as given in the census), and where at least 60 per cent (instead of 75 per cent) of male population is engaged in non-agricultural pursuits. Basic urban services must be provided to all agglomerations, which satisfy this criterion. This necessitates the involvement of government as well as private agencies.

7. Optimum Use of Natural Resources

Forest policy in the hill region needs to be tailored to meet the livelihood requirements of hill people. *Since farmers in the hill region cannot acquire large fertile farms or obtain employment within and outside agriculture to supplement their income, the option of giving them ownership rights*

of local forests merits consideration. This will induce them to give greater attention to forestry, with inter-cropping options such as farm forestry and agro-forestry. At present, the villagers have no incentive to preserve and regenerate species having high commercial value in the local forests at the village periphery. In the present dispensation, where they do not have even rights over their trees on the bunds and corners, the villagers are discouraged from taking up agro-forestry activities. The vesting of ownership right of trees to villages will prevent indiscriminate felling and exploitation of forests. This will also encourage the development of entrepreneurship and participatory community development through the formation of village-level cooperative societies. Once the preservation and regeneration of various species is ensured, the ill effects of soil erosion can be eliminated effectively. Forest-based activities will also significantly reduce out-migration.

Like forests the river water does not benefit the hill region. Appropriately the hill region could be given some compensation from the plain regions of India for providing water to the latter so that some investment would be made on water harvesting and the distribution system within the region. If irrigation supplies can be made available for ensuring timely sowing and to compensate for the deficiency of rainfall, better crop yields can be expected. Such changes can reduce the dependence on employment and income from outside the region.

Mammoth national development project like the Tehri dam have proved harmful to the hill region. The money and time spent in constructing the dam, which has yet to be completed, would have enabled the completion of hundreds of small multipurpose river projects. Massive projects instead of stemming out-migration displace rural people. In cases where displacement becomes inevitable, at least, the displaced persons should be rehabilitated by providing better infrastructural facilities than the present situations. The hill region is rich in valuable mineral deposits, which calls for intensive geological exploration. If all its natural resources are scientifically exploited, ancillary investments within the region can be stepped up, giving a boost to its economy.

8. Optimum Use of Migrant Skills and Earnings

Out-migrants and returning migrants are a potential asset, which can be tapped for the benefit of the hill economy. About 75 per cent of the returned migrants bring with them skills, experience and investible resources in the form of ready savings or regular pension flows. But in the absence of a proper investment climate, the remittances of out-migrants and savings of returned migrants are at present largely used for consumption, social ceremonies, house repair and house construction, which are non-productive. Their acquired skills also have little relevance to the village (Bora, 1987). In these circumstances, there is hardly any effective involvement of the out-migrants as well as returning migrants in the economic development of the hill region. Thus, the actual benefits of migration to the economy have yet to be harnessed. If properly channelised, the funds generated by out-migrants and returning migrants can effectively contribute towards the commercialization and industrialization of the region. This in turn would attract higher remittances from out-migrants.

The policy objective should be to devise strategies to incorporate the contribution of migration into the development planning process. An active institutional framework is needed to encourage the transfer of migrants' savings through financial intermediaries and investors. The government, financial intermediaries and small-scale industrial/investment corporations can do more to channel these savings into productive investment, including setting up their own business. This could be preceded by entrepreneurial training programmes. Amjad (1994) has suggested that bank officials in areas where there is a large concentration of return migrants could be trained to provide guidance service to potential investors. In the hills, officials of the postal department, rural cooperative societies and district industry centres should also be directed to avail such training. This requires vigorous policy measures. Once migrants' skill and fund are effectively utilized in income and employment generating activities, the future flow of out-migration could be reduced.

9. Vocational Education

It is unfortunate that while the hill regions have a higher level of literacy than the all-India average—the type and the quality of education provided in these regions is not suited to the needs of the hill economy. This has been one of the major reasons for out-migration. Most of the educated having received academic education want salaried jobs and shun self-employment. The region requires a refocusing of education towards vocational and technical education. Academic education generally leads to higher earning aspirations, draining the region of qualified persons and as a consequence reducing the skill level below the minimum necessary to pursue developmental activities. Therefore, particular attention needs to be paid to imparting more skill-oriented education to population in the region.

There is a high level of illiteracy among women, a consequence of which is that they lack requisite skills, and have a low social status. They are not exposed to the impact of technological change. Women's education, therefore, needs priority in the hill districts. It is necessary to launch various programmes aimed at offering women a wider range of both vocational training and jobs, so that the prevailing drudgery of women could be reduced. As per the climatic conditions and their socio-economic background, the most viable income generating training programmes for women would be mushroom cultivation, bee-keeping, sewing and stitching, weaving and knitting, carpet weaving, food processing, soap-making, silk production, herb and vegetable drying, pickling, forestry and nursery cultivation. Once trained, they may be given income-generating assets and marketing support. This is also likely to encourage the menfolk to participate in the projects of their spouses rather than migrate out.

10. Development Efforts by the State

All through the planning period the hill region has been allocated a low proportion of the plan outlay compared to its share of population. It has been lower than the all-state average

and lowest in comparison with other hill states. The per capita outlay in Eighth Plan for this region was 6 per cent lower than that of Himachal Pradesh (Government of India, 1992). To ensure parity in development with the special category states, the per capita outlay for the U.P. hills needs to be more than double that of Himachal Pradesh. Central assistance on a scale and pattern similar to other hilly states is needed for U.P. hills (Government of Uttar Pradesh, 1980).

To compensate for past neglect, increasing investments with a high capital content need to be made in the hill region. Finally, *a separate state, with a government exclusively of and by the people of the region committed to development is expected at the same time to stem the tide of out-migration while utilizing and recognizing human resources in the development process. Notably, potential young migrants also see a sign of hope in a separate state. This will definitely reduce the flow of out-migration*.

V. Conclusion

It has been widely held by scholars that out-migration increases land and labour productivity in the area of origin, raises rural incomes through transfers, and thus improves the standard of living of the people there. As against this view, *the out-migration of young adults and relatively better-educated males from Uttaranchal has already caused permanent regional underdevelopment. The movement involves a sizeable transfer of human capital, which has adversely affected all sectors of development. A consequence of this is a comparative shortage of males in the productive age-group and a higher dependency ratio in the region*.

A number of policy implications have been set out in the paper arising out of the prevailing scenario in Uttaranchal, assuming that the broad policy goal is to contain the tide of out-migration from the region. Naturally, these implications converge on the state's role in the development of the region so that push-out causes of migration could be eliminated or their influence reduced. So far, in the absence of effective measures, many of the favourable effects of migration on the development of the hill economy did not occur, while adverse ones such as underdevelopment and backwardness still persist and tend to induce further out-migration. Most of the suggestions are mutually interdependent and are accompanied by a rational description of implementation mechanism.

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Chapter 22

Ageing, Activities of Daily Living Disabilities and the Need for Public Health Initiatives: Some Evidence from a Household Survey in Delhi

Moneer Alam and M. Mukherjee

With downsized families, changes in older values, out-migration, and growing female participation in income generating activities, sustained and full-time family support to many functionally dependent old is likely to decline with time. Women may particularly be the bigger losers—they suffer more with problems of functional dependence in their activities of daily living and also face more of filial apathy.

India is fast becoming a graying society as a result of its upcoming prospect to achieve an accelerating growth in the size of its ageing population. Two causal factors are: (a) a varying but persistent fertility-mortality decline across the country, and (b) added lifespan with increased survival chances, especially at the later end of the life cycle. Those changes, and in particular added life years, have however been mired in the high prevalence of chronic diseases, affecting over half of the country's population aged 60 and over (NSS 52nd round, 1995–1996). Such a situation—coupled with large-scale poverty and the poor financial status of the older persons (Alam, 2004)—is likely to pose many serious issues for the country. One of the more critical may indeed be the higher incidence of frailty, senescence,[1] functional

[1]Senescence is usually defined as caused by non-disease-related physiological changes of ageing like poor reflexes, sensory decline or loss of skeletal muscle resulting in poor endurance and functional disabilities. Senescent changes can, however, be advanced or accelerated in presence of diseases. The process of ageing in India is currently mired by disease-linked senescence.

incapacitation and dependence of older dependents in activities of daily living (ADL)[2]—raising questions for the caregivers. With large-scale out-migration, declining family size and growing participation of women in economic activities, this traditional support mechanism is fast eroding. Somewhat inexplicably, this aspect has almost been completely missed in the analytical literature on health and ageing in India. The analysis presented below is therefore an attempt to fill some of this void by looking into the following:

(a) The ADL disabilities as reported by a sample of 1,385 elderly persons aged 60 and above—cross-classified by sex and four social-economic groups decided on the basis of their residential characteristics;
(b) Socio-economic risk factors in functional disabilities of the aged;
(c) Need for public health initiatives in preventing or forestalling ADL disabilities and physical incapacitation.

The need for public health initiatives has been highlighted by describing three major pathways of old-age frailties and functional dependence involving (a) physiological or senescent changes in an individual owing to the age factors, (b) non-senescent changes owing to the morbidity or poor health stock, and (c) poor living environment of the old. As many of the disabilities reported in our sample are due to the poor health conditions, it was decided to make use of the public health institutions with well-identified measures targeting healthy and unhealthy older adults separately. The authors also posit that in a country like India with very high old-age poverty, public health and its involvement in managing the health issues of the ageing population is the only cost-effective solution.

Besides highlighting the need for public health initiatives, this study also serves to make a case for evolving a long-term care strategy for the physically challenged aged. This is particularly important owing to the growing disengagement of families in providing all-time care to their ADL dependents. An alternative is to go for institutional care system, which has important financial and subsidy implications. This paper however refrains from going into those issues.

The rest of the paper is organized as follows: The next section provides a few conceptual details about the ADL disabilities, followed by an application of this concept based on a household survey with elderly co-residents drawn from all the nine urban districts of Delhi. The following section is devoted to an econometric analysis dealing with the socio-economic risk factors in causing old age disabilities. The next section, as noted earlier, deals with three different pathways of disabilities to underscore that a considerable number of disabilities in

[2]ADL refers to the activities of daily living like eating, using the toilet, bathing, cooking, combing hair, etc. Albert, Im and Raveis (2002) present an interesting discussion on the three pathways to disability in the editorial of the *American Journal of Public Health*. Those pathways will be described in greater detail later.

India are non-senescent in nature. Hence, the public health must strive to make people aware of the need for healthy ageing, and adopt a clinical approach to distribute certain health-augmenting medicines such as vitamins to the needy aged. Some policy imperatives are discussed at the end.

Ageing and ADL Disabilities: Concept, Data and Empirical Results

ADL Disabilities: A Functional Definition

Conceptually, disability is a complex phenomenon that manifests in many ways and evolves over time (Manton and Stallard, 1994). Also, it has in its making the socio-economic conditions of an individual. At a simplistic level, however, it can be defined as an individual's inability to perform a set of household and self-maintenance activities such as eating, dressing, bathing, walking, cooking, cleaning and climbing stairs etc. Under this paradigm, an individual can be described as disabled if his/her personal capabilities fall short of what has been actually demanded by his or her own environment. When people are unable to perform their basic tasks, they become dependent and seek outside assistance—formal or informal, but mostly informal in a country like India where social protection or community support mechanism is almost nonexistent.

Despite being conceptually difficult, measuring disabilities is important because of its association with decreased functional autonomy and the increased demand for long-term care (LTC). Its usefulness in making assessments about the morbidity, mortality and certain health-care needs is also very obvious. To illustrate, studies by Mor *et al*. (1994) and Severson *et al*. (1994) have shown that the ADL difficulties are significant indicators from which to derive estimates about the use of nursing home and hospital facilities. Similarly, an increasing number of long-term care insurance policies are now relying on the ADL disabilities as a trigger for paying the benefits to those covered (Van and Johnson, 1989).

Attempts have also been made in the geriatric literature to assess the hierarchy by which the loss of functional (or self-maintenance) abilities progresses among the human beings.[3] Those hierarchies or their validity in Indian conditions have, however, not been discussed in this study.

[3]Katz *et al*. (1963) have, for example, developed a hierarchy for a set of daily functions including bathing, dressing, using the toilet, transferring, feeding, continence etc. Theoretically, this ordering was justified on the consideration that, generally, people lose abilities and become disabled in a manner opposite to the order in which primary biological and physiological functions are acquired (Dunlop, Hughes and Manheim, 1997).

The Data

As already mentioned, the data for this analysis were obtained from a multi-stage survey of over 1,000 urban households in all the nine districts of Delhi.[4] This survey, originally designed for a more comprehensive study on health and livelihood issues of the aged in India (Alam, 2004), was held during June–September 2002. A total of 1,385 elderly respondents were finally screened in the survey: 617 (or 44.5 per cent) males and 768 (or 55.5 per cent) females. Using their residential location as a criterion, those households were further classified into four socio-economic groups:

(a) Households drawn from most affluent localities of all the districts (HIG Households). Such households constituted 4.9 per cent of the total sample;
(b) *Slum dwellers:* residents of identified slums, many with no social protection and low economic means. They constituted about 15.7 per cent of the sample;
(c) *Elderly/dependents residing in government colonies/apartments:* about 3.8 per cent of the total sample;
(d) *Households reside in mixed-income localities:* a large proportion was middle- and lower-middle-income traders, industrial workers and businessmen, and constituted rest of the sample.

The socio-economic identification of localities was entirely drawn according to the maps, and the guidelines prepared by the Directorate of Census (Delhi) for 2001 Census (see Alam, 2004). The authors premised that the respondents drawn from those four categories would differ in terms of their ADL issues and prevalence rates.

WHO Model of Functional Disabilities

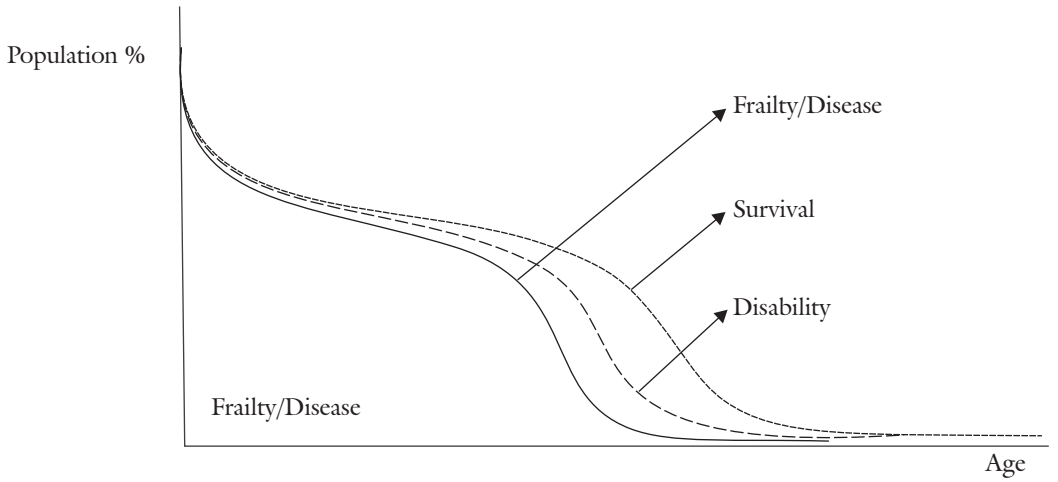
The World Health Organization (WHO) in 1981 has presented an International Classification of Impairment, Disability, and Handicap (ICIDH) to catalogue functional limitations suffered by individuals because of physiological impairments and bad health. The model was subsequently revised in 2001 to make further explorations in relationship between functioning, disability and health (International Classification of Functioning, Disability and Health (ICF, 2001).

An interesting feature of the ICF (2001) allows later life survival to be partitioned according to the functional status (Albert, 2004). The exercise presented below is largely drawn on this partitioning assumption, with two additional premises: the frailty precedes disability, so that

[4]A proportionate share of population for all the nine urban districts was obtained by using the 2001 Population Census for Delhi. Those proportions were later used to distribute the sample of households by district all over Delhi (see Alam, 2004).

people reach frailty before disability, and the states of disability precede mortality. With the high incidence of chronic and multiple diseases suffered by the aged in India, old age may turn into a painful process for many with high risks of functional impairment and dependency. Figure 1 illustrates a hypothetically partitioned survival curve underlining the basic argument that frailty followed by disabilities worsens the quality of survival in later years. This also poses question about the prospects of healthy ageing in India as envisaged in many policy pronouncements, including the National Policy on Older Persons (1999).

FIGURE 1
Partitioning Survival by Functional Status: A Hypothetical Diagram



Source: Albert (2004), p. 34.

Tasks of Daily Living and Measurement of ADL Disabilities

The ADL difficulties are entirely examined in terms of two health domains, namely, the physical and the sensory. In all, nine physiological and two sensory tasks of daily living were considered, and respondents were asked to report difficulties in performing each of them. They were also solicited to provide corresponding details about: (a) the assistance required by them in their daily activities, and (b) the availability (or non-availability) of that assistance. Thus, no or partial assistance may be considered as the unmet need for assistance.

The ADL difficulties and their health domains are as below.[5]

(a) *Physical domain:* (1) Eating, (2) Dressing, (3) Bathing, (4) Walking indoors (for example going to the toilet), (5) Outdoor walk (such as for routine shopping), (6) Cooking/

[5]In addition, there may be many other disabilities caused by cognitive, psychological or other forms of impairments. This analysis, however, failed to include them for lack of information.

home cleaning, (7) Climbing stairs, (8) Combing hair and (9) Getting up from a sitting position.

(b) *Sensory domain:* (1) Hearing losses, and (2) Vision impairment.

Using those domains and their respective tasks, attempts are made to index the functional capabilities of the respondents into the following:

- Persons in no difficulty and requiring no help: (ND/NH)
- Persons in difficulty and receiving no help: (D/NH)
- Persons in difficulty and receiving family help: (D/H)
- No difficulty/getting help: (ND/H)

Persons with no major difficulty or help requirements (ND/NH) have been considered healthier. Similarly, a few respondents did not suffer from any difficulty and yet drew assistance (ND/H). There were, however very few and bear no effect on overall results. The problem groups are therefore the persons in the second (D/NH) and third (D/H) categories. Especially, the numbers in the D/NH group suggest the magnitude of unmet assistance. Arguably, with shrinking family size, increasing out migration and growing participation of women in economic activities, that problem is expected to increase with time. A long-term care apparatus has to be developed through both private investment and public subsidies.

The functional capability indices (FCIs) may also be used to identify the size of ADL-impaired persons with and without multiple impairments. Those details, especially the number of functionally impaired (or those within the frailty-disability space in Figure 1), are expected to undermine the gains of added survival.

Prevalence Rate of ADL Disabilities: FCI Results

Table 1 presents the prevalence of ADL dependence in both health domains, and those with or without assistance. This table clearly reveals wide-ranging disabilities in most activities under-reference. Another point of even greater concern is the spread and magnitude of those disabilities. For example, the disabilities are present even in modest activities like eating, dressing, combing hair or bathing, although their size are not very high and generally vary between 3 and 6.5 per cent of sample population. To illustrate, the lowest level of dependency is found in combing hair (3.3 per cent) followed by bathing (5.8 per cent), dressing (5.9 per cent) and eating (6.6 per cent).

Contrasting this, the remaining five activities in the physical domain suggest a very high prevalence of impairments, resulting in large-scale dependencies and the need for assisted care. It appears from the table that climbing the stairs is the most difficult task for an elderly person. Getting up from a sitting position is another difficult activity for more than three fourths of the survey respondents. Moreover, it also generates high levels of unmet care. Other difficult tasks included outdoor walking and cooking or cleaning for own sustenance (Table 1).

TABLE 1
Functional Capability Index (FCI) of Respondents aged 60 and Above

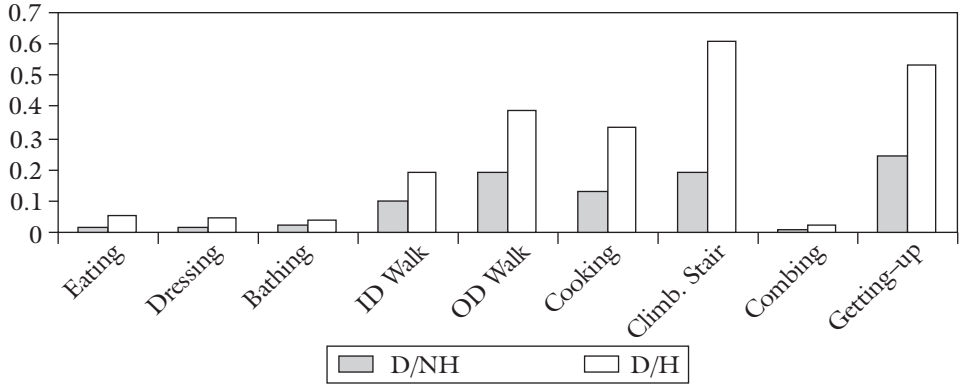
	Functional Difficulties and Need for Help (Percentages)				
Daily Activities (ADL)	*ND/NH*	*D/NH*	*D/H*	*ND/H*	*Respondents*
Physical					
Eating	93.3	1.3	5.3	0.1	1004
Dressing	94.1	1.7	4.2	0.0	1004
Bathing	93.9	2.0	3.8	0.3	1003
ID Walk	71.2	9.6	19.2	0.0	1003
OD Walk	41.4	19.3	39.1	0.1	999
Cooking/Cleaning	53.5	13.2	33.2	0.1	873
Climbing stair	20.0	19.3	60.6	0.1	999
Combing	96.5	0.8	2.5	0.2	1003
Getting-up	22.2	24.4	53.2	0.2	1001
Sensory					
Reading	83.9	2.4	13.6	0.1	997
Hearing	81.5	2.6	15.6	0.3	1001

Source: IEG/CIDA Ageing Survey.

Unmet Assistance to Functionally Impaired

The worst are those in the sample who are impaired and remained unassisted. Figure 1, for example, depicts a considerable amount of unmet assistance faced by persons with poor lower extremity strength, needing them to rely on others. Lack of assistance is also reported by persons unable to go outside for routine work. Many of those unable to cook or clean also remain unassisted. And yet, the present results indicate that big fractions of the aged still draw assistance from families or other informal sources (see Figure 1). Further, the share of assisted older in all the activities is always higher. This is particularly true for the activities requiring greater physical effort. However the bottom line of those results may be to expect

FIGURE 2
Share of Functionally Impaired without Assistance



Source: Columns 3 and 4 of Table 1.

growing changes in the traditional patterns of care provision, emphasizing the need to develop alternative mechanisms for caring.

As was expected, persons with no difficulty and yet receiving help are only few and, therefore, needed no comment (Column 5, Table 1). In cases of sensory impairments, one observes that persons with hearing losses exceed those with impaired eyesight. A reverse was however expected. Instances of unmet assistance can be noticed from those results as well (Table 1).

ADL Impairments by Socio-economic Group

With the preceding evidence, a question may be: how those impairments are distributed across four socio-economic groups described earlier? In other words, do the poor elderly suffer more from the functional disabilities? Another significant question is the share of disabled with and without filial assistance in each stratum. The authors seek to examine both of those questions by redistributing Table 1 into four socio-economic denominations. The Tables 2a (ND/NH), 2b (D/NH), 2c (D/H) and 2d (i.e., share of assisted to the total disabled in each stratum) present those results.

TABLE 2a
Respondents with ND/NH by Socio-economic Group

(Percentages)

ADL Type	*HIG*	*Slum Dwellers*	*Government*	*Mixed Income*
Physical				
Eating	97.9	83.3	95.1	95.1
Dressing	100.0	91.4	92.7	94.4
Bathing	91.7	93.8	95.1	94.0
ID Walk	81.3	75.3	82.9	69.0
OD Walk	55.3	47.5	43.9	39.1
Cook/Clean	54.1	76.7	72.5	46.5
Climbing Stairs	33.3	31.5	22.0	16.6
Combing	97.9	93.8	97.6	96.9
Getting-up	27.1	20.4	12.2	22.8
Sensory				
Reading	89.6	82.4	78	84.1
Hearing	87.5	82.8	78.9	85.0

TABLE 2b
Respondents with D/NH by Socio-economic Group

(Percentages)

ADL Type	*High-income Localities*	*Slum Dwellers*	*Government*	*Mixed Income Localities*
Physical				
Eating	2.1	3.1	0.0	0.9
Dressing	0.0	0.6	2.4	2.0
Bathing	6.3	0.0	0.0	2.3
ID Walk	12.5	3.1	2.4	11.2
OD Walk	27.7	11.1	24.4	20.3

(*Table 2b continued*)

(*Table 2b continued*)

ADL Type	*High-income Localities*	*Slum Dwellers*	*Government*	*Mixed Income Localities*
Cook/Clean	10.8	5.0	5.0	15.9
Climbing Stairs	27.1	22.2	17.1	18.3
Combing	0.0	1.2	2.4	0.7
Getting-up	39.6	16.0	14.6	25.7
Sensory				
Reading	0.0	2.5	0.0	2.7
Hearing	0.0	2.1	0.0	2.8

TABLE 2c
Respondents with D/H by Socio-economic Group

(Percentages)

ADL Type	*High-income Localities*	*Slum Dwellers*	*Government*	*Mixed Income Localities*
Physical				
Eating	0.0	0.0	4.9	4.0
Dressing	0.0	8.0	4.9	3.6
Bathing	0.0	6.2	4.9	3.7
ID Walk	6.3	21.6	14.6	19.8
OD Walk	17.0	41.4	31.7	40.6
Cook/Clean	35.1	18.2	22.5	37.6
Climbing Stairs	39.6	46.3	61.0	65.1
Combing	0.0	4.3	0.0	2.4
Getting-up	33.3	63.0	73.2	51.5
Sensory				
Reading	10.4	14.5	22.0	13.2
Hearing	12.3	15.0	21.0	12.0

TABLE 2d
Stratum-wise Distribution of Assisted Respondents*

(Percentages)

ADL Type	*High-income Localities*	*Slum Dwellers*	*Government*	*Mixed Income Localities*
Physical				
Eating	0.0	81.5	100.0	80.6
Dressing	0.0	92.9	66.7	64.3
Bathing	0.0	100.0	100.0	60.5
ID Walk	33.3	87.5	85.7	63.9
OD Walk	38.1	78.8	56.5	66.6
Cook/Clean	76.5	78.4	81.8	70.3
Climbing Stairs	59.4	67.6	78.1	78.0
Combing	0.0	77.8	0.0	78.3
Getting-up	45.7	79.7	83.3	66.6
Sensory				
Reading	100.0	85.2	100.0	83.1
Hearing	100.0	88.9	100.0	66.4

Source: IEG/CIDA Ageing Survey.
* Includes instrumental assistance as well.

Table 2a suggests a positive association between the income level and the ADL competence. This is borne out as HIG old reported lesser reliance on outside support for many of their daily activities. Table 2a, for example, reveals that the activities involving eating, dressing, combing hair, walking outdoors, climbing stairs, getting up from a sitting position, reading and hearing have the highest share of HIGs with ND/NH status. Close to the HIGs are those from middle or lower-middle-income categories. As expected, older adults residing in slums are more ADL deficient, and they appear to rely less on others even in activities like cooking, cleaning and so on. By contrast, the HIGs turned out to be extremely poor in those activities. To a certain extent, this may as well be a reflection of their affluence that allows them to rely on domestic help. As a whole, however, there is no denying that the self-perceived health status—physical or functional—is more a question of social awareness and access to medical facilities. The poor, with limited means and awareness, may have fewer complaints even if surviving in poor health.

Despite less impaired in certain activities, Table 2a also revealed a sizeable fraction of high-income aged with disabilities in walking, cooking, climbing stairs, getting up and hearing. It therefore testifies that income alone cannot be the sole protective mechanism against the disabilities. Lifestyle may have a role to play.

Another source of vulnerability for the higher-income aged is the lack of assistance available to many of them. This is clearly borne out from Table 2d. However, given their smaller family size and out migrating siblings, this result does not appear very surprising. Problems of inadequate ADL support may also be observed for the mixed income households. Low-income slum-dwellers are, however, better placed in this respect (Table 2d). Does this mean that the family size, especially the number of children, helps to minimize the risks of unmet assistance of those functionally impaired?

Gender differentials in the underlying context may be noted from Table 3. In line with the general expectations, ADL-impaired women outnumber men. In addition, barring cooking or cleaning, it is true for all other activities under consideration (Table 3). The share of functionally handicapped women is shown to be disturbingly high in activities requiring more physical strength such as climbing stairs (86 per cent of women are impaired and need help) followed by the tasks requiring getting up from a sitting position (85 per cent impairment), going outdoors for routine shopping or other activities (65 per cent dependence) etc. Even cooking or home cleaning was found to be difficult for more than half of the sample women. Further, one in every seven women is shown to be suffering from auditory problems. By contrast, men were found to be less impaired, though a bigger share of them reported serious difficulties in activities like climbing stairs (73 per cent), getting up from a sitting position (69 per cent) or going out for routine activities (49 per cent).

Figure 3 makes those conditions further visible. It can be noticed that climbing the stairs is the most impairing task for aged as about three in every four men and six in every seven women are seeking help from the family. Getting up from a sitting position is almost equally difficult. Not only that, even more than half the sample women reported their inability in cooking or cleaning the place they live.

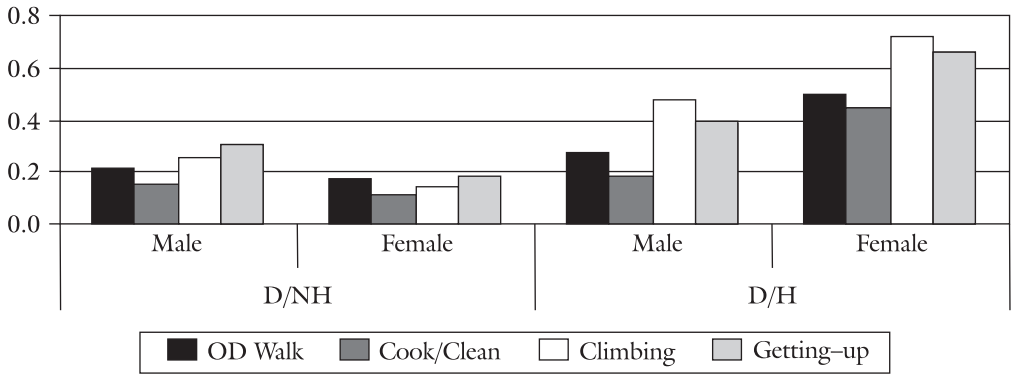
TABLE 3
Aged Males and Females with or without ADL Impairments

(Percentage)

	ND/NH		*D/NH*		*D/H*		*N*	
Nature of ADL	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male**	*Female**
Physical								
Eating	95.5	91.4	1.1	1.5	3.2	7.1	470	533
Dressing	96.2	92.3	0.8	2.4	3.0	5.3	471	533
Bathing	95.3	92.7	1.5	2.4	3.2	4.3	471	534
Indoor Walk	78.5	64.7	7.9	11.1	13.6	24.2	470	533
Outdoor Walk	51.2	33.4	21.7	17.1	27.2	49.3	471	532
Cook/Clean	66.2	43.7	15.3	11.5	18.2	44.7	378	494
Climb. Stairs	27.1	13.7	25.0	14.3	47.9	71.8	468	530
Combing	97.5	95.7	0.6	0.9	1.7	3.2	470	531
Getting-up	30.4	14.9	30.9	18.6	38.7	66.1	470	529
Sensory								
Reading	81.8	5.7	3.2	12.4	14.8	81.8	469	527
Hearing	86.0	3.2	1.5	10.8	12.3	86.0	470	531

Source: IEG/CIDA Ageing Survey.

FIGURE 3
Four Most Critical ADL Functions and Their Gender Differentials
(Percent of Males and Females)



Women are not only suffering because of higher disablements; a sizeable of them is also reporting lack of filial assistance. This is clearly highlighted by Figure 3, which underlies two significant observations: (a) unmet assistance is perceptibly large in all the four ADL domains under reference, and (b) in relation to their male counterparts, disabled women are less assisted. At the broader level, this poses many serious issues for both the disabled men and women, and their caregivers.

The level of disabilities and functional dependence as shown above is clearly an indication that care giving would soon be a difficult and time-consuming responsibility, with implicit

risks of neglect by care providers. This problem may increase even further if the disabilities are multiple. The needed support in those situations may prove more intense, and the unmet assistance, if any, becomes more traumatic. Considering this, the sample was redistributed into those who are ADL efficient (i.e. ND/NH), and those faced with single or multiple difficulties. This would perhaps help to give an idea about the burden of dependence imposed on families.

Table 4 presents this. Those results in many ways conform to those presented earlier. For instance, this table also shows women in a more pitiable situation. Further, while the shares of those with no difficulties are much less for both the genders, the ADL efficient men outnumber their women counterparts. Three points are particularly significant, especially from the policy angle. Those are:

(a) The share of persons with multiple disabilities is far higher;
(b) Compared with men, women suffer a greater number of disabilities (Figure 4);
(c) Nearly half of the responding females (49.7 per cent) reportedly suffer from three or more disabilities. In contrast, this share is less for the males (38.4 per cent).

TABLE 4
Respondent with Single and Multiple Impairments

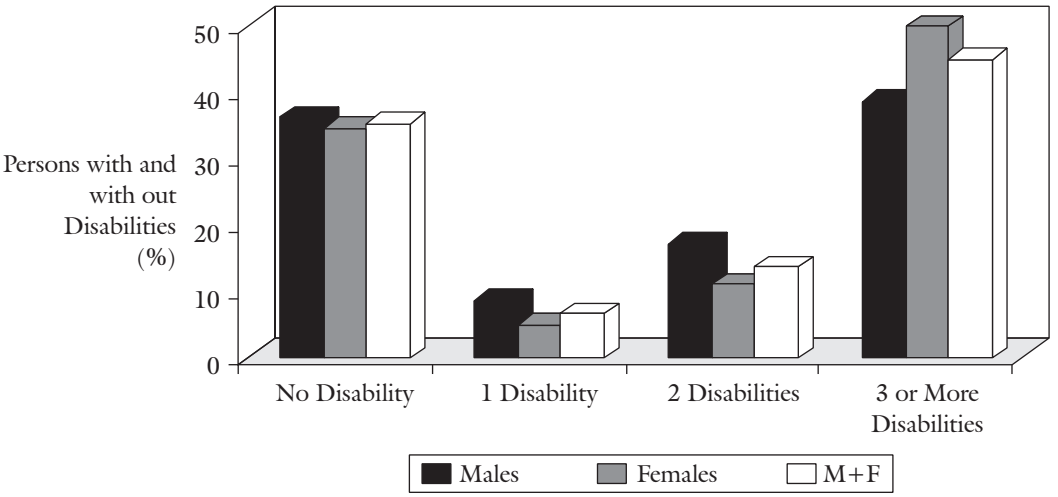
(Percent)

	Gender		
Number of Disabilities	*Male*	*Female*	*Column%*
No disability	36.0	34.4	35.1
1 disability	8.6	5.0	6.6
2 disabilities	17.0	11.0	13.7
3 or more disabilities	38.4	49.7	45.0
n	617	768	1385

Source: IEG/CIDA Ageing Survey.
Note: Column totals may not compare with Table 1 or Table 3 due to differences in response formats.

Many issues arise from those results. One is the quality of survival at the tail end. Another is the gender dimension of the functional health. Particularly women with their multiple disabilities may ultimately drop below the threshold of physical, sensory or cognitive capacities and, as a result, need more intense care. Could the required care be arranged through familial sources? This is indeed a big question and needs to be examined. Yet another aspect of this issue relates to the ongoing debate on healthy ageing. With so many cases of disabilities and dysfunction, the whole idea of healthy ageing may lose much of its relevance. Further, it may also require broadening the concept of health by taking into consideration the special needs of the aged, especially the disabled. As a first step, perhaps, an attempt may be made to identify a few of the major risk factors associated with the ADL disablements. Next is the question of a cost-effective solution to some of those problems.

FIGURE 4
Distribution of Responding Males and Females by Number of Disabilities



Source: Table 4.

Socio-economic and Lifestyle Factors in ADL Disabilities

Health outcomes—physical or functional—are often studied by using two different methods. One may require a more medically oriented approach with a study of a prospective cohort and its lifelong history, including health behaviors and health risks. This approach is, however, not in practice among health economists. Even the gerontological research cohorts usually begin from age 55 and above (Albert, 2004). Another method is to use certain proxy measures and capture the likely risk factors in heath or disabilities. The authors have relied on the latter and have used a host of socio-economic and lifestyle indicators to assess the possible risks of ADL disabilities among the aged.[6] Below is a brief discussion of the model, including the construction of variables chosen for the exercise. This is followed by the results.

Description of the Model

The necessary details of the model are given in the box below. Given the multiple and discrete native of our dependent variable (i.e. number of disabilities) a count data model is employed. Methodologically, those models usually rely on the Poisson process where each y_i is drawn from

[6]For a good discussion on the relevance of socio-economic factors in health outcomes, see Smith (2004).

a Poisson distribution with parameter e_i (related to the explanatory variables X_i). A serious drawback of this model, however, lies with its assumptions implying a conditional mean and an equal variance. In reality, however, those assumptions are highly unlikely.[7] This problem is to some extent minimized by a Negative Binomial Model that allows a cross-sectional heterogeneity (Greene, 2002). The Poisson model is generalized by introducing an individual, unobserved effect into the conditional mean (i.e., In $\gamma_I = X'_I$ ă + ȃ). This leads to bringing about a difference in the conditional mean and conditional variance. It was therefore decided to use both of these specifications for the analysis reported below.

Description of Variables		
Estimation model	Dependent variable	Independent variables
Count data regression (Negative binomial)	ADL disability index (0–3) as shown in Table 4	(i) Initial health stock (ii) Standard of living index (iii) Habit index (iv) Age and age square (v) Sex (vi) Marital status

Construction of Variables

Following variables have performed better in explaining the risks of ADL disabilities (see Appendix Table A1 for descriptive statistics).

1. *ADL disability index (0–3)*: A composite index of disability was generated to characterize the number of disabilities suffered by the sample population (see Table 4).
2. *Income status*: The individual's income is proxied by their standard of living indices (SLI). The SLI was constructed on the basis of the asset holdings of individual households, where the assets were scored on the basis of their notional market prices. Finally, these overall scores were aggregated for every sample household, and assigned to each household member.
3. *Initial health stock index (1–4)*: Healthier persons are generally less disabled. In order to capture this effect, the authors tried to formulate a health index by taking into consideration the number of diseases an individual has suffered over the past one year. Respondents were asked from a pool of about 17 diseases commonly suffered by old (Appendix Table A2). A scrutiny of this data suggested that none of the individuals in

[7]For more discussion on those issues, see Cameron and Trivedi (1986), Grootendorst (2002) etc.

the sample was reported suffering from more than four diseases. Individuals were then indexed on a scale of 1 to 4. An individual suffering from one disease is considered healthier (and scored 1) than any other suffering from more number of diseases.[8]

4. *Habit index (0–2)*: Healthy habits will also help to make a person less prone to disability. In the survey, the authors tried to capture this effect by considering the lifestyle of the sample aged, e.g. whether or not they go for a walk or meditate regularly.
5. *Sex:* This variable was considered in a binary format with 1 assigned to males and 0 otherwise.
6. *Age and age-square*: Persons aged 60 or above as reported by them at the time of the survey. Age-square was used to make assessments about certain non-linearity (e.g. a kind of parabolic relationship) between the age and number of disabilities.
7. *Marital status:* Another binary variable with currently married men and women were assigned 1, and 0 otherwise. This variable was included to judge the role of companionship in functional health.

Discussion of the Results

Two specifications were used. One was with age and age-square along with other socio-economic variables and factors representing habit. Age-square, as explained, was especially introduced in response to an earlier argument that functional disabilities in India are not essentially the outcome of age-related senescence. Frailty and poor health stock have a role. The age-square was however replaced in second specification to minimize its co-linearity risks with the age. Instead, a marital status dummy was used assuming companionship protects against disablement.

Specification 1

As was expected, specification 1 in Table 5 reveals that the health stock of individuals—characterized by number of diseases—is one of the most potent risks of disabilities. This highlights the importance of an emerging concern by medical gerontologists, namely, the health linkages between the early and later years of an individual's life. As most of the existing literature on this issue relies on the higher age cohorts, those linkages are not yet fully established (Albert, 2004). For a country like India with a very high prevalence of early life diseases (World Bank, 1993), this issue has serious policy implications.

Another notable finding of this analysis is the significance of the lifestyle, particularly the habit of regular exercising. The present results clearly indicate that persons with regular walking habits are less susceptible to ADL disabilities. The coefficient of habit index in Table 5 is

[8]The authors have, however, failed to account for the nature and gravity of those diseases/conditions.

TABLE 5
Risk Factors in ADL Disabilities Dependent Variable: ADL Disability Index (n = 959)

Variables	*Coefficients*	*St. Error*	*z*	*P>|z|*
Specification 1				
Constant	–2.5661	1.7162	–1.495	0.1350
Health stock index	.12043**	0.0219	5.500	0.0000
Habit index	–0.0656*	0.0257	–2.556	0.0110
Age	0.0837	0.0478	1.750	0.0800
Age^2	–0.0005	0.0003	–1.534	0.1250
Sex	–0.0917*	0.0462	–1.982	0.0470
Income status	–0.0035*	0.0016	–2.234	0.0250
Specification 2				
Constant	0.0424	0.2180	0.195	0.846
Health stock index	0.1224**	0.0218	5.603	0.000
Habit index	–0.0610*	0.0256	–2.387	0.017
Age	0.0105**	0.0031	3.336	0.001
Age^2	0.0097	0.0494	0.197	0.844
Sex	–0.0986	0.0525	–1.878	0.060
Income status	–0.0036	0.0016	–2.303	0.021

statistically significant at the 1 per cent level with a negative sign, implying greater risks for persons with a sedentary life. Another significant factor in this context is the income status of the aged. Persons with higher SLI values are less likely to suffer disabilities in the physical domain. Gender is yet another risk factor. It validates earlier findings showing women outnumbering men in many activity-specific disabilities. Age is also a factor linked with the impairment risks, but those risks may subside with advancing age. However, it cannot be argued conclusively as the age-square remains statistically insignificant.

The second specification drops the age-square, while a marital status dummy was added to explore its relationship with old-age disability. All other explanatory variables remained the same. While this equation considerably improves the age factor as one of the serious challenges to old-age health, it fails to signify the presence of a partner as a shield against the risks of functional disability. The coefficient nevertheless yields the correct sign. The rest of the variables behave as in the preceding specification.

The results drawn on the basis of those specifications are indeed informative and likely to help in designing policy responses to improve old-age health. However, one has to exert caution as many other factors responsible to poor old age health have not been included in those two exercises. Some of the more recent literature, for example, describes several biological, environmental and genetic factors with important health outcomes.[9] Similarly, the health stock

[9]A recently edited volume by Keleher and Murphy (2004) includes several good articles on many of those health determinants. Specially, for example, see Nicholson and Stephenson (2004, pp. 23–39) and Swinburn and Cameron-Smith (2004, pp. 40–57).

characterized by early childhood diseases may considerably affect the health outcomes in later years (Barker, 1997). Taking into account the cumulative effects of prolonged exposure to individual stressful events (Seeman *et al*., 1997) or reactions to the poor past of many individuals (Wilkinson, 1996) may also help to improve the health models.

Ageing, Functional Disabilities and Public Health: Tracing for A Link

Over the recent past, India has been transitioning in many ways—economically, demographically and in terms of its epidemiology. At the economic level, for instance, India is in the process of growing privatization, especially in the realms of major health and non-health services. That process has, however, been initiated without working to develop a credible social safety net for the vulnerable segments such as the aged. At the demographic level, India is largely out of the high fertility-mortality syndrome with major gains in terms of added lifespan and increased survival chances. In terms of the disease pattern also, India is fast getting out of the early twentieth century phase of contiguous and poverty-driven ailments. Obviously, the last two transitions—demographic and epidemiological—have largely been the outcome of improved living standards, better medical infrastructure and effective public health measures, including a high rate of vaccinations to prevent major childhood diseases.

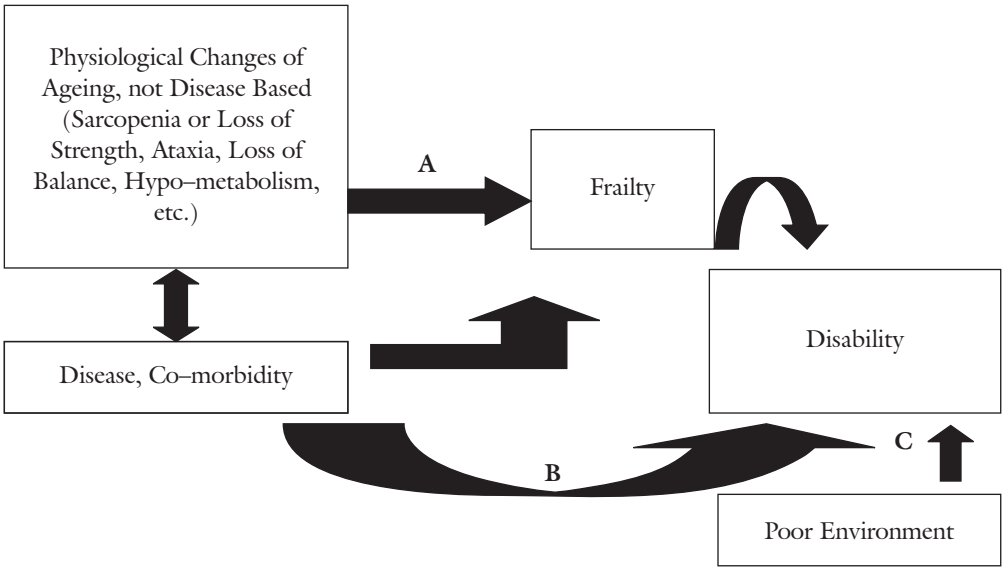
Despite those improvements, most of the preceding results are mired in poor health status of the aged with a very high prevalence of co-morbid conditions and multiple disabilities. With an increasing market role, growing cost of medical care, persisting poverty, decline in quality of services provided by public hospitals and the degenerating old-age diseases, it appears that a large fraction of elders in India is running out of options. With time, some may even lose family care. Clearly, those issues need serious attention.

Some of those considerations drove the authors to examine in the remainder of this study: (a) pathways that produce ADL disabilities, and (b) their low-cost, easily affordable public health responses.

Figure 5 is drawn on the assumption that disabilities are the outcome of three-way causations: (a) age-determined senescence, (b) general or disease-related frailties, and (c) social environment of the older persons (Albert, Im and Raveis, 2002). Pathway A, for example, exemplifies the direct effects of age-related physiological changes in the human body resulting in senescence, contracting or thickening in many vital organs, frailty, lack of body resistance, memory run down, and loss of functional abilities. Those changes may eventually leave the aged in an incurable condition with an ultimate option of seeking medical or home care. Only a few can afford those options in India.

Pathway B to fall into disabilities, by contrast, is a direct outcome of various ailments and frailties, a situation presented in Appendix Table A2. It can be observed from this table that over half of the respondents reported frailty as the cause of their disabilities.

FIGURE 5
Pathways of Frailty and Disability



Source: Albert, Im and Raveis, 2002.

The environmental condition of Individuals, marked by arrow C in Figure 5, may also be a factor in producing severe disabilities. Especially, the lack of a supportive environment, such as those marked by the D/NH in Tables 1 to 3, is likely to drop people into an insecure condition. Geriatricians now already recognize that an unsavory family atmosphere can yield disabilities to people who are otherwise the same in terms of frailty or medical conditions.

Of those three pathways, the role of B and C are turning out to be a potent causal factor of disabilities in the Indian context. And, for a majority of the ageing Indians, getting away from those conditions seems difficult without concerted efforts by major stakeholders, including the families, the community, non-governmental organizations and, above all, the Government. At the government level, the public health strategies perhaps offer a viable and more cost-effective solution. It may, however, require changing the pathways of disabilities and preventing people from falling into B and C (Figure 5).

Role of Public Health in Preventing Disabilities

A big question in this context may be: how can the public health be used to alter the pathways leading to the disabilities? A recent study by Albert (2004) has examined this issue at a broader level. The study identifies a set of public health goals for four different categories of older persons: (a) robust (like the ND/NH in Tables 1–3), (b) demented, (c) older old or senescent, and (d) frail owing to previous diseases. Table 6, summarizes each of those goals, underlines

the need for preventing frailties among the robust, and making improvements in the living conditions of the frail by helping them to retain their remaining physiological abilities.

TABLE 6
Ageing Experiences and Goals of Public Health Strategies

Type of Older Persons	*Goals of Public Health*
Robust	Prevention of frailty and disability
Demented	Prevention of excess morbidity, and excellent custodial care
Late stage of life (older old)	Reduction of isolation, maximization of choice
Non-senescent frail	Environmental modification to reduce task demand; rehabilitation to reduce task demand; rehabilitation to increase capacity by developing spread abilities

Source: Albert (2004).

Albert's study further argues for changing the pathways of ageing by sensitizing people to improve their post-50s lifespan. This, inter alia, requires individuals to take up enhanced habits of cognitive engagements, physical exercises, balanced diet, moderate drinking, and no smoking. Frequent health screenings was also advised. The study also recommends providing mineral supplementation by primary health institutions to forestall the decay in bone mass of the very old (e.g. 75+). As a part of public health measures, those persons may also be provided with prophylactic medicines to cut down the risks of cardiac (or similar other) deaths.

The third pathway, the unsupportive environment, is another critical factor and needs serious consideration. Understanding the social context of ageing may therefore be significant to devise ways for creating a more amenable atmosphere for the aged.

Considering those facts, it seems imperative for a country like India to draw a comprehensive preventive mechanism to make the process of ageing a more endurable experience. The public health route of ageing particularly remains completely unexplored.

Summary and Conclusion

The following issues were at the core of this analysis:

- Physical and sensory impairments of the older adults and their ADL dependencies, cross-classified by gender and a set of four socio-economic groups,
- Likely causes of those impairments, and
- Some of their public health responses, especially in the form of primary prevention strategies.

Functional impairments in both the physical and sensory health domains were judged by the curtailed self-maintenance activities of the older adults. In all, 11 ADL tasks from the two health domains were considered. The results indicate a very high prevalence of disabilities in

both the domains—dropping a majority of the older males and females below the threshold of their ADL capacities. At the sensory level, a larger number of people had reported suffering from hearing losses. The vision impairments came next.

Physically, more than three quarters of the respondents reported disabilities, particularly in activities like walking outdoors, getting up from a sitting position or climbing stairs. This indicates the lower extremity strength as one of the biggest old-age problems, causing large-scale ADL dependencies. With changes in social norms, out migration, and growing involvement of women in outdoor activities, sustained and full-time family support to many of those dependants is likely to gradually wear-off.

Despite good instances of family support to their elderly, persons with unmet assistance did exist, and in significant proportions. This proportion may increase with time.

The gender dimension of disabilities appears much worse, with a big fraction of women reporting disabilities and lack of a supportive atmosphere. More than half of the women reported incompetence in cooking or cleaning. In addition, a majority of them reported impairment in lower extremity strength, constraining their movement.

Among the causal risk factors in those ADL disabilities, individual's previous health stock turns out to be a major source of functional impairment. Similar other risk factors included age, lower financial status, and sedentary lifestyle. Being a woman is another very significant risk factor.

To conclude, two specific observations drawn from this analysis are particularly significant for policy planners. One is the low quality of survival in later years owing to high prevalence of disabilities. The second relates to the fact that in many cases the disabilities are not simply senescent or age-determined. Gender, health related factors and lifestyle do have their roles. It is therefore advisable to follow a public health regime by resorting to:

(a) Creating awareness among people about healthy ageing and its prerequisites;
(b) Setting up public health goals for different segments of the older population—robust, frail, demented and very old;
(c) Taking up drug supplementation activities to ensure primary prevention of complex conditions.

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seminar on ageing in Macao (China), 18–21 October 2004. This paper was also presented in a consultative meeting on elderly care at the All India Institute of Medical Sciences (New Delhi) on 4 November 2004. Many useful suggestions arising from those presentations, and also the comments given by the anonymous referees of the paper, are gratefully acknowledged.

Appendix

TABLE A1
Descriptive Statistics of Variables in Table 5

Variable	*Observations*	*Mean*	*Std. Dev.*	*Min*	*Max*
Disability index	1385	1.64	1.33	0	3
Habit index	1019	1.03	0.92	0	2
Age Square	1385	4685.68	971.68	3600	9801
Age	1385	68.12	6.74	60	99
Gender	1385	0.45	0.50	0	1
Health stock index	959	2.57	1.03	1	4
Std. of living index	1385	38.16	14.62	1	90
Marital Status	1018	2.07	1.02	1	5

TABLE A2
Disease-Disability Matrix

	Disability Index				
Diseases	*0*	*1*	*2*	*3*	*Col.%*
1. Poor vision/Cataract/Other eye impairment	31.7	34.1	19.5	14.6	4.28
2. Lung problem/Respiratory problem/Asthma	7.7	23.1	15.4	53.8	1.36
3. Tuberculosis/Other chronic fever	33.3	33.3	33.3	0.0	0.31
4. Diarrhea/Gastroenteritis/Stomach ulcer	33.3	66.7	0.0	0.0	0.31
5. Skin disease	33.3	33.3	0.0	33.3	0.31
6. Angina/Chest pain/Cardiac problem	5.9	5.9	11.8	76.5	1.77
7. High BP	19.4	9.7	19.4	51.6	3.23
8. Arthritis/Rheumatism/Joint pain	3.9	5.2	10.4	80.5	8.03
9. Back Pain/Slip disc	8.3	4.2	25.0	62.5	2.50
10. Neurological or Mental problems (Depression)	50.0	0.0	0.0	50.0	0.21
11. Cancer (of any form)	0.0	0.0	0.0	100.0	0.10
12. Demented/Memory loss	0.0	0.0	100.0	0.0	0.10
13. Alzheimer	0.0	0.0	0.0	0.0	0.00
14. Frailty/General weakness/Run down condition	7.9	10.2	24.4	57.5	52.97
15. Injury & related disabilities	0.0	0.0	0.0	100.0	0.73
16. Burn & related disabilities	0.0	0.0	100.0	0.0	0.21
17. Diabetes & other problems like Prostate/Dental, etc.	2.7	6.6	21.2	69.5	23.57
Row Totals (Number)	76	97	208	578	959
Row %	7.9	10.1	21.7	60.3	100.0

Source: Alam, M. (2004).

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Chapter 23

An Analysis of Recurrent Costs of the Free ART Programme of the Government of India[1]

INDRANI GUPTA, MAYUR TRIVEDI AND SUBODH KANDAMUTHAN

Introduction

The potential accessibility of Antiretroviral (ARV) drugs at reduced cost and the emergence of large-scale Antiretroviral Treatment (ART) programmes in developing countries like Brazil, have spurred many other developing countries to start their own national programmes on treatment with ARV. India is one such country that has recently launched its own "Free ART" programme in April 2004.

While the initiative has been launched in several sites, it is as yet not clear what the financial implications are of scaling up the programme on an all-India basis. One major drawback in assessing the implications of scaling up is the lack of unit cost data, which is key to the estimation of resource needs, and also critical for any subsequent analysis of cost effectiveness and impact evaluation, which yields important information to policymakers for fine-tuning the treatment programme.

There have been studies done on costing of ART programmes with a view to informing policy on scaling up. The first country to offer a public programme with ARV was Brazil, which triggered off a spate of studies on cost and cost-effectiveness of ART (see for example, Bastos et al. 2001). While pointing out the cost-effectiveness of ART, these studies also documented

[1] The reference for the full version of the paper is: *An Analysis of Recurrent Costs of the Free ART Programme of the Government of India* (with M. Trivedi and S. Kandamuthan). World Bank. South Asia Human Development Sector. Report No. 18. July 2006.

issues of management and implementation of the programme. The more recent studies have taken as given the cost-effectiveness of giving ART, but have focused more on scaling up and their financial implications. A review of several costing studies on South Africa (see Boulle et al. 2003) indicate that anticipated coverage remains the key uncertainty in cost estimates, and emphasize service capacity and readiness—rather than resources—as critical issues in scaling up. More recent costing studies look at resource requirements: for example, a study based on Nigeria (Comber et al 2004) estimates the total cost of ARV in the public sector in Nigeria, and includes costs of voluntary counseling and testing, treatment of opportunistic infections, and other resource requirements of implementing the national programme. They find that drugs comprise the largest single component (50 percent) of total cost of the programme, followed by monitoring tests and labour costs. Significantly, the study also finds that a large proportion of the treatment costs are borne by the patients, for both tests and drugs. A similar study done for Zambia (Kombe et al. 2003) brings out the need for caution in scaling up based on estimates of per unit cost of the government programme, and from the perspective of sustainability.

A very recent study from Thailand (Supakankunti 2004) evaluates the economic costs associated with the national programme and also analyses the costs borne by patients and their productivity changes.

However, while many countries worldwide have attempted costing of their national programme on ART, India did not have any economic or financial estimates of how much it actually costs to run the free ART programme, if all sources of spending are included. To fill this gap, a study was undertaken by the Institute of Economic Growth, Delhi, with funding from the World Bank, and supported by the National AIDS Control Organization (NACO), New Delhi, with the aim of coming up with preliminary estimates of the recurrent financial cost of the ART programme.

Free ART in India

While there are a few alternative views around the exact number of infected individuals in the country, the National AIDS Control Organisation (NACO[2]) estimates indicate that currently there are approximately 5.206 million HIV infected individuals in India (NACO 2006), making it second to South Africa in terms of the numbers infected. In response to the epidemic, NACO has a comprehensive programme comprising targeted interventions for groups at high risk, preventive interventions for the general community, low cost AIDS care, institutional strengthening and inter-sectoral collaboration.

[2] NACO is the government nodal agency in charge of formulating, coordinating and implementing policies and response on HIV/AIDS in India, through state level agencies called State AIDS Control Societies (SACS)

Till 2003, the access to ART in India was quite limited; it was estimated that out of 7,50,000 ART eligible individuals, only 13,000 were on ART by the end of 2003. In other words, less than 2 percent of the ART-eligible individuals were on ART in India; the corresponding global figure was around 8 percent (Gupta et al, 2003). Till then, ART delivery was mainly through the private sector, and through various government institutions like the Central Government Health Scheme (CGHS), Employees State Insurance Corporation (ESIC), the Armed Forces Medical Services, and the Railways. These arrangements were not systematic or by design, and were in place mainly as part of a system of employer obligations in these government organisations.

With mounting domestic and international pressures to respond to the increasing treatment need, the government on the eve of the World AIDS Day, 2003, announced its programme of free distribution of ARVs in selected states. In June 2004, the Global Fund on AIDS, TB and Malaria awarded a financial grant of US $ 165 million to provide ART in the public sector and through public-private partnerships for 1,00,000 people living with AIDS over a five year period.[3]

As announced by the then Health Minister, the actual plan aimed at providing free anti-retroviral treatment to 1,00,000 people living with HIV/AIDS by the end of 2005, and to provide treatment to an additional 15–20 percent of AIDS cases each year, thereafter, for a period of five years. The roll out started in April 2004, and covered three groups: women covered under 'Prevention of Parents To Child Transmission' (PPTCT) programme, children below 15 year of age, and AIDS cases that seek treatment in public sector hospitals. The programme was started in the six high prevalence states of Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Manipur and Nagaland, and in the capital city of Delhi. Recent reports indicated that NACO was aiming to expand the ARV roll out to 100 centres—with at least one site in each state—by the end of the year 2005.[4]

Interestingly, the programme was put in place in government hospitals/medical colleges, without much interaction with the state health departments. Since it was being run as a central programme, the state health departments were not actively taken on board for planning purposes, though the funding for the hospitals came from these departments. Instead, the State AIDS Control Societies (SACS), which were running the prevention and control programme in the states, were made the focal points of the treatment programme as well. The national guideline for implementation of ART was formulated and distributed across the ART centres. Attempts were made to strengthen the health system through capacity building measures for treating physicians, and each ART site was given some start-up financial help.

[3] http://www.nacoonline.org/directory_arv.htm

[4] Answer of the minister of state in the Health Ministry to Lok Sabha: Unstarred question no. 454 has been answered on 27th July 2005.

According to NACO, currently, there are about 39,000 patients on ART, of which more than 76 percent access ART from NACO-supported ART centers. In addition, there are other sites where ART is offered for free, the major ones being in the NGO sector (about 10 percent). The private sector covers about 6 percent of ART patients currently on treatment in India. In all, there are currently 54 NACO supported ART sites all over the country, with 39 of these being in GFATM[5] states, declared as high prevalence. Another 15 sites are in medium/low prevalence states that are not being funded from the GFATM funds.

Rationale and Objectives of the Study

Till recently, India had no comprehensive estimates whatsoever on the economic or financial costs of treatment with ARV, either in the public or in the private sector. The only study is a recent one by Bhat and Saha (2006), which uses incremental cost approach to calculate per client cost of providing ART for a site in Gujarat, and arrives at a figure of Rs. 668 per month. However, these calculations are based on the direct provision of ART and do not take into account other shared costs incurred by the different departments of the hospital. For the government programme, it is even more essential to arrive at such costs, to know the burden on different entities and to understand the feasibility of sustaining the programme over the years. Also, a somewhat neglected angle has been the lack of recognition that core government funds are being spent to sustain the programme, since a significant part of the costs of running the programme is being borne by the hospitals that are actually treating the patients. Due to the fact that the hospitals are part of the government system, the importance of cost-saving or costing often seem absent from the priorities of both planners and implementers.

Another reason for undertaking a costing exercise is to understand the component of total cost that is borne by the individuals, while accessing ART.

The present study attempts a full financial analysis of the recurrent costs of the ART programme of the government of India, with a view to understand the following:

- The per client cost of provision of ART by the government
- The share of various components of the programme in total cost
- The distribution of costs across the different bearers of such costs
- The resource implications of scaling up and the long run sustainability of the programme

[5] The Global Fund on AIDS, TB and Malaria (GFATM) awarded a financial grant of US $ 165 million to provide antiretroviral treatment in the public sector and through public-private partnerships for 1,00,000 people living with AIDS over a five year period.

Methodology and Data Collection

The unit cost of any intervention is measured as the total cost divided by the output measure. It is an average figure and indicates the cost needed per intervention. An economic cost analysis involves a broader evaluation of resources used, regardless of who actually pays for those resources. Calculation of unit economic costs includes financial costs, and values all resources that go into the programme, at costs that reflect their true value in alternative uses.

To arrive at unit costs, it is necessary to first lay down the components of the programme, and then to cost each of these components in its entirety. Different approaches have been adopted for arriving at the functional components of an ART programme, but broadly, the following components go into it:

- ARV drugs
- OI treatment
- Diagnostic tests
- Out Patient Department (OPD) service
- In-Patient Department (IPD) service

Ideally, a proper costing exercise should include both recurrent and capital costs, as well as fixed recurrent costs that are applicable every few years, like costs of training and maintenance. However, in this analysis, the capital costs have not been considered.

As for the OPD and IPD costs, these would include human resources as well; for example, physicians' (and that of other health care personnel's) time to look at patients in OPD, IPD, giving treatment for opportunistic infections (OI) or running the diagnostic tests are therefore, in principle, already counted under these heads, unless it is assumed that additional time is being spent by these individuals on the ART programme. If the latter is true, value of additional time will need to be attributed to the programme.

A key component of a costing exercise in countries like India, is to elicit shared costs, i.e. cost of inputs that are not obviously part of the ART programme, but indirectly are important for the programme to run. In India, the programme is being run in government hospitals, and a significant part of the ART programme costs is being borne by the hospitals themselves, which is included in this analysis as shared costs.

The analysis calculates mainly financial costs, rather than economic costs using shadow prices. In the absence of capital costs, the relevance of shadow prices in the ART programme comes mostly from the value of personnel in the programme; however, since the perspective is programmatic, rather than societal (except for the component of costs incurred by individual), only costs accruing to the government has been considered operationally. It is recognized that physicians trained in the ART centres have high opportunity costs in the private sector, but if the government wants to scale up the programme, it will have to hire only at rates that are pre-fixed, and no additional incentives are possible to give in the government set up.

There are various methods of costing programmes like step-down allocation, simultaneous allocations etc., but we have followed an intuitively simple methodology, given below:

1. Collect cost associated with the ART clinic: since the NACO programme created an ART centre at each site, and funded most of it, this exercise entailed a straightforward collation of costs from mainly the SACS offices. Mostly, these were costs borne by NACO, but wherever any other staff was putting in full time work, their time/salary was included as well.

For costs at the level of the hospitals, the following steps were involved:

2. Identify the major departments that were involved in treating ART patients. Most often the departments involved in the ART included Medicine, Skin/STD and Gynecology.
3. Collect total IPD and OPD data from these identified departments, as well as volume of ART patients being sent to these various departments.
4. Collect information on time allocation (for ART) of physicians and other health personnel of these core departments.
5. Identify the major diagnostic departments involved in running tests for the ART patients, which include:

    a. Microbiology
    b. Radiology
    c. Pathology
    d. Biochemistry

6. Collect from each site details on the various mandatory tests done for the ART patients and frequency of such tests.
7. Elicit from these diagnostic departments volume data on tests, so that allocations due to the ART programme could be done.
8. Collect department-wise annual expenditure data for each of the core and diagnostic departments identified as being directly or indirectly involved in the ART programme.
9. Allocate costs to each of the departments based on volume data.
10. Collect volume data from VCTC, which is taken to be the most unambiguous measure of increase in patient load, to see trends over time.
11. Collect expenditures incurred by NACO/SACS on drugs purchased, training, and CD4 test kits & reagents.

Finally, human resource costs incurred by NACO and SACS on the ART programme, were collected as the last step in this methodology.

As is clear, there are mainly four distinct 'government' entities that are incurring costs for the ART programme being run at these hospitals:

- NACO
- SACS
- Hospitals
- State governments

At times, parts of the costs have been borne by other organisations like the WHO and GFATM, which were flagged at the time of the analysis.

The methodology described above was used for eliciting all the costs with one important caveat: since the general hospitals studied were quite large with huge OPDs, it was decided that OPD costs will not be considered separately, especially since the ART patient loads were a very small part of the total OPD load.

Once all the cost components were in, the total cost for each of the sites was calculated and the unit costs arrived at by a simple division of total costs by the number of clients being

TABLE 1
Brief Overview of the Selected Sites

Site City	*Year of Establishment*	*Type of Hospital*	*Specialty*	*Total OP 2005*	*Total IP 2005*
GHTM Chennai	1928	Super specialty	Well known for Tuberculosis and HIV treatment; oldest NACO site	3,19,971	24,588
Medical College, Trivandrum	1951	Medical college attached Multi/ super specialty	Kerala's oldest medical college; ART site started as state govt. initiative. Now converted into NACO site	4,53,691	65,754
Government Medical College Thrissur	1981	Medical college attached Multi/ super specialty	Kerala Government started the ART Site, Now a NACO site	1,18,913	21,616
B J Medical College Ahmedabad	1953	Medical college attached Multi/ super specialty	Only ART site in Gujarat	6,38,017	66,670
Ram Manohar Lohia Hospital Delhi	1930	Multi/super specialty	Funded by Central government	11,57,653	48,937
Lok Nayak Jai Prakash Hospital Delhi	1930	Medical college attached Multi/ super specialty	One of the First NACO ART site	10,62,768	67,960
Regional Institute of Medical Sciences Imphal	1972	Medical college attached Multi/ super specialty	Funded by Central government through North East Council	2,37,297	27,588

treated at the end of the study period. Alternative definition of volume, defined by "total client months on therapy" at the end of study period, was also calculated and used as another denominator, as will be explained below.

An important component of the cost of the ART programme was expenditure incurred by the patients themselves in accessing ART from the sites. A total of 264 interviews were conducted spread over all the ART sites, with a focused questionnaire that attempted to elicit the amounts individuals had to spend out of pocket to access the free ART at the sites: the items included were ART drugs, OI drugs, tests, transport, stay, wages lost and food.

The details of the 7 sites selected in consultations with NACO and their characteristics are given in Table 1. Since the aim was to understand the cost of the free ART programme, two sites were selected which were initially not NACO sites, but were being supported entirely by the state government and were offering free treatment as well: these are the two Kerala sites at Trivandrum Medical College and Thrissur Medical College. The Trivandrum Medical College became a NACO-supported site in May 2005, and the Thrissur site was inducted into the NACO programme in November 2005.

The study sites differed from each other significantly in terms of personnel, procurement of drugs for ART and OI, issues around treatment of opportunistic illnesses and data management. Below, some of the initial issues and concerns of the ART programme are mentioned without mention of specific sites; it must be noted that not all the sites had similar problems.

In addition to the problems specific to the ART programme, one major finding of the team was around the general data management in the hospitals, especially around book-keeping and accounts. None of the hospitals, except one, had department-wise breakup of expenditure, which meant that the exercise on cost apportionment was almost impossible to do. Lack of proper data implies that many additional assumptions have to be made about how the total annual expenditure of the hospital should be divided among different departments, which renders the costing exercise somewhat tedious as well as imprecise.

Needless to say, the calculations of total cost of the ART programme for all the sites could be made operational only with some critical but sound assumptions, which will be spelled out in the next section, wherever relevant. The cost estimates are therefore, approximations, but the margins of errors are believed to be small.

Key Methodological Assumptions and Parameters

The total costs were arrived at based on alternative assumptions about key parameters, which are discussed below.

a Reference Period

Table 2 gives details of when the ART programme started in each site, and the study period.

TABLE 2
Reference Period for the Study

Site	*City*	*ART Started*	*NACO Site Started*	*Study Period*	*Study Period in Months*
GHTM	Chennai	1994	Apr 04	April 2004–March 2006	24
TMC	Trivandrum	March-2004[6]	May 05	April 2005–March 2006	12
BJMC	Ahmedabad	April 2005	Apr 05	April 2005–March 2006	12
THR	Thrissur	November-2004	Dec 05	November 2005–October 2005	12
LNJP	Delhi	April-2004	Apr 04	April 2004–March 2006	24
RIMS	Imphal	1995	Apr 04	April 2004–July 2005	16
RML	Delhi	April-2004	Apr 04	April 2004–March 2006	24

The analysis is mainly based on the reference period mentioned above, but also includes a section where the differences in costs over two years are looked at, based on an analysis of those sites for which more than one year's data was available. This was done so that the costs from the NACO-supported sites could be compared, and also to understand the sources of changes in costs over time. Presumably, these sources also present potential control knobs for managing the total cost of the programme. For presentation purposes, the costs were presented as monthly per client costs.

b Volume on ART

The most definitionally challenging of all the variables that went into the cost calculations was the volume "on ART". A study of the various possibilities indicated that there is no one standard way of arriving at the denominator. The number of people on ART by the end of the study period includes adjustments for deaths, treatment failure, drop outs, lost to follow-up, re-transfers and re-installed. Figure 1 presents the trend in these variables across sites, and indicates that these variables are quite insignificant in most of the sites.

Table 3 presents alternative ways of looking at the volume on ART. The first column presents the number ever started, the next one indicates the number at the end of the study period and the third column indicates those who have been on therapy for the entire study period. From the costing perspective, however, it may seem as though the most relevant number is the one that captures usage of drugs, which should also adjust for the staggered entry into the programme. In other words, for the reference period, for those who entered in the first month, a full 12 months of stay in the programme would be counted; but for those entering into the 2nd month, only 11 months should be counted etc. If these adjustments are made to the variable 'clients alive and on therapy', which is already adjusted for exits from the programme due to

[6] The ART programme started in November 2004, but became functional in the department of Medicine only on March 2005.

FIGURE 1
Distribution of Clients Ever Put on Therapy Across Study Sites

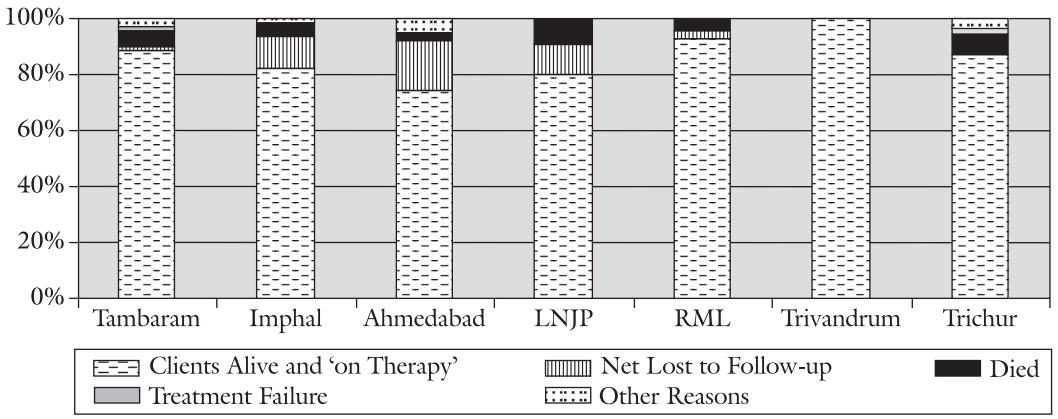


TABLE 3
Volume on ART – Alternative Definitions

Site	*Number of Clients Ever Started*	*Number of Clients at the End of Study Period*	*Number of Clients Who have Been on Therapy for Entire Study Period*	*Equivalent Client Months*	*Ratio of Client Months to Clients Ever Started*
Tambaram	2941	2606	1083	25989	8.8
Imphal	276	226	228	3642	13.2
Ahmedabad	1635	1210	819	9824	6.0
LNJP	651	523	288	6901	10.6
RML	1302	1205	555	13317	10.2
Trivandrum	498	498	350	4200	8.43
Thrissur	353	308	196	2348	6.7

deaths, treatment failure etc, one can arrive at an alternative definition of volume, which can be defined as the "equivalent client months on ART", which is indicated in column four of Table 4. The last column, which is the ratio of client months to those ever started gives an idea of the ability of the programme to retain people; the lower the number, the more churning is there in the programme in terms of the exits and entries into the programme.

Firstly, the table shows that the sites are quite dissimilar in terms of client loads. Also, many more people have been in the programme and consumed drugs for that duration, which may be inevitable with death and treatment failure, but can also happen due to non-adherence and drop out. Ultimately, the client-month definition has an intuitive appeal because it indicates the net ART uptake. For this analysis, we use both these definitions to present alternative scenarios of costing. The reference period and volume numbers are the two variables that allow us to present alternative scenarios of costing.

TABLE 4
Per Client Cost Across Sites and Items

Sites	*Tambaram*	*Imphal*	*Ahmedabad*	*LNJP*	*RML*	*Trivandrum*	*Thrissur*	
Volume on ART	*2606*	*226*	*1210*	*522*	*1205*	*498*	*308*	*Aggregate*
Human resources-ART centre	64	254	48	186	68	60	60	106
Human resources-others	35	164	42	76	37	63	43	66
ARV drugs	228	642	299	324	203	583	500	397
CD kits and reagents	93	482	209	99	101	297	0	183
OI drugs	5	137	7	4	3	6	7	24
Hospital department support	50	95	38	25	27	17	20	39
Miscellaneous	1	0	0	3	1	0	0	1
Contingency grant	1	8	0	0	2	0	0	2
Per client cost–1	**476**	**1782**	**644**	**716**	**442**	**1026**	**630**	**817**
Training costs	0	0	7	17	7	17	137	30
Establishment grant	1	78	6	0	2	32	0	17
Per client cost–2	**477**	**1861**	**657**	**733**	**451**	**1075**	**767**	**860**

c Additionality of CD4 Test

Another important methodological concern is whether the entire CD4 testing in the reference period should be attributed to the ART programme, because CD4 tests were routinely being done in many of the sites even before the ART programme was put in place. Firstly, only three sites had CD4 testing facilities well before the start of the respective ART programmes. Secondly, in one of these sites, RIMS, the numbers bounced around a lot due mainly to self-rationing by the hospital, because of unavailability of drugs as well as overuse of the machine. As for Tambaram, it had a very different profile compared to the other general hospitals; TB and HIV were the two major diseases it was dealing with, and the CD4 numbers were understandably much higher than in other hospitals. Finally, the only other relevant site, the CD4 numbers from RML, if projected (without ART) seemed similar to the ones with the ART programme.

The issue of additionality of CD4 tests was, therefore, difficult to resolve in any logical fashion. In our calculations, we have taken the current CD4 test numbers for calculating the additional test load, at the risk of slight overestimation. From the point of view of setting up a new site with a CD4 machine, there is no easy way to separate the spontaneous demand for CD4, from demand that is being generated in anticipation of the ARV treatment; thus, it may not be too wrong to use the current numbers in the calculations.

As for the additional load on the microbiologist, this seemed to be on an average around 25–30 percent, based on the responses received. Going by the same logic, this proportion may be somewhat of an overestimate, but was used in our calculations nevertheless. It must be remembered that with scaling up and setting up of additional sites in these cities, the load on the CD4 machine as well as on the microbiologist would be reduced, as was seen from the RIMS case (the CD4 test numbers decreased with opening up of new site nearby). A view

that emerged from the various discussions with the site personnel was to have a dedicated medical officer/microbiologist for the ART programme.

d Sources of Expenditure

As explained in the methodology, there are several distinct parts to the total costs, each of which are explained below, and the detailed assumptions used in the calculations are given in Table 5. Additional site-specific assumptions are given in the Annex.

- ***Human resources to support the ART centre:*** the research indicated that many physicians at the hospitals are giving time to the ART centers, in addition to the ones hired specifically for the programme. While the proportion of time spent and the number of physicians[7] involved in the programme varied from site to site (from one to about six in a general hospital[8]), in no site was the ART centre being run only by the ART doctor. Most of the extra effort was coming from personnel of the medicine department, followed by microbiology department.
- ***Human resources, ART center:*** NACO ART programme envisaged that the following personnel would be required for running each site: 2 Medical Officers, 1 Data Entry Operator (DEO), 1 Counselor, 1 laboratory technician and 1 record keeper cum computer

TABLE 5
Per Client Costs Based on "Client Months on ART"

Sites	*Tambaram*	*Imphal*	*Ahmedabad*	*LNJP*	*RML*	*Trivandrum*	*Thrissur*	
Volume on ART	*1083*	*228*	*819*	*288*	*555*	*350*	*196*	*Aggregate*
Human resources-ART centre	153	253	71	337	147	85	95	163
Human resources-Others	84	163	63	137	81	90	68	98
ARV drugs	548	637	441	588	440	829	786	610
CD kits and reagents	225	478	309	179	220	422	0	262
OI drugs	11	136	11	8	7	9	12	28
Hospital department support	120	94	56	45	58	25	32	62
Miscellaneous	2	0	0	5	3	0	0	1
Contingency grant	2	8	0	0	4	0	0	2
Per client month cost–1	**1145**	**1770**	**951**	**1300**	**959**	**1461**	**992**	**1225**
Training costs	0	0	10	30	16	24	215	42
Establishment grant	2	78	10	0	4	45	0	20
Per client month cost–2	**1147**	**1847**	**971**	**1330**	**979**	**1530**	**1208**	**1287**

[7] In many countries, physicians spend time counseling the patients; this happens also in India, and is captured by the extra time spent by 'hospital' physicians on the ART programme.

[8] Tambaram hospital is mainly a TB hospital, catering to a large number of HIV positive patients. Therefore, the number of physicians involved in the ART programme is much higher.

operator. Three out of 7 sites did not have 2 medical officers when they were started, and counselors were sometimes taken from the VCT center, initially. The rest of the personnel were appointed as scheduled in most of the sites; in few sites the appointments were made late and essentially the hospital staff were running the ART programme for a long time. The costs of ART center personnel were straightforward to calculate and attributed entirely to NACO and to hospital, as the case may be.

- ***ARV drugs:*** the supply of ARV drugs presents a mixed scenario: while NACO is supposed to supply the drugs, the state-initiated programmes were buying the drugs on their own, through the SACS or relevant state departments. Even after these sites became NACO sites, the drugs continued to be supplied by the state government, at least for a while. Additionally, there were also instances of NACO-sponsored sites where local level purchases were made by SACS to meet the demand gaps. The cost of these drugs was obtained from a variety of sources: ART monthly reports compiled at the sites (and submitted to the respective SACS) gave figures on consumption of the various drugs, which were then used in conjunction with unit prices (obtained from NACO/SACS/other relevant state agencies[9]) to arrive at total cost of drugs consumed. Weighted average of unit cost was calculated when there was more than one supplier i.e. NACO and SACS.
- ***CD4 kits and reagents***: costs of CD4 tests was calculated based on prices of CD test kits and reagents.
- ***OI & prophylactic drugs***: the common prophylactic drug used was Septran; this and other common OI drug costs were included using consumption figures.
- ***Hospital department support to ART programme***: six departments, which include 4 diagnostic departments—Radiology, Microbiology, Pathology and Biochemistry—and Medicine and Skin departments were included in the cost calculations. Unfortunately, none of the general hospitals keep accounts separately for each department. Thus, the proportions on department-wise breakup of total costs from RIMS were used for the other hospitals, to arrive at department-wise costs, for these 6 departments. For Medicine and Skin, total volume of inpatient admissions was taken as the denominator and the admission of ART patients as a numerator.
- ***Miscellaneous:*** this involved refreshments, office charges like printing and stationary by SACS, and other petty expenses. These could be obtained from the SACS office.
- ***Contingency grant:*** NACO grants Rs. 50,000 every year for running expenses.
- ***Training cost***: training of ART team consisting of 10 people.[10] NACO is responsible for arranging and funding all training in NACO sites. State programmes like those in

[9] For the Kerala sites, the Directorate of Medical Education, Department of Health and Family Welfare purchased the drugs. Even now, when these sites have become NACO sites, the drugs are not being supplied by NACO.

[10] Consisting of one Physician, One Surgeon, One Gynecologist, one Pediatrician, one Community Medicine Specialist, one Microbiologist, one Psychiatrist, one TB Specialist, one STD specialist and one Staff Nurse.

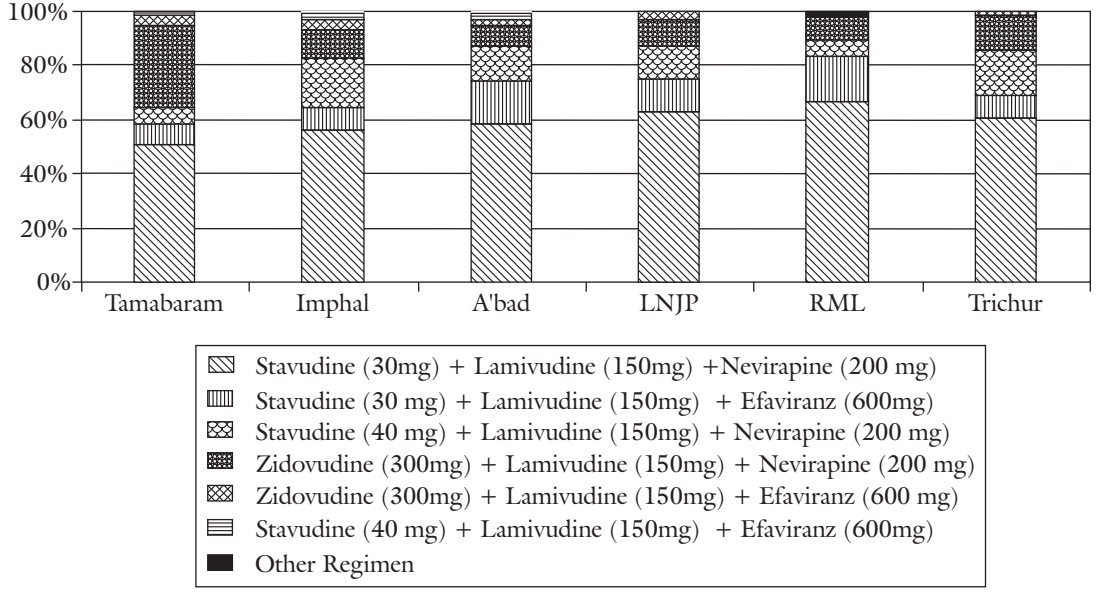
Kerala followed a slightly different pattern of training. Delhi SACS also arranged some training for counsellors, which has been included under training cost. For RIMS and Tambaram—being themselves training sites—there were no training expenses.

- ***Establishment grant:*** additionally, NACO granted Rs. 50,000 in the first year for the purchase of computer and printer. Only in one site, RIMS, were there expenses on building renovation, which was borne by the state SACS.

As was mentioned above, a part of the total expenditure of the hospital was apportioned to the ART programme, which was based only on current costs, and not capital costs; thus for instance, any equipment purchased was left out of the calculations of the total hospital cost.

Before turning to the analysis, it is important to present the different drug regimens in some detail, since drugs and drug prices pay a central role in the costing exercise. Figure 2[11] below shows the various combinations used across the sites, which indicates that the government programme is providing only 1st line drug regimen. Apart from Tambaram, Chennai—where a significant proportion of clients are on Zidovudine combinations—most of the other sites are mainly using the combination of Stavudine (30 mg), Lamivudine (150 mg) and Nevirapine (200 mg). Clearly, the total cost of drugs would depend on what combinations are being used, and in what proportions.

FIGURE 2
Distribution of ART Clients Across Drug Regimens



[11] The distribution across drug regimens was not available from Trivandrum.

Costs of the ART Programme: Analysis

The major results are presented below under different heads, to make the exposition easy to understand.

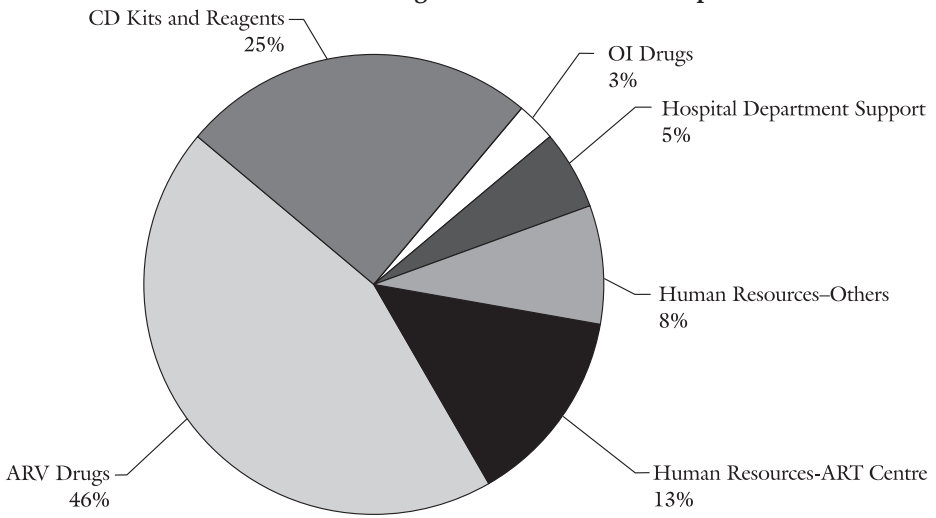
Itemized Monthly per Client Costs Across the 7 Sites under Alternative Assumptions of Volume

Table 4 presents per client costs across the different items for all the sites, using the definition of "those on ARV by the end of the study period", as the definition of volume.

It is interesting to see that the monthly unit costs vary substantially across the sites. If one looks at per client cost–I, the unit costs are between about Rs. 450 to about Rs. 1800. The last column of the table gives the average per client cost, which comes to about Rs. 817 leaving out training and establishment grants; including these gives a per client cost of Rs. 860.

Figure 3 shows the share of each of the items in total cost, obtained from the last column on average unit costs.[12] Interestingly, drugs comprise only 46 percent of the total costs, with the remaining costs being spread across the other items. This is lower than the share of ARV in the Thai national programme, which was estimated at 60 percent.

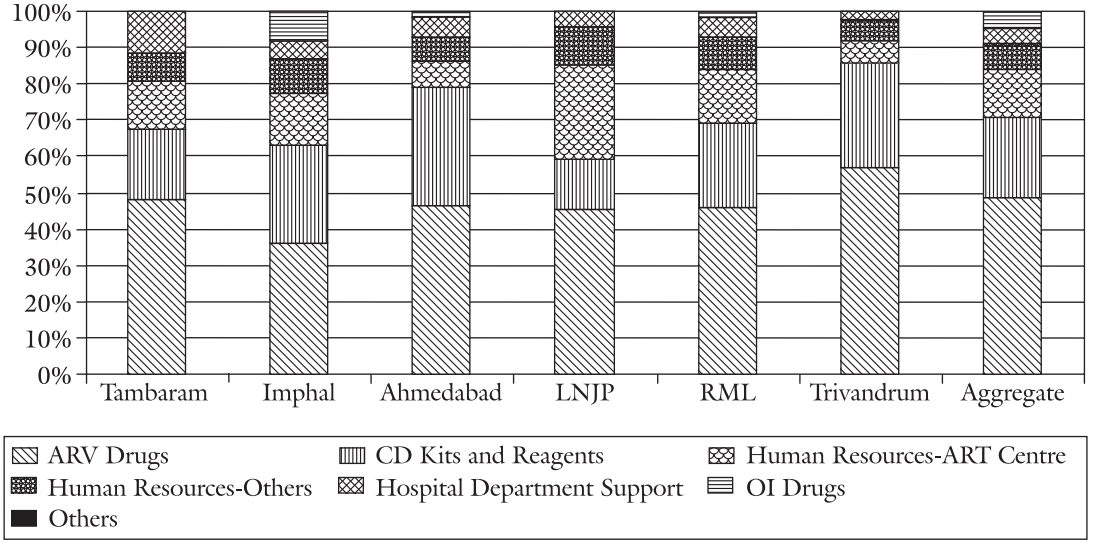
FIGURE 3
Distribution of ART Programme Cost Across Components



[12] Thrissur has been left out from this, since it did not have a CD4 machine, and including it would have yielded inaccurate shares.

Figure 4 presents a site-wise picture of the itemized costs. Overall, the major cost driver remains the cost of drugs; whenever the sites could not take advantage of the bulk purchase done by NACO, the drug costs were high, as was the case with the Kerala sites and Manipur. Next in importance is cost of CD4 tests, which depend on both the volume (which makes it lower) and the number of mandated tests, which is hospital-specific (Thrissur is an exception because it did not have a CD4 machine). As for human resources, the larger the hospital, smaller is the burden on human resources; thus for instance, Ahmedabad, RML and Trivandrum have a very low share of costs contributed by human resources.

FIGURE 4
Share of Programme Components in Total Cost



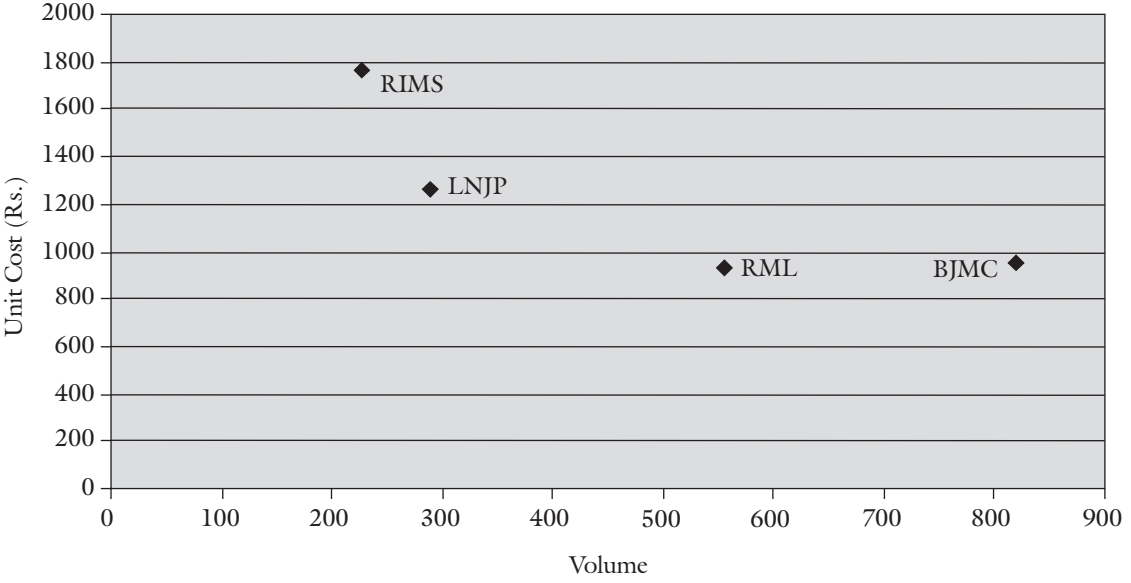
Per Client Costs Based on Alternative Definition of Volume

As discussed before, an alternative definition of volume (on ART) is to adjust for the staggered entry into the programme over the reference period, and use the "client months on ART" as volume. Table 5 is similar to Table 4 above except that it uses the "client months" definition. As can be seen, the per client costs are higher using this definition; also the costs for drugs now look more similar across sites than in the previous table. This definition is a more accurate way of assessing the actual costs of running the programme, because it takes into account the monthly drug consumption. Based on this definition, the per client costs of ART comes to between Rs. 1225 and Rs. 1287 depending on whether or not recurrent fixed costs are included.

Overall, the shares across the components are very similar between the two definitions, and therefore a chart similar to Figure 3 based on Table 5 is not presented here.

If one compares the unit costs against the volume on ART across the NACO sites only (leaving out Thrissur, Trivandrum and also Tambaram because it is a specialised hospital), there does seem to be a trend towards lower costs with higher volume, indicating the likely presence of economies of scale. Figure 5 plots the unit costs against the volume for the 4 sites, where a clear negative relationship is evident. In fact, BJMC, Ahmedabad, seems somewhat of an outlier because it purchased a large amount of drugs on its own. While a much larger sample is necessary to confirm this, it does seem as though NACO can keep avail of economies of scale if it sets up ART sites in places where the numbers are going to be larger.

FIGURE 5
Relation between Volume and Cost



Distribution of Programme Costs

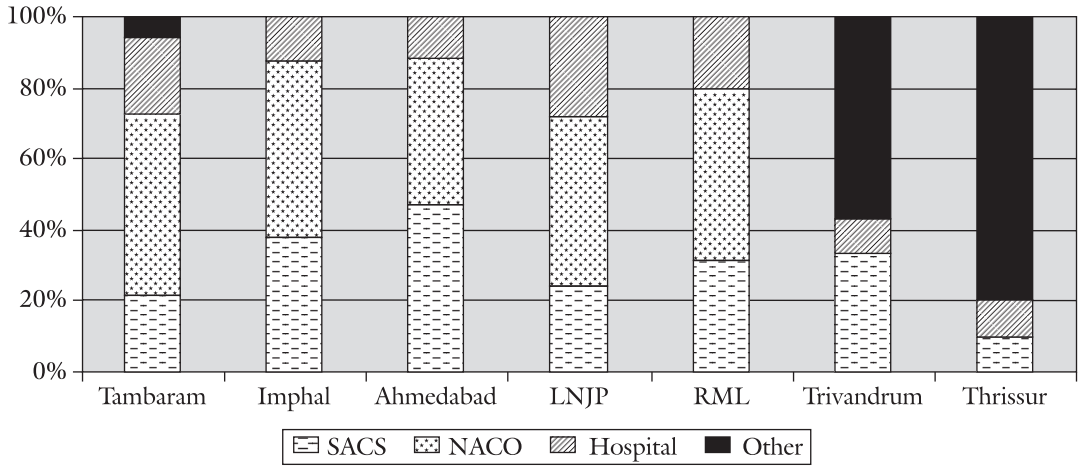
The following two tables show the distribution of the total costs across the various agencies: SACS, NACO, hospital and state government. While the expenditure incurred by the hospitals are also ultimately from the state government, (Department of Health), functionally these are different entities, and thus, the analysis is presented separately for each. In fact, the funds of the various SACS come from NACO as well, but since the ART programme is a separate sub-programme of NACO, the analysis separates expenditures of SACS from NACO.

Table 6 and Figure 6 present the allocation of total recurrent costs. There was not much of a difference between the two definitions of costs, with and without the fixed costs of training and establishment, so only one set of figures (omitting fixed recurrent costs) are presented here.

TABLE 6
Burden of Total "Recurrent" Cost Across Entities (%)

Sites	*SACS*	*NACO*	*Hospital*	*Other*
Tambaram	22	51	22	6
Imphal	38	49	13	
Ahmedabad	47	41	12	
LNJP	24	48	28	
RML	31	49	20	
Trivandrum	33	0[13]	10	57
Thrissur	10		10	80
Average across selected NACO sites[14]	35	47	18	

FIGURE 6
Share of ART Programme Cost Across Entities



Since Trivandrum and Thrissur were initially state programmes, leaving these two sites out gives the following allocation: NACO-47 percent, SACS-35 percent and hospitals-18 percent (last row in Table 6). Thus, slightly less than half of the total cost of running the programme is borne by NACO; the SACS are also spending a significant amount of funds from other sources to run the ART programme, mostly on the CD4 kits and reagents. Finally, and most interestingly, the sites themselves bear some of the burden (mainly through departmental support and personnel), though they do not receive any additional funding for running the programme.

[13] The figure for NACO's share is 0.3 percent.
[14] Imphal, Ahmedabad, RML and LNJP.

A new development is the proposal of the NACO to centralize the purchase of CD4 kits and ARV drugs. If we shift the burden of CD4 and ARV drugs to NACO, the shares in Table 6 will change as indicated in Table 7. Now, the true burden on NACO would be around 78 percent of the total programme cost, with the hospitals contributing about 18 percent (in a lower total cost amount).

TABLE 7
Burden of Total "Recurrent" Cost Across Entities—with CD4 Test and ARV to NACO (%)

Sites	*SACS*	*NACO*	*Hospital*	*Other*
Tambaram	2	71	22	6
Imphal	9	78	13	
Ahmedabad	2	87	12	
LNJP	3	70	28	
RML	2	78	20	
Trivandrum	4	29	10	57
Thrissur	10	0	10	80
Average across selected NACO sites	4	78	18	

Impact of Reduced Prices of ARV Drugs and CD4 Test Kits

While the analysis was underway, the prices of ARV drugs had already come down substantially, and NACO was able to procure these drugs at a much reduced rate. It is easy to see that reducing the prices of ARV drugs and CD4 tests kits would significantly reduce the unit costs of the programme. Table 8 presents a hypothetical scenario with 50 percent reduction in prices of ARV drugs and CD4 test kits.

TABLE 8
Estimated Unit Costs with Reduction in Prices of ARV Drugs and CD4 Test Kits

Site	*Unit Cost with No Change*	*Unit Cost with 50% Reduction in ARV Prices*	*Unit Cost with 50% Reduction in ARV and CD4 Kit Prices*
Tambaram	1145	871	759
Imphal	1770	1451	1212
Ahmedabad	951	731	576
LNJP	1300	1006	916
RML	959	739	629
Trivandrum	1461	1046	835
Thrissur	992	599	599
All sites	1225	920	789
All sites except Thrissur	1264	974	821

Clearly, if NACO can bring down the prices of ARV and CD4 by 50 percent, per client cost of the programme is going to fall by about 23 percent. The effects of such reductions on future cost projections will be discussed later in the paper.

Out-of-Pocket Expenditure

To understand whether individuals spend out-of-pocket when they access ART, a sample of 264 individuals was taken from each of the 7 sites. Since the respondents had to be interviewed at the ART clinic, the sampling was purposive, but the interviews were spread over several days. Also, there did not seem to be any particular pattern to the type of individuals attending the clinic on any particular day, since all the individuals were coming back for their monthly refill of ARV drugs. Therefore, no significant bias was introduced in this kind of sampling.

Out of a sample of 264 individuals, 68 percent were males and the average age of respondents was 36. About 74 percent of the respondents were currently married, and 18 percent were single. The rest comprised widows, divorcee etc. More than half the sample of individuals was currently working.

On an average, respondents were on free ART for at least 12 months in the sample. The questionnaire asked in detail about different type of expenditures incurred while accessing ART. Table 9 indicates the percentage of individuals who spent non-zero amounts on any of the amounts, and the average monthly expenditure on these items.

TABLE 9
Out-of-pocket Expenditure to Access ART

Item	*Percentage Non-zero*	*Average Expenditure*
ARV	12	27
OI drugs	52	108
Vitamins	41	54
Food and nutrition	56	212
Initial test	61	96
Monitoring test	21	18
Hospital stay	35	88
Transport	96	158
Wage loss	39	83
Lodging	4	18
Other	63	50
Total expenditure		**911**

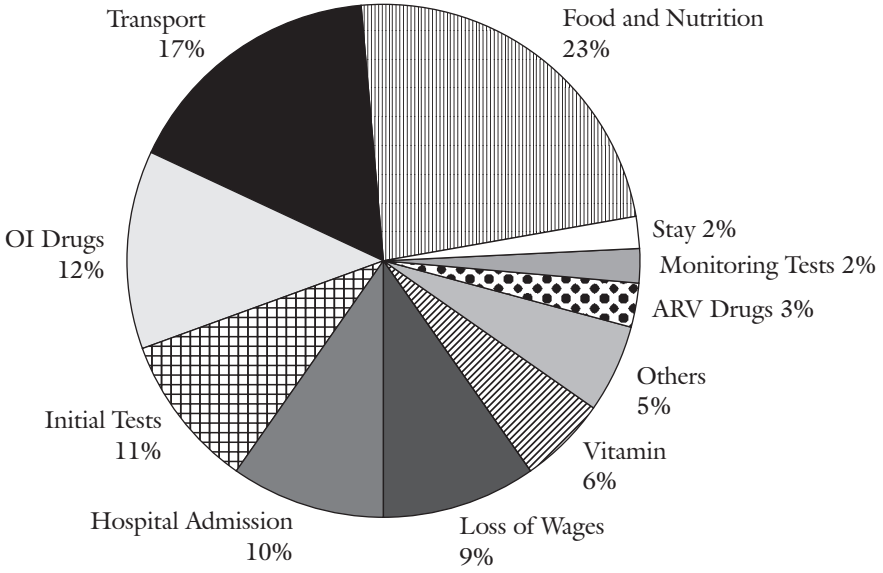
The three major items of expenditure are food and nutrition,[15] transport, and OI drugs, respectively. On an average, individuals were spending Rs. 958 per month to access the free ART. While this amount does not seem a large sum, for the poorer socioeconomic categories, a regular monthly expenditure of about Rs. 1,000 could mean a significant burden of treatment.

[15] The question on food was worded carefully and the interviewers were also trained to ask the question so that routine food intakes were not included. The emphasis was on whether the client has been advised by anyone to take additional nutritious food like eggs, meat, milk, and fruits.

This is almost equal to unit cost of provision of therapy, indicating that the actual cost of accessing ART is double than the cost of provision.

Figure 7 shows the share of these various items in total monthly expenditure, and reconfirms the importance of food, transport, and OI drugs.

FIGURE 7
Distribution of Individual Cost While Accessing ART



The importance of nutrition in ART is now slowly gaining recognition,[16] and there is some evidence to suggest that the efficacy of treatment in a well-nourished person is better than in an under-nourished one. As for transport cost, the importance of this in the context of health seeking behaviour is now well documented. Thus, it is not surprising that transport constitutes a significant part of the total out-of-pocket expense.

Finally, other studies have found that tests can impose a significant burden on individuals and they are less willing to pay for tests than for drugs (Gupta et al 2004).

The implication of these results is clear: if economic burden is a reason for non-adherence in some of the clients, there is some justification in trying to find alternative sources of financing for some of the major items, like food, tests and transport; this may ensure higher adherence than otherwise, and ensure a better treatment outcome.

[16] http://www.unsystem.org/scn/Publications/AnnualMeeting/hiv_reference/SCN_HIV_articles/ARV_and_nutrition_interactions.htm

Overview of Results and Future Projections

The key results of this analysis are given below:

- The average per month per client recurrent cost of the ART programme is Rs. 1264 or about $30; thus, the annual per client cost is Rs. 15,168 or $353.
- There are economies of scale in provision, and the total costs are proportionately lower for NACO centers with higher clients.
- The bulk of the costs come from drugs (46 percent), followed by CD4 test costs (24 percent), human resources (22 percent), hospital support (5 percent) and OI drugs (3 percent) respectively.
- On an average, the share of costs across entities is thus: NACO–47 percent, SACS–35 percent and hospitals–18 percent.
- If NACO can reduce the prices of ARV drugs and CD4 test kits by half, it can reduce the per client cost by 23 percent.
- Centralizing drugs and CD4 test kits purchase will shift the burden (of a lower total cost amount) mostly to NACO, and its share will increase to 78 percent.
- The expenditure incurred by the clients themselves while accessing ART is about Rs. 900 ($21) per month.
- Thus, the societal cost of ART comes to around between Rs. 2164 per month or Rs. 25,968 annually ($604).

What do these results imply?

The first implication is about scaling up and calculation of total cost of provision. Any planning for further expansion can be based on these numbers, and depending on the scale-up plan, financial planning can be undertaken using these numbers. Table 10 gives a hypothetical example of a possible financial planning exercise, based on NACO's aim to put 100,000 people on ART by the end of the financial year 2007, and thereafter an additional 15–20 percent for the next five years (NACO ART Guideline, 2004). Such projections do not address the issue of deaths directly, but does so indirectly, by using treatment "slots" as the basis of calculations, which is inclusive of attrition due to death, non-adherence and treatment failure. Also, since the calculations are based on recurrent costs, costs of new CD4 machines are not included, which can be calculated separately. The unit cost taken here is the one taken from Table 8. Also, the assumption is that NACO is now going to bear the costs of CD4 test kits and ARV drugs. Thus, starting with a unit cost of Rs. 1264 per month (which translates into about $350 per year), what do the costs look like in the next five years?

The total cost of the programme over the next 5 years would be $215 million, out of which NACO's share would be 81 percent.

TABLE 10
Projections of Costs of ART Programme for the Next 5 Years
(In millions of Rupees)

Year	*Projected Volume*	*Annual Cost @ Current Unit Cost of Rs. 1264*	*Annual Cost in Million US$*	*Share of SACS*	*Share of NACO*	*Share of Hospital*
2007	100000	1517.3	35	37.80	1226.26	253.28
2008	110000	1669.1	39	41.58	1348.88	278.60
2009	121000	1836.0	43	45.74	1483.77	306.46
2010	133100	2019.6	47	50.31	1632.15	337.11
2011	146410	2221.5	52	55.34	1795.36	370.82
Total over 5 years	–	9263.5		230.78	7486.41	1546.27
		(100%)	–	(2.5%)	(80.8%)	(16.7%)
Amount in millions of dollars	–		215	5	174	36

Table 11 is similar to Table 10, except it uses the assumption of 50 percent reduction in prices of ARV drugs from 2007 onwards. The total cost of the programme over the 5 years reduced from $215 million to $166 million.

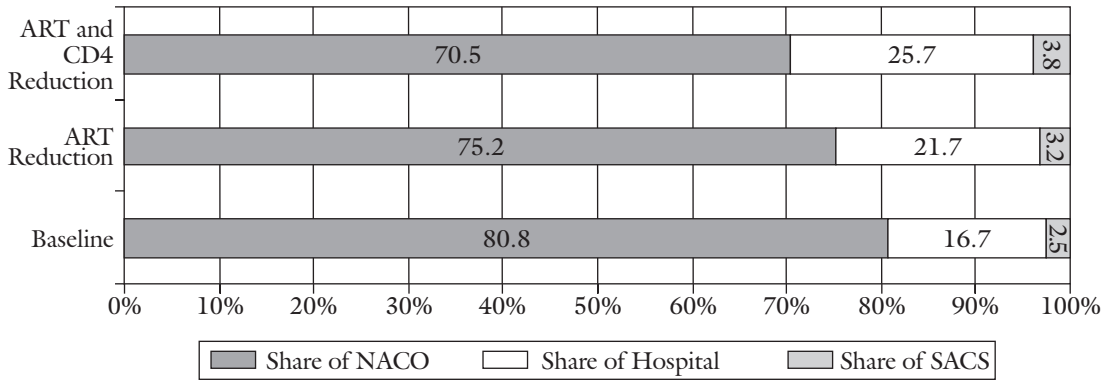
TABLE 11
Projections of Costs of ART Programme for the Next 5 Years, Under Assumption of Reduced Prices of ARV Drugs (In millions of Rupees)

Year	*Projected Volume*	*Annual Cost @ Estimated Unit Cost of Rs. 974*	*Annual Cost in Million US$*	*Share of SACS*	*Share of NACO*	*Share of Hospital*
2007	100000	1168.9	27	37.72	877.86	253.35
2008	110000	1285.8	30	41.49	965.65	278.68
2009	121000	1414.4	33	45.64	1062.22	306.55
2010	133100	1555.8	36	50.21	1168.44	337.21
2011	146410	1711.4	40	55.23	1285.28	370.93
Total over 5 years	–	7136.5		230.29	5359.45	1546.72
		(100%)	–	(3.2%)	(75.1%)	(21.7)
Amount in millions of dollars	–		166	5	125	36

If an additional assumption of a reduction of 50 percent in the price of CD4 test kits is made, the total cost comes further to about $140 million for the next 5 years (Table not presented here).

It is easy to see that the two main cost drivers, price of drugs and CD4 test kits and reagents, which are in a way the only two control knobs with NACO, can substantially impact on the unit costs: the cost saving would be substantial under the assumption of reduced prices of drugs and test kits. Figure 8 shows the changing burden on each entity due to these price changes, and indicates that the share of NACO is going to come down and that of the sites will increase in the total programme cost. However, it must be kept in mind that the total burden of the programme is smaller in each successive scenario, and therefore, while the share of the

FIGURE 8
Change in Burden Across Entities Under Different Scenarios of Prices



hospitals seems to be increasing, the total burden on the hospitals would be lower. The major sources of expenditure for the hospitals are department costs and personnel time given to the ART programme, which are not affected by reductions in prices of ARV drugs and CD4.

Summary and Conclusions

The annual unit cost of ART provision is about $353 without taking into account the costs borne by the individuals. This works out to be $1 a day; if one adds another about $0.7 per day based on the individual costs, the per day cost comes to around $1.7 a day. Interestingly, the comparable figure from the Thailand study seems to indicate a per client cost of $78 per month, or $2.5 per day, which is somewhat higher than the figure estimated in this study. In an absolute sense, the cost of provision in India does not seem to be very high; however, given the increasing number of individuals who will need to be put on therapy, and kept on it, it seems like a huge financial commitment from the government.

A key variable for estimating annual costs will of course be the number of people put on ART. A related issue is about the relation between demand and quality; the quality of the government programme is certainly going to determine to what extent individuals would want to join it, and how many of them would prefer the private providers, despite the cost difference. If the quality is maintained at the current level in years to come, there in fact may be a switch away from the private to the public sector, which will only help keep up the demand. The relevance of this is in planning, which will need to use realistic volume figures to estimate accurately the costs of scaling up.

How do these estimates of costs compare with, say, the health budget of the country? The question of affordability was also raised by the World Bank study referred to earlier, which indicated that the most ambitious of the ART programmes (to support all those below the poverty line) would be about 70 percent of the central health expenditure (World Bank 2000).

However, since then, prices of ARV drugs have come down significantly. Also, there have been substantial increases in the allocation to health and family welfare, and restructuring of the programmes, so that it is no longer meaningful to talk only about health expenditure. The revised health and family welfare budget for 2005–06 was about $2250 million. The 2007 estimates of cost of the ART programme (without any changes in costs of ARV and test kits), comes to about $35 million, which is around 2 percent of the total health and family welfare budget. With 50 percent reduction in both the prices of drugs and kits, this reduces to about 1 percent of the health and family welfare budget. The comparison with the earlier World Bank study and the different cost estimates within this study indicates that there are huge savings to the programme costs through reductions in prices of drugs and kits. As for NACO's own resources (excluding GFATM funds), the budget estimates for 2006–07 is $148 million (MOHFW 2006); using the lower estimates of ART programme, the total ART cost for 2007 would be $23 million, which is about 16 percent of NACO's core resources. If we assume that only 70 percent of the total cost would be covered by NACO, then also about 11 percent of total core resources of NACO would be required for the ART programme for 2007.

The above exercise was just an illustration of the possible implications of a scaled up programme. Clearly, the question of financial sustainability is critical here, and it is recommended that Financial Sustainability Planning (FSP), an exercise advocated and practiced in the case of immunization by the GAVI/WHO, is a good way of planning for the future. While most of the cost has to be borne by NACO, the sites may need additional help and funds, so that their current services for other departments are not hampered. Additionally, if adherence of the programme is seen as the most critical component of the public programme, then individuals may need additional assistance, especially with new emphasis on the need for nutritional supplements to make the ART work optimally.

Currently, NACO's ART programme is being supported by GFATM. However, the sustainability of this funding and the possibility of other donors to support a scaled up programme are issues that NACO will need to focus on with immediate effect. Additionally, if NACO plans on adding second line drugs to the programme as well, the financial feasibility of the entire programme will need to look into.

Careful planning, ways to bring down costs without sacrificing quality, and negotiations with donors are strategies that need to be worked on simultaneously in the immediate future, for the ART programme to be sustainable.

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Section V

Sociological Perspectives: Religion and Family

Chapter 24

The Sociology of Hinduism: Combining the Book and Field Views

T.N. MADAN

Is a Sociology of Hinduism Possible?

To begin, I would like to briefly address two objections to the project of a sociology of Hinduism. Hinduism, it is said, is not a religion, for it does not have a founder, or a single foundational scripture, or a set of fundamentals of belief and practice. A notion of the supernatural is not central to it, and the idea of moral law that may be considered a substitute is highly relativistic. These and other similar doubts have been around a long time. M.N. Srinivas, for example, acknowledged them, and wrote about the 'amorphousness' and 'complexity' of Hinduism and the difficulty of defining it (1952, 1958, 1968). All this did not, however, deter him from writing about it.

Max Weber considered reverence for the Vedas and belief in the sacredness of the cow as defining features of Hinduism (1958: 27), but he too noted the virtual lack of dogma in Hinduism (ibid.: 21) and the fact that the term itself was a recent Western coinage (ibid.: 4). He observed: 'Hinduism simply is not a "religion" in our [Christian] sense of the word. What the Occidental conceives as "religion" is closer to the Hindu concept of *sampradāya*' (ibid.: 23). He paid no further attention to the issue. Whether Hinduism is a religion or not, and whether religion itself is a meaningful cross cultural category, it would be pointless to deny that Hinduism is a cultural tradition and thus a legitimate subject for study.

But some historians have objected that Hinduism is not an old tradition, that it is only a nineteenth century fabrication of Christian missionaries, Orientalists, builders of the colonial archive, and would-be makers of an Indian nationalism. 'What has survived over the centuries', Thapar writes, 'is not a single monolithic religion but a diversity of sects which we today have put under a uniform name' (1997: 56). This is, I am afraid, questionable.

There are other historians who have documented the continuities as well as the discontinuities between the early religion of the Vedas and the later religion of the Smritis, Shastras, Puranas and the Epics. They have also drawn attention to the 'family resemblance' among the regional traditions of myth and ritual to come to the conclusion that, whatever may have been the earlier connotations of the Persian-Arabic term 'Hindu', by the medieval times it certainly identified most of the known peoples of India by their religious beliefs and practices (see, e.g., Lorenzen 1999 and Michaels 2005).

For this we have the testimony of the great traveller-scholar al-Biruni, who came to India with Mahmud Ghaznavi and composed his famous work, *Tarikh-ul Hind*, around 1030 A.D. after living in India as a participant observer for a dozen years. Beginning with the Hindu conception of God, his wide ranging ethnography covers, among other topics, sacred texts, mythology, metaphysics, ritual, custom, law and the sciences to distinguish and even contrast the Hindus as a socio-cultural and religious category from the Muslims. He sarcastically notes the Hindus' willingness to argue with words in defence of their religion but not die for it as apparently every good Muslim would.[1]

I will mention only a few other witnesses. In the middle of the fourteenth century, the chronicler Abd al-Malik Isami categorized the people of the Deccan as Hindus and Muslims in his account of the victories of the sultans. In the north, the Shaiva mystic Lalla of the Kashmir Valley, however, called upon the thoughtful and the wise to abandon the distinction between Hindus and Muslims as followers of different faiths, and recognize the in-dwelling Divinity in all human beings. By the sixteenth century the religious connotation of the terms Hindu and Muslim was well established, for instance, in the vernacular literature of eastern, northern, central and western India. In the seventeenth century Shivaji spoke of his sacrifices for the Hindu dharma. And so on, until we read about 'Hinduism' early in the nineteenth century. Rammohun Roy was perhaps the first Indian to use it, in 1816 (see King 1999: 100). The roots of the authentic (as against the degenerate) 'Hindooism' lay, he argued, in the Vedanta. He regretted that the 'ancient religion had been disregarded by the moderns' (see Kopf 1979: 13).

Srinivas on the 'Spread' of Hinduism and 'Sanskritization'

In short, the recognition of the diversities of belief and custom among self-acknowledged Hindus on a regional or local basis—the proverbial trees of ethnographic description—does not require us to deny the existence of a more than a millennium-old, evolving subcontinental

[1] Al-biruni wrote: '… they [the Hindus] totally differ from us in religion, as we believe in nothing in which they believe, and *vice versa* [an echo of the Quran 109]. On the whole, there is very little disputing about theological topics among themselves; at the most they fight with words, but they will never stake their soul or body or property on religious controversy' (Sachau 2002: 3).

religious heritage—the sociological wood. An insightful way of doing this was provided by Srinivas in the Coorg book. In a summing up towards its end, he recalls his use of the concept of 'spread' throughout the book, categorizing Hinduism for heuristic purposes as 'All-India', 'Peninsular', 'Regional', and 'Local'. 'All-India' Hinduism he writes, 'is Hinduism with an all-India spread, and this is chiefly Sanskritic in character'. After drawing attention to the step-by-step change of scale, Srinivas continues: 'In a very broad sense it is true that as the area of spread decreases, the number of ritual and cultural forms shared in common increases. Conversely, as the area increases, the common forms decrease' (1952: 213–14). That is, they do not disappear completely.

The sceptical historians will perhaps fault Srinivas for making the methodological error of category assumption, illicitly smuggling in a fictional Hinduism into his analytical framework. The charge will not stick, for he provides ethnographic ballast for his framework by pointing out that the different levels of Hinduism are not hermetically sealed, but the stages of a two-way social process characteristic of the caste-based social structure of South Asia. While Sanskritic (or Brahmanical) Hinduism, the one with the all-India spread, had shown a remarkable capacity for absorbing local cultural elements, 'local' Hinduisms too have borrowed from the Sanskritic reservoir of belief and practice. This latter process has had its roots deep in history with significant consequences; Srinivas famously called it 'Sanskritization'. He wrote:

> The caste system is far from a rigid system in which the position of each caste is fixed for all time. Movement has always been possible, and especially so in the middle regions of the hierarchy. A low caste was able, in a generation or two, to rise to a higher position in the hierarchy by adopting vegetarianism and teetolism, and by Sanskritizing its ritual and pantheon. In short, it took over, as far as possible, the customs, rites, and beliefs of the Brahmins, and the adoption of the Brahmanic way of life by a low caste seems to have been frequent, though theoretically forbidden (Srinivas 1952: 30).

The extreme caution that marks this initial formulation of the notion of Sankritization is noteworthy. It generated an enormous body of ethnographic work—more perhaps than any other theoretical construct in the history of the sociology of India—and was in the process refined by Srinivas himself and by others in the mid-1950s. Notable among these were Marriott (1955), who used the terms 'universalization' and 'parochialization' for the two-way process; Bailey (1958), who introduced the important notion of limits, showing how those below the barrier of pollution do not have this route of upward mobility open to them; and Sinha (1962), who wrote about Rajputization or state formation among the tribal peoples. Srininvas (1966a) himself presented more nuanced formulations, linking Sanskritization to Westernization and secularization, almost in linear progression, as strategies of status enhancement. His virtually unqualified positive assessment of Sanskritization as productive of socio-cultural cohesion (Srinivas 1967) provoked some criticism of his failure to unmask the hegemonic character of the process. My concern here is not to make an overall assessment of his paradigm of social change, but only to look at it for the light it throws on the processual nature of Hinduism.

All this is of course well known; let me just add that some of the most significant long-term evidence of the two-way process of cultural borrowing has been provided by historians themselves. One of the richest such works is Chakrabarti's (2001) insightful account of the cultural and religious history of medieval Bengal, in which the wily Brahmans are shown to have played a most significant role in the creation of what in Srinivas's terms is an example of regional Hinduism.

Srinivas on Rituals and Social Solidarity: A Fieldview

Let me now turn to another crucial aspect of Srinivas's study of Hinduism. A casual look at his bibliography reveals not more than about ten titles that would suggest that Hinduism, or more generally religion, was one of his principal concerns as a sociologist; but titles can be deceptive. If one were to think of him as primarily a sociologist of caste, one would have to note that, in his judgement, caste as a social institution derived its legitimacy from religious values. His first major publication was *Marriage and Family in Mysore* (1942), but the focus, as he himself states at the very beginning, is very much on the family as a site for the performance of rituals: puberty rites, marriage rites, delivery and naming rites, and celebratory periodical rites (fasts and festivals) are described. The practices of the Brahmans are distinguished from those of the 'non-Brahmans' among the Kannada castes. Little is said about the economic side of family life, although there is a short chapter on bride price, or of interpersonal relations beyond a brief discussion of the conflict-ridden relations between mothers-in-law and daughters-in-law. What is equally noteworthy is that the beliefs that go with the rites receive little attention. Thus, 'the purpose of death ceremonies' is described in a short quotation from Monier-Williams (ibid.: 150–51).

In continuation of this emphasis, religion in the Coorg book also is structured around what Srinivas calls the 'ritual idiom'. 'Every society', he writes, 'has a body of ritual, and certain ritual acts forming part of the body of ritual repeat themselves constantly. Not only ritual acts but also ritual complexes, which are wholes made up of several individual ritual acts, frequently repeat themselves' (1952: 70). It is thus that ritual contributes to social solidarity. What we have here is near reification of ritual, as if the act moves under its own steam. The connected beliefs, notably ritual purity and pollution, with which the book is significantly concerned, and notions like *dharma* and *karma*, *pāpa* and *punya*, provide only an underpinning. The same cluster of values finds mention again in *The Remembered Village* (1976: 312–19) and, in likewise manner, as a backdrop of behavior. There are no detailed descriptions of rituals here, presumably because processed fieldnotes of the observations made may have been lost in arson in his office at Palo Alto (ibid.: xi).

I find the emphasis on observable behavior an intriguing aspect of Srinivas's methodology and would like to dwell on it briefly. We are told by Professor A.M. Shah that Srinivas's

impressionable childhood was spent in the setting of a long house in the city of Mysore in which five Sri Vaishnava Brahman families had their abode (Shah 1996: 198). Writing himself about the life of the Brahman families of the village of Rampura, Srinivas observes that it was 'permeated by ritual' (ibid.: 293); so must have been, one imagines, the daily life of his own natal household. The preoccupation of the Brahmans everywhere with *karmakānda*, that is with the performance of life-cycle rituals, as householders is well known. Moreover, the *karmakānda* is behaviouristic insofar as the efficacy of the *mantra* is believed to lie in the utterance and of the associated bodily movements and gestures (*mudra*) in correct form and procedure. Any search for the meaning of the ritual act as a whole is considered redundant if not injurious to the purpose of the ritual.

The writing of Srinivas's doctoral dissertation under the supervision of Radcliffe-Brown at Oxford must have been a felicitous meeting of minds. In his Foreword to the Coorg book, Radcliffe-Brown wrote:

> For the social anthropologist the religion of a people presents itself in the first instance not as a body of doctrine, but as what we may call "religious" behaviour as a part of social life. Social anthropology is behaviouristic in the sense that we seek to observe how people act as a necessary preliminary to trying to understand how they think and feel (1952: vi).

There would be little to complain about this procedure if all it meant was that it is in social activity that the meaning of concepts and beliefs is located, not in themselves. But in practice it has usually resulted in religious beliefs being pushed into the background and rendered secondary.

At the very commencement of the post-Enlightenment study of religion, some of the pioneers were sceptical about the existence of religious belief outside the fold of what they considered the fully evolved religions. Thus, Smith (1894) stated that 'antique religions had for the most part no creed; they consisted entirely of institutions and practices' (2002: 16–17). Earlier, Coulanges (1864) had affirmed 'the necessity of studying the earliest beliefs of the ancients in order to understand their institutions' (nd: 11ff.), only to conclude that in those cultural settings beliefs (for example about the inseparability of body and soul) were forgotten in course of time and the connected rites alone (for example burial and the building of tombs) survived as evidence of their existence. 'Thus a complete religion of the dead was established', he wrote, 'whose dogmas might soon be effaced, but whose rites endured until the triumph of Christianity' (Coulanges 1864: 21).

Coulanges was one of the teachers of Durkheim, who defined religion as 'a unified system of beliefs and practices' (1915: 47), but devoted more attention to the latter. Tylor's (1913) speculation about the origin of primitive religion in the notion of the individual soul, and the earlier characterization of belief as an 'act of the mind' by Hume (1757), would have stood precisely for the kind of psychologism, and in effect reductionism, to which Durkheim was firmly opposed. For him the social fact, comprising both collective representations and group activities, could be legitimately explained only in sociological, not psychological terms.

Durkheim in turn influenced Radcliffe-Brown, who wrote in his ethnography of the Andaman Islanders (1922) about their beliefs (for example, in 'a class of supernatural beings'), but by his own declaration he foregrounded ritual.

The point of the digression is to suggest that, intellectually, Srinivas belongs to a celebrated but not uncriticized tradition in the sociological study of religion, which valorizes behaviour at the cost of belief. To be fair, I must mention that in his studies of Hinduism there are references to beliefs, but these are brief and remain confined to a mention of sectarian differences in the conception of deities (theology) and to a more general set of metaphysical ideas, notably *samsāra*, *karma*, *dharma* and *moksha*. The practical notions of ritual purity and pollution, however, receive rich treatment in the Coorg book.

It is likely that Srinivas's distrust of 'bibliocentrism' in the study of Hindu society held him back, but the 'fieldview' itself would have revealed a great deal more about beliefs than is to be found in his book had he been theoretically differently oriented than he was, beliefs of the kind that we find in the doctoral dissertation of Jayanthi Beliappa, a Coorgi scholar. I should add here parenthetically that Srinivas (1973) himself later on expressed dissatisfaction with the limitations of the functionalist framework.

Like Srinivas, Beliappa too set out 'to comprehend the nature of the relationship between religion and social reality'. Bypassing Radcliffe-Brown, she turns to Durkheim to emphasize that for him 'the concreteness of social reality was embedded in a cognitive system' just as 'systems of knowledge were grounded in a social framework' (1979: 1.9). This is elaborated to lead to the study of how the Coorgis 'comprehend and construct their cosmology in order to derive from it a system of meanings that help their social life as a small community to endure'. She explores 'areas of religious experience in which there is a clear delineation of religious discourse for the routines of everyday life' (ibid.: 2.1). Beliappa acknowledges the great value of Srinivas's pioneering study, but suggests that an alternative approach, grounded in structuralism rather than functionalism, may reveal to us more about how the Coorgis themselves *conceptualize* their social life. For instance, birth and death are for them 'meaningful' events, besides being occasions for the performance of appropriate rituals. 'Function' and 'meaning' are of course intertwined aspects of these rituals. And the question of 'meaning'—the question of making sense of the world—engaged Max Weber deeply.

Weber on the Place of Beliefs in Hinduism: A Bookview

I would like to begin my discussion of some aspects of Max Weber's 'view from afar' of Hinduism with the thought that he nailed to the masthead of his celebrated (although in some respects flawed) study of the rise of the spirit of capitalism in the West. In the opening paragraph of the book, he maintained that the offspring of 'modern European civilization, studying any problem of universal history' were bound to reflect on the circumstantial uniqueness of certain 'cultural phenomena' that have 'appeared' there, and which they would 'like

to think … lie in a line of development having *universal* significance and value' (1930: 13, emphasis original). Paradoxically, uniqueness is here considered generalizable, and the history of the West is privileged. As Marx put it, it was the mirror in which the rest of the world could see the face of its future.

Given such a point of departure for his massive project of the study of the economic ethics of world religions, Weber's study of Hinduism was inevitably cast in the mould of otherness. While Srinivas was born into Hindu society and studied it from within although as an anthropologist—he wrote eloquently about 'the study of one's society' (1966b)—Weber was distant from it in every conceivable respect, the absolute outsider. Srinivas wrote about Hinduism from personal experience and fieldwork study. He used secondary sources also in both the Mysore and Coorg books but sparingly, and these were contemporary English language rather than traditional texts.

Weber drew heavily upon the colonial archive (including descriptive and census reports) but he also delved into the traditional texts (in German or English translation). The Brahmanical ideas that he examined for their secular, sociological significance came from his obviously selective reading of the Vedic corpus, the *smriti*, *shāstra*, and *nīti* literatures, the *Mahābhārata* and the *Rāmāyana*, the Upanishads, even the *tantra* texts. He also consulted contemporary exegeses and commentaries by Western and Indian scholars. In short, Weber's view of Hindu society and religion was the 'book view' par excellence. Now, as I have already said, Srinivas was deeply suspicious of 'bibliocentrism'; he was equally wary of 'paleocentrism'; they were for him two sides of the same counterfeit coin. The aridity of the book view, its lack of contact with lived reality, were known to him from the work of some of his Bombay University colleagues. That Weber's approach was different was not known to Srinivas when he formulated his early views, because although the original work was published in 1920, he did not read German, and the English translation, *The Religion of India*, was published only in 1958.

Differences of method notwithstanding, what I find striking in the first place is the similarity of substantive conclusions arrived at by Srinivas and Weber, but there are significant differences too. For both the caste system was the fundamental institution of Hinduism, and the Brahmans were the crucial mediators in the relationship of religion and society. Both recognized them as ritual specialists and repositories of sacred knowledge, but Weber especially stressed their role as the 'cultural literati', weaving out their webs of metaphysics that had for very long ensnared the 'masses'. What the creative minority thought up, the mimetic majority acquiesced in one way or the other.

All Hindus, Weber wrote, 'accept two basic principles: the *samsara* belief in the transmigration of souls and the related *karman* doctrine of compensation. These alone are the truly "dogmatic" doctrines of Hinduism' (1958: 118). Such acceptance had become manifest in the ordering of social relations, in the caste system. The bond between 'idea' and 'action' is summed up in one of the most memorable passages of *Religion of India* (pp. 121–2):

> *Karma* doctrine transformed the world into a strictly rational, ethically determined cosmos; it represents the most consistent theodicy ever produced by history. The devout Hindu was accursed to remain in a structure which made sense only in this intellectual context; its consequences burdened his conduct. The

> *Communist-Manifesto* concludes with the phrases "they (the proletariat) have nothing to lose but their chains, they have a world to win". The same holds for the pious Hindu of low castes. He too can "win the world", even the heavenly world; he can become a Kshatriya, a Brahman, he can gain heaven and become a god—only not in this life, but in the life of the future after rebirth into the same world pattern.[2]

I would like to draw attention to two aspects of Weber's statement. First, he highlights a view of society that emphasizes its embeddedness in a morally determined universe in which good fortune or bad fortune is a deserved condition, and society is not a matter of customs and transactions but of moral imperatives and social obligations. One does what one ought to do and not what is personally pleasing or profitable: one must be true to one's group *dharma*.

But—this is the second aspect—*dharma* is absent in the passage, although it is almost invariably bracketed with *karma* by most authorities including Srinivas. *Dharma* is in fact introduced at the very beginning of the work, given the broad connotation of all social action as ritual, a kind of social liturgy, and contrasted to dogma (ibid.: 21). 'Hinduism is primarily ritualism', Weber observed, 'a fact implied when modern authors state that *mata* (doctrine) and *marga* (holy end) are transitory and … freely elected, while *dharma* is "eternal"—that is, unconditionally valid'. But '*dharma* differs according to social position… *dharma* depends upon the caste into which the individual is born… *dharma* can be developed…by finding thus far unknown but eternally valid consequences and truths' (ibid.: 24–5). Weber's conception of Hinduism as ritualistic is not the same, it should be emphasized, as Srinivas's conception of it as a configuration of domestic and extra-domestic rituals associated with the human life cycle and religious devotion.

Srinivas regards the 'ideas of *karma, dharma* and *moksha*' as 'intimately related to the caste system', and acknowledges that, their Sanskritic origin notwithstanding, they have reached 'the common people' through various channels of communication (1968: 359). In the Rampura book, he describes how in the judgement of the villagers generally, *dharma* refers to good, liberating conduct and *karma* to evil actions which have consequences that hold one in karmic bondage (1976: 312–19). But he does not engage with these ideas in any great detail.

Srinivas rather focuses, as I said earlier, on another set of ideas in his writings, particularly in the Coorg book: these are the ideas of good-sacred and bad-sacred, of ritual purity and pollution (*madi* and *polé* in Coorgi speech). It is these that he sees as the principal determinants of interpersonal and inter-group relations in the contexts of the family and caste. Needless to emphasize, these ideas are more readily discernible in everyday behaviour—relating to, for example, food taboos, bodily contact, and occupational choice—*but not more important* than the more abstract ideas of *dharma* and *karma* that Weber focused on. In this Srinivas anticipated

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[2] It may be helpful here to quote Weber's gloss of the notion of theodicy (1948: 122):

> The age-old problem of theodicy consists of the very question of how it is that a power which is said to be at once omnipotent and kind could have created such an irrational world of undeserved suffering, unpunished injustice, and hopeless stupidity. Either this power is not omnipotent or not kind, or, entirely different principles of compensation and reward govern our life—principles we may interpret metaphysically, or even principles that forever escape our comprehension.

Louis Dumont's later valorization of ritual purity as the cardinal value that defines hierarchy (Dumont 1970). It is not therefore surprising that Dumont (1959: 9) should have hailed the Coorg book as a modern classic in about half a dozen years after its publication. Notwithstanding his programmatic declaration that the sociology of India lies at the confluence of Indology and sociology (1957: 7), Dumont the fieldworker is closer to Srinivas than Dumont the textualist is to Weber. I cannot, however, pursue this trail here. I must return to Weber.

Weber was not, of course, a fieldworker, but he was sensitive to such ethnography as was available to him and his perspective was processual. The best way to illustrate this is to recall what he wrote about the diffusion of Hinduism over time, and here he anticipated Srinivas most remarkably. He called this process Hinduization, and believed that Hindu 'propaganda in the grand manner', or simply 'missionary propagation' (1958: 9), had been going on for close to a millennium: Hinduism had thus spread from the heart of northern India (Aryavrata) to the rest of the country. This extensive Hinduization (as he called it) sucked local, tribal communities into a subcontinental religio-social milieu. Indeed, the propagators are 'met halfway' by the 'outsiders' (ibid.: 14).

The process, Weber noted, was multi-stranded, involving the selective but expanding use of the expert services of the Brahmans, adopting new kinds of work and occupations, altering dietary habits and social customs, and accepting new modes of religious behaviour. Gradually, the outsiders would usually find themselves transformed into impure Hindu castes. Within the broader framework of extensive Hinduization, Weber noted, there was a tendency to engage in intensive (or internal) Hinduization in pursuit of status enhancement (ibid.: 11). If material gain motivated the Brahman to be accommodative (a player of the game), the quest for social legitimation drove the climbers forward and upward, hoping to bridge 'the abysmal distance Hinduism establishes between social strata': Weber called it the peculiar 'religious promise' of Hinduism (ibid.: 17).

What all this means we know very well indeed, thanks to the vast body of ethnographic studies generated by Bose's seminal essay on 'the Hindu method of tribal absorption (Bose 1941) and, of course, Srinivas's discussions of Sanskritization. Weber appreciated as well as Bose and Srinivas that the processes were collective and not individual, that it could not be 'otherwise' since individuals can never rise except as a 'caste' (ibid.: 11ff.). The similarity between Weber's and Srinivas's views is so striking that it is puzzling that not much attention has been paid to it (Kulke's 1986 article is a notable exception). Srinivas himself never mentions it in his published work.

The only references to Weber in Srinivas's writings that seem to exist are with reference to the argument about the lack of appropriate ideological resources in Hinduism for the endogenous development of capitalism. Thus, we have a very short comment (in a co-authored encyclopaedia article), criticizing Weber for 'a partial view of Hinduism', but noting that 'Weber himself [had] identified a few elements of "rational ethic" in Hinduism', and concluding with a reference to the managerial and administrative abilities often displayed by 'Hindu ascetics' who head 'large and wealthy monasteries and temples' (1968: 364). A somewhat more detailed reference is Srinivas's (1973b) discussion of a seminar paper by Milton Singer, who argued that Weber's

views on the relationship of Hinduism and capitalism were ill informed and misleading; Srinivas agreed and, further, criticized Weber's understanding of Hinduism as a religion. Regretably, the criticisms are based on a rather hasty reading of Weber's work. He totally ignores the convergence of their views in the context of Sanskritization (Srinivas) and Hinduization (Weber); this is indeed regrettable.

Weber's views about Hinduism and capitalism have been subjected to much criticism, some of it based on misreading what he actually wrote. This is how he describes the scope of his study: 'Here we shall inquire as to the manner in which Indian religion, *as one factor among many, may have prevented capitalistic development* (in the occidental sense)' (ibid.: 4, emphasis added). Could any formulation be more cautious even if it is not wholly open minded? Nor can Weber's thesis be disproved by describing what Indian entrepreneurs achieved in the nineteenth century often in competition with British entrepreneurs. Weber's concern was with *initial* development (or the first appearance), and he held the hereditary and non-innovative character of caste-based division of work as much responsible for the non-emergence of the spirit of capitalism as any religious ideas as such. It is not my contention that Weber's thesis, whether about Europe or its generalizability, is above criticism (see, e.g., Munshi 2003 for an excellent recent critique), but lack of space does not permit fuller discussion here.

In any case, the question about capitalism with which Weber begins *The Religion of India* is not all that interested him in Hinduism. In the first part of the book, after introducing the ideological backdrop, he discusses the Hindu social system comprising tribe, caste, sect, etc. It is in this discussion that the convergences between him and Srinivas are pronounced. Part two, which is about as long as the first, focuses on 'orthodox and heterodox holy teachings'; in the concluding part he moves into east Asia with the Buddhist missions to return to nineteenth century India's restoration movements.

For a final comment on Weber's work, to illustrate his interest in the role of ideas, I may recall his insightful discussion of the *Bhagavadgītā* (ibid.: 180–91), which, he says, 'in a certain sense represents the crown of the classical ethics of Indian intellectuals' (ibid.: 185). Here he lays bare 'the inner conflict' of the Hindu tradition, notably that between the Brahmanical and Kshatriya ways of life, and between two modes of salvation represented by, first, the moral agent's assumption of responsibility for breaking out of the karmic chain and, secondly, his seeking refugee in divine grace (*prasāda*) (ibid.: 187), a radical departure from the classical Brahmanical tradition.

A key question is posed by Draupadi in the *Mahābhārata*, writes Weber, when, apropos Yudhishthira's 'blameless misfortune', she tells him that 'the great God only plays with men according to his whims'. Yudhisthira's response is: 'one should not say such things, for by the grace of God the good receive immortality and, above all, without this belief people would not practice virtue' (ibid.: 182). And without virtue there is no social life: social norms ultimately arise when individuals learn to care and give, trust and conform.

But, then, how does one practice virtue? The *Bhagavadgītā* teaches the ethic of conformity to one's *varna dharma* or obligations established by nature, Weber notes: right knowledge (*jnānyoga*) for the Brahman and right action (*karmayoga*) for the rest. The Kshatriya must

wage war and rule—'without any concern for consequences', especially not for personal success (ibid.: 184). 'The inner-worldly ethic of the *Bhagavadgītā*', Weber observes, 'is "organismic" in a sense hardly to be surpassed. Indian "tolerance" rests upon this absolute relativising of all ethical soteriological commandments' (ibid.: 189–90). In his apprehension of absolute relativism in Hindu ethics, and the resultant tolerance, Weber is of course mistaken: maybe fieldwork in an Indian village would have brought to his notice the widely known fact, recorded by ethnographers (see e.g. Mathur 1965), that there are shared values also, the *sādhāran dharma* that defines one's humanity and cuts across *varna* boundaries. And there is exploitation, oppression, and violence. Weber obviously did not know certain things and got others wrong. (I wonder if he ever knew a Hindu or met one.) That is not remarkable: what is so is how much he knew right, and how comprehensive his outline of a sociology of Hinduism—and indeed of the comparative sociology of religion—was.

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Chapter 25

The Family in Official Discourse: International Programmes and National Perspectives in India and China[1]

PATRICIA UBEROI

Suddenly, in 1994, everyone was talking about 'the family'. This unprecedented spurt of official and public interest was not the outcome of the earnest efforts of family sociologists, though they were certainly called in to lend the voice of academic authority to the clamour of opinions. It was simply that 1994 had been declared the 'International Year of the Family' (IYF), and everyone had to be seen to do their little bit for a worthy cause.

Typically, India was rather late in its run-up to the event. Typically, too, the follow-through was sluggish. As the Secretary of the Ministry of Social Welfare at the time assured the disconcerted delegates at the national seminar which inaugurated the year's programme,[2] the deliberations and recommendations of such seminars are routinely destined to 'sit on the shelf'. True to this prediction, the event soon passed into history as further internationally sponsored programmes of social development absorbed official and media attention and—equally importantly—public funds.

But while the recommendations of the national seminar and other IYF programmes may indeed be gathering dust 'on the shelf', the event was not without its usefulness. Firstly, it brought 'the family' back on to centre-stage. This was a pleasant change for family sociologists, among whom I number myself (see Uberoi 1994b). For too long we had suffered the unkind

[1] This paper continues an argument put forward in an earlier paper (see Uberoi 1994a). I am grateful to the Institute of Chinese Studies, Delhi, for research support for this project.

[2] National Seminar on 'The International Year of the Family, 1994: Enhancing the Role of the Family as an Agency of Social and Economic Development', New Delhi, May 1994.

comments of fellow sociologists who insisted that the family had only limited importance in modern societies where institutions such as the creche, the school, the hospital, the old age home, the media, etc., had assumed the social functions that the family had once performed. The IYF also stimulated the production and publication of empirical materials and studies on the family and on social policies affecting the family (e.g. GOI 1994a, 1994b). And of course it generated an impressive quantity of 'official discourse'[3] on contemporary challenges to the institution of the family. Though professional observations contributed to the production of this official discourse, this material is interesting not so much as a source of *information* on current trends and problems, but rather as providing an insight into official *thinking* on the family: the family as the focus of ideology.

The official discourse of the IYF was not the *only*, or even the most significant, ideological statement on the family for 1994. Towards the end of the same year, and quite independently of the activities of the IYF, there occurred an extraordinary media event that again brought the family—the *Indian* family—to the centre of public attention. This was the release of the Hindi commercial film, *Hum Aapke Hain Koun…!* (known by its acronym, *HAHK*).[4] In popular reckoning, *HAHK* was an ideal 'family film'. By this was meant (a) that it was all about family life in general, and marriage in particular; and (b) that it was the sort of good clean film that the whole family could watch together without embarrassment. Remarkably, it also made a huge profit for its producers and distributors, confounding the opinion that Indian popular cinema had been reduced to nothing but sex and violence and restoring faith in the enduring power of wholesome Indian 'family values' (see Uberoi 2001).

Undoubtedly, the cinematic text of *HAHK* is a much more exotic object of sociological analysis than the dry official policy statements of the IYF. But the latter are not uninteresting for all that. In particular, they disclose a tension—both convergence and resistance—between the family policies and social development agendas of international agencies, and the perspectives and priorities of individual participating nations.

This paper aims to explore these tensions. It looks first at the official IYF programme documents, focusing on their inner contradictions and speculating on the unspoken, and to my mind rather sinister, political agenda that they disclose. It then looks at the rendering of the programme in two different national contexts—India and China—noting their distantiation both from the international IYF agenda and, equally significantly, from each other. Though the tension between international agendas and national priorities in matters of social development is often typified as a struggle between the nations of the North and those of the South,

[3] The term 'official discourse' derives from Frank Burton and Pat Carlen's useful *Official discourse: On discourse analysis, government publications, ideology and the state* (1979).

[4] Rajshri Productions, directed by Sooraj Barjatya (see Uberoi 2001). A number of critical analyses of this film have appeared in the popular press and journals. Interestingly, few of them focus on what the film has to say about the institutions of family and marriage *per se*, emphasizing instead the film's endorsement of conspicuous consumption, its underlying *Hindutva* ideology, and its mixed messages with reference to women.

between the highly developed and the least developed countries, there are also interesting divergencies between the nations of the South, as this brief account will demonstrate with reference to India and China.

A few words of caution may be in order. Firstly, it would be evident that the Indian and Chinese IYF documents are not absolutely comparable. This is largely because of the rather different nature of the relationship between the institutions of state and civil society in each case. Thus, in India, non-government organisations have had a much greater role in the formulation of 'official' policy (and also in contesting official policies and designing alternatives) than is the case in China, where the NGO sector is still quite underdeveloped and constrained.

Secondly, state policy typically has internal contradictions across different sectors. For instance, as will be seen in the present instance, focus on issues of women's welfare and liberation very often provokes criticism of traditional 'family values', whether Indian or Chinese. More importantly, the programmes of economic liberalisation to which both countries are committed pose a serious challenge, only partially conceded, to the social welfare sector. Cynically one might say that, in the present global environment of liberalisation, the administration of welfare is motivated not by 'welfarism' as ideology and as a value in itself, but by recognition of the need for a 'safety net' to counteract the more drastic and socially destabilising effects of economic liberalisation.

I. The International Year of the Family

On 8 December 1989, a UN Assembly resolution proclaimed 1994 the International Year of the Family. As is well-known, most international programmes are directed towards social groups which are perceived to be marginalised or vulnerable in some sense or other: women, indigenous peoples, the disabled, the aged, and so on. But interestingly, the celebration of an International Year of the Family does not really conform to this pattern of remedial support to socially vulnerable groups. To be sure, the programme literature does recognize that there are some types of families and family situations which require intensive external intervention and support so that members can lead a humanly decent life and the family fulfill its basic care and nurturing functions. Particularly vulnerable are the so-called 'female-headed households' which, in less developed as well as advanced societies, tend to be economically disprivileged; single-person households, which often reflect situations of social, economic and psychological deprivation and breakdown; and families 'at risk' by virtue of the incapacity or delinquency of some members (e.g., families affected by alcoholism, AIDS, chronic illness), or in the face of major social upheavals and natural disasters (cf Bharat & Desai 1991).

The IYF literature acknowledges the special needs of such families and their individual members who in many cases have been *sectorally* addressed by other UN programmes (for the aged, the disabled, etc.), and seeks a more *holistic* approach to their problems in the wider framework of the family unit. To this extent, the IYF appears superficially consistent with other

international programmes for social development through affirmative action on behalf of the socially and economically disadvantaged.

But remedial support to families in distress or at risk is not in fact the only, or indeed the central, thrust of the programme. Quite to the contrary, a close reading of the IYF literature suggests that the rationale for the effort lies elsewhere; and, moreover, that it was motivated by several quite contradictory impulses. To some extent, such contradictoriness is to be expected in all such documents, which represent hard-fought compromises between the competing interests and perceptions of UN member states. In another sense, the mixed messages of the IYF literature epitomise genuine and unresolved dilemmas in official thinking about the family. This deconstruction does not seek to unravel the different threads that went into the making of the programme documents, though that might be a revealing exercise. Rather, taking the documents as a 'given' text, it seeks to highlight their internal tensions.

In a nutshell, the official publicity for the IYF suggests three variant emphases, serendipitously summated in the slogans and emblem produced for the event.[5] As originally conceived, the theme of the year was to be (i) 'Family: resources and responsibilities in a changing world'. However, for reasons unstated in the published documents, the slogan that eventually emerged from the preparatory planning exercises was (ii) 'Building the smallest democracy at the heart of society'. Additionally, along with the slogan was an emblem, described with dripping sentimentality as (iii) 'a heart sheltered by a roof, linked by another heart to symbolise life and love in a home where one finds warmth, caring, security, togetherness, tolerance and acceptance'. These three statements of the rationale for the IYF neatly encapsulate the contradictions at its core. Was it primarily a programme concerned with renegotiating a new role for the family in circumstances of economic restructuring? Was it an effort to introduce principles of equality and human rights into a domain that has been relatively inscrutable in these respects? Or was it a celebration of the selfless, altruistic love that makes family relationships qualitatively different from relationships in the public domain and the market place? The programme literature attempts to affirm all three of these principles at once, notwithstanding their basic incompatibility of emphasis.

Let us begin with the first of these slogans: 'Resources and responsibilities in a changing world'. What exactly are the changed circumstances that make the family a set of *resources* rather than of *needs* and that vest it now with special *responsibilities*?

As already noted, over the last hundred years in the advanced societies of the west, the state and other institutions had gradually taken over many of the characteristic social functions of the human family—caring for the young, the aged, the mentally and physically incapacitated, and so on. This process was even more complete in many of the erstwhile Communist states which had sought to free family members, especially women, for more productive economic roles. Most developing countries have also aspired to the same welfarist goals, though hampered by overall poverty and a severe constraint on financial resources.

[5] The following discussion draws on Kapur 1993; Murthy 1994; and Uberoi 1994a.

But all that is in the past, now. With new economic policies of deregulation and privatisation there has come a stagnation or effective reduction of spending on the social welfare sector in many former 'welfare states'. As the coordinator of the IYF programme, Henryk J. Sokalski, wryly remarked while introducing the rationale for the programme: 'more and more governments are retreating from a lead role in the provision of social services and are leaving (or returning) that responsibility to families' (Sokalski 1993: 8). In other words, the IYF's urgent address to 'the family'—as a unit, as a concept, and as an ideal—is clearly motivated by the knowledge or expectation that governments will be increasingly unwilling to maintain and augment social spending and that, in proportion, families will be obliged to take on an enhanced social welfare burden. This new role for the family is rationalised by the shortage of resources, even in the developed economies, to fill the ever-growing 'care gap', supported by a critique of the dependency that welfare supposedly induces and endorsed by a barely-disguised stigmatisation of welfare-dependent groups (AIDS sufferers, unwed mothers, unemployed youth, etc.). To this is added a sentimentalised celebration of the family as the 'basic unit' of society (whatever that might mean) and as the 'natural' site of care and nurturance. The family, as Sokalski goes on to remark, 'continues to provide the natural framework for the emotional, financial and material support essential to the growth and development of its members, particularly infants and children, and the care of their dependents, including the elderly, aged and infirm' (ibid.: 7).

This sentiment, embodied in the IYF emblem, would appear unexceptionable as a statement of both fact and ideal. But it is clearly not as innocuous as it appears. Firstly, it renders what is essentially a policy *choice* (i.e., a reduction of welfare expenditure) a matter of necessity and of self-evident economic rationality: alternatives are simply not conceded. Secondly, it *naturalises* the caring functions of the family to a larger political agenda. Indeed, the discovery of a positive role for the family in social and economic development has a rather curious ring for most sociologists, for whom the family had hitherto represented a focus of ascriptive loyalties inimical to economic rationality.[6] Thirdly, the return of nurturing functions to the family is a *gender* issue of major importance for the simple reason that, in almost all societies, the major burden of 'care' falls unevenly on women. Thus, to shift social welfare provisioning from the state to the family with the argument that the family does it so naturally and so efficiently is likely to affect women much more than it affects men, adding to women's household responsibilities and reducing their competitiveness in the employment market.

As it happens, however, and as the official IYF documents concede, it is not necessarily a simple matter to return welfare responsibilities to families, at least, not in those countries which have already tasted welfarism. Families may be unable, or worse still unwilling, to shoulder the burden of care for their weaker members. There may be several reasons for this. On the one hand, social and demographic changes in the *developed* countries have ensured that the family is no longer what it was (or *what it was supposed to have been*), at the time when the

[6] For an early review of some of the literature for and against this thesis, see Madan (1993).

welfare state was first coming into being, having now contracted even beyond the valorised nuclear family form of parents and their minor children.[7] Many people, especially the aged, live alone; many never marry; many cohabit without marriage; many couples choose not to have children; many children are born out of wedlock; marital breakdown and remarriage are common; and homosexual partnerships are increasingly tolerated. Under the circumstances, where and what is 'the family' to which social welfare functions should be returned?

Additionally, as Sokalski morosely admits, the philosophy of individualism, which on the whole was believed to have had a positive relationship with economic development, has conversely ensured that 'many people now feel less responsible for family relationships' (Sokalski 1993: 7) and are unwilling to meet the basic needs of other family members. He might also have added, though prudence and political correctness no doubt dictated otherwise, that in many societies women have come to have increasing stake in employment and careers outside the home. However, given the fact of the retreat of the welfare state, families must now be actively *persuaded* and *assisted* to fill the 'care gap'. Failing this, the local community or NGOs should be encouraged to take up the slack in forms of participatory development (what is called 'subsidiarity' in contemporary UN parlance).

The second slogan of the IYF—'building the smallest democracy at the heart of society'—has quite a different thrust. On the one hand, the programme documents insist that 'the state should offer to families a respect for their ability to self-govern, and recognise the autonomy of the family unit' for the purposes of providing welfare services'. At the same time, and somewhat contradictorily, they also insist that this endorsement of family autonomy should not be at the expense of the rights and freedoms of individual members, or in violation of the principle of equality of the sexes:

> The boundaries of the family should not ... provide refuge for the scourge of domestic violence, the abuse or neglect of children, the systematic and abhorrent subjugation of women, or mistreatment of the elderly, persons with disabilities or other members with special needs. ... There is clearly a place for the intervention of the state in the lives of families. That obligation rests on the states' commitment to the protection of the basic human rights of all members of society. (Sokalski 1993: 9)

In other words, there is clearly a dilemma between endorsing the family and its more or less inegalitarian authority structure as an adjunct to economic restructuring, and seeking—on quite different grounds—to open the family to interrogation on questions of rights, equality and freedom. The uncomfortable truth is that the rights of individual family members and the rights of the family as a collectivity cannot easily be kept in balance. And in any case, introducing rights discourse into family relations is likely to subvert the spirit of selfless altruism on

[7] I cannot at this point go into the complex question of the changes in family form in modern times. Suffice it to say that, according to a pervasive model, modernisation has universally brought about a change from the extended to the nuclear family form. This formulation, which incidentally endorses the white middle-class value system, has been challenged by new work on the historical sociology of Europe, and also in the Asian context. For a recent summary of the issue with respect to India, see Shah (1996).

which the caring and nurturing functions of the family depend. Indeed, few realistic observers of contemporary family life would anticipate that policies that 'aim at fostering equality between men and women within families and to bring about the fuller sharing of domestic responsibilities and employment opportunities' will make the family a more stable institution—at least not in the short run—for the furtherance of welfare functions and state policy objectives. On the contrary, under present conditions in many societies, such restructuring is likely to make the family a site of conflict and contestation, rather than of cooperation and conciliation.

II. The Indian Perspective

Having argued that the IYF programme literature embodies serious internal contradictions, let us now look—albeit very sketchily—at the way in which the programme has been interpreted and rendered in two different national contexts: India and China. We begin with India.

The Indian Approach Paper for the IYF (1994b) was produced by social scientists (chiefly from the Family Studies Unit of the Tata Institute of Social Sciences, Bombay) in conjunction with officials of the Ministry of Welfare, and finalised in consultation with other academics, delegates from other Ministries and Departments of the government, and representatives of various NGOs involved in aspects of family welfare. Though it conforms to the general line of the international agenda, reiterating some of its platitudes and reproducing the contradictions already alluded to, its emphasis and focus are nonetheless distinctive in several respects, detailed below.

Firstly, it seems that the idea that the state inevitably will (and in any case should) increasingly relinquish some of its welfarist activities and return them to families is not a very palatable idea in the Indian context, where the state has still not succeeded in ensuring basic food, shelter, education and health for its citizens, and where political parties continue to try to woo voters with populist 'anti-poverty' programmes, regardless of organisational feasibility and fiscal consequences. Welfare institutions remain woefully underdeveloped, both in the public and the voluntary sector, and for the most part, whether they want to or not, families take care of their vulnerable and handicapped members as best they can. Or else, they are simply abandoned to destitution.

It is not surprising under the circumstances that the bogey of the retreat of welfarism does not loom large in the Indian IYF documents. On the contrary, the mood of the Indian Approach Paper (GOI 1994b) and other documents (e.g. GOI 1994a) is ever to solicit the state for *more* help: for instance, to rationalise existing government programmes; to fill identified gaps in existing social welfare provisions; and to protect vulnerable categories from the indirect effects of structural adjustment policies. There is no great foreboding expressed that the process of structural adjustment will inevitably entail a direct and deliberate cutback in welfare spending in India, as it already has elsewhere. However, the choice of the title, 'Enhancing the role of

the family in social and economic development' for the Indian IYF preparatory meeting might be read as an indirect admission that families (rather than the state) are expected to be the chief instruments of social welfare; after all, what other role can one imagine for the family in promoting socio-economic development?

Secondly, though the Indian document reiterates the official IYF rhetoric on the family as the 'basic unit' of society, it is much more forthright on the question of the inequalities, abuse of rights, lack of freedom, and direct oppression that routinely occur within families. In fact, departing from the cautious language of the international documents, it states in no uncertain words that the family in India is a 'patriarchal' institution which is founded on and expresses a 'hierarchy by gender, age and generation':

> ... The family [in India] has not been a cradle for nurturing democratic values. In fact, the child gets socialised into the concepts of inequality by gender and age in the name of familism. Even women ingest the patriarchal values and, in turn, utilize their power and position over others such as the younger women within the family as well as over men and women of lower castes and classes.
>
> Besides the family members, patriarchy is also internalised by the community, the society and the state. It therefore affects all the spheres of our lives and not just the family life. The need for a democratic family structure is a major challenge for the families and not just for women. (GOI 1994a: 10)

In other words, the Indian documents explicitly identify (sexual) inequality in the family as the basis of the inequality that permeates society as a whole, and insist that 'a change from an authoritarian or feudal to a democratic egalitarian society can be brought about *only through a family revolution'* (GOI 1994a: 10, emphasis added). Patriarchy, it is stated, must be resolutely 'abolished' (ibid.: 12).

Notwithstanding this strongly-worded critique of the patriarchal character of the traditional Indian family[8] and the assertion of individual members' rights within the family, the Indian literature nonetheless urges that: 'it is the responsibility of every family member to care for and support family members in the event of crisis such as disability, illness and old age' (GOI 1994a: 20): 'Every child,' it is contended, 'has the right to be reared by his or her natural parents. Parents have the primary responsibility to rear their children' (ibid.); and so on. This conception of familial responsibility not only accords with the spirit of the international agenda on the family in the age of the retreat of welfarism, but *also* endorses a recognisably traditional and very widely shared conception of the Indian family as based on reciprocal obligation between the generations and the sexes.

This brings us to a third, and quite striking, divergence of the Indian IYF programme literature from the international agenda, namely a nationalistic preoccupation with the virtues of the traditional Indian family as a privileged signifier of the national community. Indeed, the

[8] It should be recorded that the documents also acknowledge the variety of Indian family types, and comment favourably on the matrilineal systems of southwest and northeast India.

Indian documents cited here were 'framed' by a statement of the Minister of State for Welfare which, in effect, subverts the radical (and clearly feminist-inspired) critique of the Indian family system that the documents manifestly present:

> India is proud of its ancient heritage of a united and stable family system. The Indian families have demonstrated a unique strength of keeping themselves together despite the growing stress and strain and external influences on the Indian culture. An Indian family is by and large still perceived as a homogenous unit with strong coping mechanisms.[9]

In statements such as this—and there were a great many of them (especially by politicians!) through the course of the International Year of the Family—one is made aware that the Indian family has an iconic status in national self-representation. An 'imagined' tradition, it indexes the moral and spiritual superiority of India *vis-à-vis* a degenerate West, where family life is seen to be under constant threat from a combination of wifely infidelity, filial insubordination, and an excess of self-interested individualism. This is a theme that has been consistent through the last hundred years of self-reflection on the singularity of the Indian family and the superiority of the institution of the traditional Indian joint family. And it continues today as concerned citizens seek to insulate themselves from the potentially corrupting influence of the 'cultural invasion' from the West.

III. The Chinese Perspective

Now for the Chinese rendering of the IYF programme in relation both to the international agenda and to the Indian interpretation of that agenda.

At a meeting of the UN Asia-Pacific region Preparatory Committee for the IYF, held in Beijing in May 1993, the Chinese government endorsed 'the purposes and principles' of the IYF programme, and stated its willingness 'to actively take part in observance activities and follow up work'. What these 'purposes and principles' actually were remained inexplicit in the report. Addressing the gathering, State Councillor Peng Peiyun (significantly, Minister in Charge of China's State Family Planning Commission) noted, in the characteristic Chinese official rhetoric of numbers, that China had over 270 million families. Reiterating the language of the UN documents, she further observed that 'the family is the basic unit of society and performs many social functions' ... 'of great importance to maintaining social stability and promoting economic and social development.'[10]

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[9] See K.Y. Thangka Balu, Speech at the National Seminar on 'Enhancing the Role of the Family as an Agency for Economic and Social Development', New Delhi, 15 May 1994.

[10] The Preparatory Meeting for the 'Family Year' held. Xinhua, 24 May 1993. *News from China,* vol. 5, no. 22, p. 9.

These comments would appear unremarkable were it not for the fact that the Chinese revolution has produced one of the most radical critiques of the institution of the family in human history, and followed it up since 1949 with the initiation of important measures to liberate women from oppressive marriages through a new Marriage Law and to undercut the economic basis of the traditional lineage system through land reform, collectivisation and finally communisation.[11] Particularly under attack since the May Fourth Movement (1919) was the absolute authority of clan elders over junior kinsmen, of fathers over sons, and of husbands over wives, these hierarchical relations being linked both metonymically and metaphorically to the politics of imperial despotism and the hold of traditional religion. As Mao Zedong put it in his famous 'Report of an investigation into the Peasant Movement in Hunan' (1927):

> A man in China is usually subjected to the domination of three systems of authority: (1) the system of state (political authority)...; (2) the system of clan (clan authority), ranging from the central and branch ancestral temples to the head of the household; and (3) the system of gods and spirits (religious authority). As to women, apart from being dominated by these three systems they are further dominated by men (the authority of the husband). These four types of authority—political authority, clan authority, religious authority and the authority of the husband—represent the institutions of feudalism and patriarchy; they are the four bonds that have bound the Chinese people, particularly the peasants. (Schram 1969: 257)

Given this background, the contemporary emphasis on the family as a source of 'social stability' and official concern for the 'stability' of family life are significant.[12] Harmony between the generations, based on esteem for elders, is attributed with some pride to China's special tradition of family life. The custom of arranged marriage is deplored (though obviously still widely practised) and the principle of free choice in marriage upheld by law. Nonetheless it is made clear that sexual attraction is not a proper basis for the choice of a marriage partner, which is better based on 'friendship' (as between brothers) or 'responsibility' (a concept left unexplained). The low divorce rate and the universality of marriage are seen to testify to the

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[11] Several observers have noted, however, that certain policies of the pre-Reforms period actually 'created demographic and material conditions conducive to large, multigenerational households with extensive economic and social ties to nearby kin' (Davis & Harrell 1993: 1). The Chinese hostility to the family is in marked contrast with the situation in India where, on the whole, the Nationalist Movement did not provoke a very vigorous critique of Indian family life except in so far as the position of women was concerned. Even this latter critique was ambivalent, for the Indian 'joint family' was also idealised as the repository of traditional Indian cultural values, and much ink spilled on deploring the decline of this excellent institution. For analysis of the contradictory nationalist attitudes to the family, see e.g. Chatterjee (1989); and Chaudhuri (1995). On the idealisation of the Indian joint family and the impact of this on sociological apperception, see Shah (1968).

[12] It should be noted here that preoccupation with the question of 'social stability' is not restricted to discourse on the family, but is general in contemporary Chinese social, economic and political discourse. Sinologists see this as reflecting concern with the possibly destabilizing effects of China's very rapid and uneven economic growth.

enduring wisdom of China's cultural tradition, while a measure of anxiety is expressed regarding the possibly destabilising effects on China's family life of the increased level of contact with westerners and with Chinese from Hong Kong and Taiwan, some of whom are reported to have entered into bigamous marriages with Chinese mainland women.

In a major change in policy since 1979, the role of the family in economic development has been officially recognised and prioritised through the dismantling of the commune organisation and the introduction of the 'family responsibility system' in the agrarian sector. Most importantly, however, the family is seen as developmentally crucial in another (if more indirect) way as the locus of efforts at population control—either assisting or resisting this most important of state developmental projects. This is interesting, for family planning finds no mention in the UN's official IYF agenda. The latter, as already noted, concedes that there may be compelling circumstances under which the state must take cognisance of conduct in the otherwise private and 'autonomous' domain of the family—abuses of freedom and rights, and violence against women, children and the elderly—but it does not conceive of a vigorous role for the state in supervising reproductive behaviour in the private space of the conjugal relation, and in eugenic planning. Indeed, even in India, where population control is official state policy, IYF programme documents avoid linking family policy with the tendentious issue of family planning. Not so in China, however, where preoccupation with population control conspicuously modulates all reflection on changing patterns of family life and related welfare issues.

As elsewhere, the IYF has provided the occasion for Chinese social scientists to comment at some length on the current state of the Chinese family, contemporary trends, future prospects, and specific problems demanding correction. Problems may be grouped into several types:

(1) First are those problems seen to stem from the lingering, or recrudescence, of the values and practices of the traditional Chinese family system. Of particular concern are those problems deriving from the traditional preference for boys over girls and associated with clan-exogamous, patrivirilocal marriage—especially female infanticide and the neglect of female children; sex-selective abortion; and so on. Despite the legal endorsement of free choice marriage in China's Marriage Law of 1950, arranged marriage is admitted to be common, especially in rural areas, and parents are often said to 'interfere' in their children's marriages. There are also complaints regarding high expenditure on marriages, and the introduction of mercenary considerations into matchmaking.

Nonetheless, as already indicated, there is also considerable nostalgia for the traditional Chinese family system, which is recognised to have had its strengths, as well as its much-publicised weaknesses. The Chinese family is seen as a protective and caring institution marked, in particular, by respect for the elderly and by the stability of the marital relation. It is claimed that these are the virtues that have made the Chinese family an enduring institution through several millennia.

(2) It is also recognised that the new trends toward marketisation may have reinforced or exacerbated old habits of thought and practice, especially in respect to the exchange of property at the time of marriage (bridewealth and/or dowry), and the heavy expenses that marriage festivities very often involve. However, here again there is ambiguity, for the celebration of China's growing post-Reform prosperity is often expressed in terms of a catalogue of the consumer goods that young couples can now hope to purchase or expect to be gifted at the time of marriage, or of the variety of services that can now be availed of for facilitating the wedding celebrations or the planning of the honeymoon. It is clear from this evidence that getting married can be a rather costly business in China nowadays, and that conspicuous consumption during marriages is one of the new (or new-old) status symbols that marketisation has encouraged.

(3) There are, further, some new developments in family relations that seem to be connected with the increased scope for the private ownership of property. For instance, there are now reported to be 'contracts' regarding the control and disposal of property between husbands and wives, and between parents and their children, fixing responsibility for support and maintenance. In one view, such innovations are 'modern' arrangements suited to conditions of marketisation. In another, this commercialisation of family relations can only undermine the natural affection and spirit of cooperation and mutual trust on which Chinese family life has always depended.

(4) Chinese documents also disclose a certain apprehension that economic liberalisation will lead to a liberalisation in respect of social values as well; for instance, an increase in the divorce rate is anticipated, and an increase in the co-habitation of unmarried couples, though this is strongly disapproved. Divorce, which was earlier conceived as a mechanism to liberate women from forced or oppressive marriages, is now viewed in a rather less positive way as, potentially, a validation of desertion or infidelity; and, most certainly, free-choice marriage is not meant to open the door to sexual promiscuity. Sociologists anticipate that there will also be an increase in marriages between Chinese and foreigners, and clearly see this as a social trend that needs to be carefully monitored.

(5) Finally, observers seek to prepare for the social and family problems that will be consequent upon the implementation of the population control policies. Looking ahead, they predict that the typical Chinese family would now have an inverted pyramidal structure—the 4-2-1 (four grandparents, two parents and one child) formula. As the Chinese population rapidly ages over the next decades, there will clearly be a massive need for health and old-age insurance schemes, pension funds, and geriatric care. Moreover, in a circular sense, the success of population control *itself* depends on people's confidence in the adequacy of social welfare provisions (see Davis & Harrell 1993: 4). Thus, social welfare, family policy and population control are perceived as most intimately connected, and it is this that gives a very distinctive emphasis to China's formulation of its IYF strategy.

Chinese official documents do not explicitly concede that, with economic reforms, the state either will or should retreat from its welfare aspirations and return these to families. But there is nonetheless considerable anxiety on the question of the administration of welfare, focused particularly on care for the aged. Despite comprehensive old-age care for workers in state enterprises, particularly in urban areas, in many rural areas families continue to bear the major burden of care for their aged and infirm members. Realistically speaking, universal old age benefits are a very long way off, and the problem is, if anything, getting more difficult as China's population ages.

This overall situation is of some significance in respect to family planning work. A combination of much enhanced life expectancy and the falling birth rate has meant that the Chinese population is an increasingly aged one, imposing an enormous financial and care burden on the young. Indeed, if the one-family-one-child policy were fully successful, the parental generation of the 4-2-1 family (a working couple caring for four elderly parents and a young child) would be functioning under considerable strain. And it goes without saying that, in all likelihood, the burden of this excessive family care and domestic work would fall disproportionately on the wife.

In urban areas, where pressures on housing, employment and facilities are much greater, where supervision of family planning can be more rigorous and where pension provisions and other facilities for the aged are better developed, family planning measures have been on the whole more successful. But the population is a disproportionately aged one, and the growing transient ('floating') population of China's cities and metropolises increasingly difficult to supervise and regulate.

In the countryside, where welfare provisions are underdeveloped and where families continue to have to care for their aged members, the birth rate is much higher. This is attributed to the traditional desire for a son to continue the family line and care for the aged, the increased prosperity of rural families in many areas, and also, contrariwise, to the unrelieved poverty of other areas which are still to undergo economic development and demographic transition. In any case, since it is recognised that the success of population control measures is dependent on adequate social security, the government must continue to invest in specific areas of social security (particularly pension reform and old age care) while attempting to centralise and rationalise coverage, allow and even encourage the regulated privatisation of some services, and subsidise efforts by recognised non-government agencies as well. Indeed, according to recent reports, 'charitable' organisations and activities are now growing, with state blessing—an extraordinary development in socialist China.

In sum, Chinese family policies also appear to be rather instrumental in their motivation—but in their own special way. That is, this instrumentalism is not merely directed to counterbalancing the anticipated retreat of welfarism, as is increasingly the case in developed societies, but is tied in with state fertility control programmes. Where earlier the Chinese state had aimed primarily to free its citizens from family responsibilities in order to increase the national productive capacity, the paramount contemporary motivation seems to be that of population

control to secure the gains of development. Family welfare measures are primarily keyed into this all-important goal, to which is added a rather grudging guarantee of support to individuals in circumstances of absolute destitution, and the exhortation to individuals and families to find for themselves privatised means of insuring against any such eventuality.

In the present Chinese context of uneven development, however, even a limited and instrumental delivery of welfare to the total population poses stupendous problems of organization, distribution and financing, and of political will. There are no simple solutions at hand. So, until such time as basic welfare measures can be universally and satisfactorily implemented, people's resistant 'feudal' habits of thinking reformed and their reproductive desires fully disciplined even as they become more prosperous, the family will continue to be commended as the 'basic unit' of society, where virtues of selflessness and altruism, love and caring, are nurtured and exemplified. In the last analysis, through successive radical political and economic experiments, the family remains—or has returned to being—China's foundational welfare institution.

IV. Conclusion

The discourse of an event such as the International Year of the Family provides a number of interesting insights into types of official thinking on the family in contemporary times. On the one hand, as an *international* programme, the IYF can be presumed to represent the dominant voice of the countries of the North, and of the hegemonic classes therein, tempered by token acknowledgement of contrary voices and interests both within and outside the highly developed societies. In other words, the IYF is a common programme whose overall ideological and pragmatic thrust has been somewhat blunted by the need for political accommodation across classes, regions and nations; indeed, across the sexes as well. The result, as I have indicated in the first section of this paper, is a rather contradictory policy statement open to different emphases and interpretations in different national contexts.

As noted, the retreat of welfare is presented in the international IYF literature as a simple fact of life in the developed societies, presumably soon to be extended to the developing societies. There is also a covert justification of this process on grounds that are now familiar. The first is a purely pragmatic consideration: with increasing demands on resources, governments can no longer muster the funds for financing social welfare. Besides, it is claimed, in a perverse sort of way the 'care gap' is something that seems to keep growing no matter how enormous the resources invested in plugging it. This leads into the second, 'moral', argument against comprehensive social welfare, namely that it *creates* dependence and prevents people helping themselves. The suggestion is that people become (and remain) welfare-dependent primarily because welfare is available; and not the other way around. Self-help is regarded as morally superior to dependency/paternalism; so if individuals cannot help themselves, they can be assisted in a more democratic and participatory way by their families, the local community, and locally-based NGOs. This 'subsidiarity' is deemed not only more spiritually

uplifting, but also ultimately more efficient than welfare administered by ponderous state bureaucratic apparatuses. Together, these several pragmatic and/or moral arguments constitute a teleology: what is presently seen to be happening in some advanced societies of the West is *destined* to happen in the natural course of events, and is therefore not negotiable *via* different policy options. This is the point of view implicit in the perspectives of international funding agencies such as the World Bank and International Monetary Fund, and pressed vigorously by technocratic developmentalists and marketisation enthusiasts.

Compared to many other UN initiatives in respect of social development (e.g., the Cairo Population Conference, the Copenhagen Conference on Social Development or the Beijing Women's Conference), the celebration of the International Year of the Family was remarkably free of public controversy. This was so despite significant differences of stress and orientation not only between the international agenda, obviously shaped by perspectives from the North, and the national agendas of less developed countries such as India and China, but between these two societies as well. Remarkably, also, there appears to have been very little contestation over IYF policy *within* the latter societies, that is, between organs of the state and institutions of civil society, though one might have expected a vigorous defense of the principles of welfarism or, considering the gender implications of the IYF programme, a measure of protest from and on behalf of women.[13] Instead, especially in the Indian case, a critique of 'patriarchy' was built into the IYF policy statements, reproducing at the national level the contradictions of the international programme documents. (Perhaps it was this critique that was responsible for the recommendations quickly taking their place 'on the shelf'!)

There may be several reasons for this unusual cordiality. On the one hand, and in contrast to international policies in respect of such issues as population and environment, the IYF actively invites member states to formulate their policy goals in the light of their own individual needs and priorities. This makes possible the easy co-optation of the programme to the service of specific national goals—in the Indian case, a vaguely conceived liberal 'development' agenda, in the Chinese case, population control as the privileged focus of state development efforts. Secondly, as I have sought to show in Section I of this paper, the IYF programme is itself a pastiche of contradictory directives, thereby enabling manifold interpretations and disarming potential criticism. Finally, one should not discount the possibility that member states have developed their own covert forms of resistance to international pressures while giving the appearance of conformity and approbation. Family policy invites such resistance, for the family is everywhere, and in a very conservative way, deeply identified with the national society. It is therefore hardly surprising that, along with a radical pledge to 'democratise' the family and to transform its patriarchal foundations for modern times, in line with the IYF agenda, one finds in both the Indian and the Chinese documents insistent valorisation of their traditional family systems.

[13] See, however, in the Indian case, Kapur (1993); Murthy (1994); and Uberoi (1994a).

This no doubt has a cynically instrumental function in circumstances where the state cannot hope to deliver comprehensive welfare to such vast populations, many still living in poverty. But it is also a reflection of continued anxiety in both these countries over the possible loss of national cultural identity in the age of globalisation.

* * *

This is where *HAHK* comes in.[14] *HAHK* is popularly construed as a discourse on the 'traditional' Indian family at a moment of crisis of values. Actually, this is not immediately evident from the cinematic narrative, which merely underlines the compatibility of traditional family values with affluence, conspicuous consumption, and new lifestyles. Rather, it is to be read off from the film's quite excessive display of family life-crisis rituals on the one hand and, more importantly, from the several acts of probable and improbable *sacrifice* that family members make for each other (Uberoi 2001). That this focus on the family as a symbol of Indian culture was not a 'flash in the pan' is confirmed by the extraordinary popularity of the successor blockbuster movie, *DDLJ* (*Dilwale Dulhaniya Le Jayenge,* 1995). In this latter film, Indian family values face the direct challenge of diaspora and globalised lifestyles... . And triumph in the golden mustard fields of Punjab.

But that is another story.

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[14] I am not aware of comparable texts in contemporary Chinese popular culture (cinema, novels, TV soaps, etc.), but this would certainly be a line worth investigating.

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Index