PEACE SCIENCE: THEORY AND CASES

Series Editor **MANAS CHATTERJI** *Professor, School of Management, Binghamton University, US*
Guest Professor, Peking University, Beijing, China

PARTHA GANGOPADHYAY AND MANAS CHATTERJI
with a preface by Michael Intriligator

PEACE SCIENCE:
THEORY AND CASES

Contributions to
Conflict Management, Peace Economics and Development Volume 11

SERIES EDITOR
MANAS CHATTERJI

BOOKS IN THE SERIES

Contributions to
CONFLICT MANAGEMENT, PEACE ECONOMICS
AND DEVELOPMENT VOLUME 11

PEACE SCIENCE: THEORY AND CASES

PARTHA GANGOPADHYAY

University of Western Sydney, Sydney, Australia

MANAS CHATTERJI

Binghamton University, New York, USA

Reprints and permission service
Contact: booksandseries@emeraldinsight.com

ISOQAR
QUALITY
ASSURED
ISO 9001

UKAS
QUALITY
MANAGEMENT
026
Certificate number 1985

Awarded in recognition of
Emerald's production
department's adherence to
quality systems and processes
when preparing scholarly
journals for print

INVESTOR IN PEOPLE

CONTENTS

LIST OF DIAGRAMS

LIST OF FIGURES

LIST OF TABLES

FOREWORD

Since the 1980s the global system has displayed a clear bifurcation that has immense implications for the stability of global peace. On the one hand, the forces supporting peaceful settlements of conflicts and violent disputes have been gaining significant momentum especially in the developed part of our globe. On the other hand, violent conflicts are a recurring theme in poorer regions of the globe. The main goal of the book is to develop and test consistent economic models to articulate that lasting global peace is critically predicated upon the above bifurcation. Global peace is therefore highly fragile. In order to achieve sustainable global peace, careful and collective negotiations must take place to bridge the above bifurcation between the rich and the poor. In many societies today, violent conflicts regularly spring up that usually cause a destruction of economic and social assets and loss of human lives. In other societies, on the contrary, a peaceful resolution of serious conflicts often takes place. Even many societies seem to traverse from conflicts to peace and to costly conflicts again, where some seem to enjoy lasting peace. The literature on the economics and politics of peace and conflict has made a significant scientific progress during the last five decades. A new social science discipline called Peace Science has emerged and considerable research materials are presently available. The objective of Peace Science is to develop and integrate tools, methods and theoretical frameworks available in the social and natural sciences, law engineering and other disciplines and professions. This field is interdisciplinary. This book presents some of these theories and their applications paying emphasis on:

- Consolidation of the present state of the theory of peace and conflicts
- Clarification of the economics and politics of peace
- Lifting the whole subject into new and uncharted territories.

<div align="right">

Manas Chatterji
Series Editor
May 2009

</div>

PREFACE

Partha Gangopadhyay and Manas Chatterji have produced an outstanding book on Peace Science that will help further the establishment of this field as one with a solid academic base and with many practical applications in the world of policy. The field combines traditional international relations theory with peace and defense economics and national and global security studies in order to study peace. Peace science has made important contributions in recent years, many of which are treated in this book. Of course, more must and will be done to provide a framework to prevent war and promote peace, building on the earlier contributions, including this book.

While the advent of the UN system has done much to prevent or stop interstate wars, some wars of this type have nonetheless begun in recent years and they must be analysed in order to understand how to prevent them. Even more important has been the advent of major internal wars, particularly in the poor nations of the global south, and considerable work must still be done to treat the bases of these wars in order to understand them and to prevent them. Peace science as elaborated in this book can play a significant role in this work.

Michael D. Intriligator
University of California,
Los Angeles, CA, USA

INTRODUCTION

Violent conflicts and peace are the flip sides of the same coin of our societies. In many societies, conflicts of violent nature regularly spring up, which cause a destruction of economic and social assets and needless loss of human lives. In similar societies, on the contrary, a peaceful resolution of serious conflicts often takes place. Even many societies seem to traverse from conflicts to peace and to costly conflicts again. Some societies do seem to enjoy lasting peace. The literature on the economics and politics of peace and conflict has been with us now for several decades. An abundant crop of excellent work has appeared supporting, critiquing and complementing the original ideas that economic development is a precursor to an effective resolution of conflicts and, hence, a pre-condition for sustainable and lasting peace. Yet some parts of the world are still replete with unending chains of violence and conflicts. The prospect of a lasting global peace is still a forlorn hope. What is needed at this critical juncture is not an additional work discussing or rectifying or tweaking some points of detail, but a comprehensive and general re-working aiming at the following:

- Consolidation of the present state of the theory of peace and conflicts
- Clarification of the economics and politics of peace
- Lifting of the whole subject into new and uncharted territories

By so doing the current research manuscript will offer a series of new insights into the problems and prospects of war, peace and conflicts. In order to shed new lights on the pressing issues related to peace, we will approach the problem and prospects of war and peace from new angles and thereby evade the dominant tradition, methodology and models within which the existing work had proceeded so far. Let us have a look at the central issues that our work will examine in great detail.

In Chapter 1 entitled A Study of Endogenous Fragmentation of States as Deterrence to Peace, we start our journey into an uncharted territory: the starting point of our research is a casual empiricism that intrastate conflicts have been on the ascendancy while the incidence of interstate conflicts and

frequencies of ideological conflicts have subsided in the post-Cold War world. As positive examples, the prospect of global peace has been ably aided by the following developments:

- The frequency of armed conflicts fell by about 40% in the 1990s except in sub-Saharan Africa where the incidence remains high.
- Genocides and politicides declined by 80%.
- International arms transfers went down by 33% in value.
- Forced migration of refugees fell by about 45%.
- Battle-deaths declined by about 80%.
- War-death rates came down by about 35%.
- Military spending as a percentage of GDP declined in most countries and globally by almost 50%.
- The number of soldiers per 1,000 people went down by 35%.

Against this positive backdrop, there is some evidence that conflicts have a regional bias, as most violent conflicts are located in poorer regions of our globe, which poses a serious threat to the global peace. The prospect of a lasting global peace has been threatened by some of the following developments:

- The major exception and continuing source of conflicts has been sub-Saharan Africa whose growth of real GDP per capita adjusted for PPP halved from the 1980s to the 1990s. A recovery since 2000 has started, which can reverse the trend in violent conflicts.
- The region is also known to have serious problems with fragile availability of foods and hunger. However, there are a host of other problems in these regions.
- According to the World Bank's World Development Indicators of 2005, the number of people living in extreme poverty (at less than $1 a day) doubled in sub-Saharan Africa from 1981 to 2001.
- Since the end of the 1980s, 80% of the world's 20 poorest countries (many in the sub-Saharan region) have suffered from a major war.
- Military expenditure as a proportion of GDP and the number of soldiers per 1,000 people changed little in the region.
- Battle-deaths actually fell in sub-Saharan Africa through the 1990s (apart from an all-time high spike from 1998 to 2000 due to the Eritrean war). However, war-deaths in this region have vastly exceeded battle-deaths due to indirect deaths.
- Disputes over natural resources triggered some region's long-standing ethnic tensions that have contributed to violent conflict.

- Resources like timber benefit some groups under conditions of violent conflict, or it is produced and traded in the wake of recent violent conflict.
- The World Health Report 2004 of the World Health Organization stated that the HIV/AIDS epidemic had its 'most explosive growth' in the mid-1990s in Africa, and by 2003, it was 'home to two-thirds of the world's population living with HIV/AIDS'.
- Human under/malnutrition, HIV/AIDS, onslaught and continuing human hunger and personal insecurities can turn some of the backward regions into veritable minefield wherefrom one can only expect holocaust.
- The persistent famines in the Horn of Africa coincided with violent conflicts within and between Ethiopia, Eritrea and Somalia in the last 15 years.

Since the early 1990s, the modern world has been rocked by what is known as intrastate conflicts. There is clear evidence that there are significant tensions within many nation states, which usually leads to the fragmentation of a state into powerful rival groups who actively engage in violent conflicts to reach their individual goals. These conflicts recur regularly and are extremely violent in nature. The chapter provides a comprehensive analysis of the economic foundation of the fragmentation of a state into rival groups. It is important to note that ours will be one of the very few attempts to explain why and how a nation state can fragment, or split, into rival camps that can act as a pre-condition for violent conflicts.

As a first step towards our goal, let us focus our attention on what is commonly known as intrastate conflicts, which have rocked our globe since the early 1990s. We explain the role of *fragmented* states in the war and peace in our modern societies. We offer a new foundation to what is commonly known as intrastate conflicts. The fragmentation of a nation state connotes the following three common elements, which can often lead to what is usually termed as a 'failed state':

1. At the local, regional or national level, there appear powerful economic leaders, or political actors, who wield significant control over specific groups of people based on their ethnicity or economic or political or social backgrounds.
2. Members of a group offer economic and political allegiance to their leaders and pledge political support to their local leaders at the expense of the national interests; a relationship similar to that of patron–client develops.
3. The leaders choose open, or tacit, confrontation of violent nature with the state or other groups. They pursue narrow and sectarian interests by

applying political and economic pressures on the nation state and other groups. Intrastate conflict and inter-group rivalry are characterised by mutual violence of these groups against each other, or against the state.

The fragmentation can either lead to an all-out civil war as in Sri Lanka or a frozen conflict as in Georgia. One of the main characteristics of fragmentation is the control of group members by their respective leaders. The chapter applies standard models of non-cooperative game theory to explain an endogenous fragmentation, which seeks to model the equilibrium formation of rival groups. Citizens become members of these rival groups, and some form of *clientelism* develops in which political leaders control their respective fragments of citizens. Once the divisions are created, the inter-group rivalry can trigger violent conflicts that may seriously damage the social fabric of a nation and threaten the prospect of peace for the people for a very long time. In other words, our main goal in this chapter is to understand the formation of the patron–client relationship, or what is called clientelisation.

In Chapter 2 entitled 'An Economic Study of Ethnic Heterogeneity and its Implications for Conflicts and Peace', we examine the economics of ethnic diversity in our modern societies and their consequences for peace. In Chapter 1, we examined how intrastate conflicts can take place between groups of people based on their ethnicity or economic or political or social backgrounds. We now turn to the economics of ethnicity in a heterogenous society. By so doing in Chapter 2, our attention is riveted on an ever-increasing incidence of inter-ethnic conflicts in an ethnically heterogeneous society. Our basic questions in this chapter are somewhat simplistic and mainly two-fold:

- Why do some societies entertain ethnic heterogeneity?
- Why do people display ethnic intolerances and sometimes get into costly and violent conflicts?
- Why does ethnic fragmentation promote economic growth and peace in some societies?

These questions are neither well understood nor fully addressed by social scientists. Though intolerances are universal, serious and costly conflicts occur disproportionately in low-income countries and push these nations further down the poverty trap. In this chapter, we define conflict as a high level of intolerance that imposes serious costs on at least one involved party. In the same index, peace is defined as a low level of intolerance.

An important consensus today is that serious intolerance, or conflict, has a substantial economic dimension; hence, we expect economists to offer a positive contribution to our collective bid to analyse intolerances and conflicts. In order to understand intolerances – and consequent conflicts – we will ask the much-abused questions of an economist:

- What are the constraints on and incentives for conflicts?
- Why, in some societies, conflicts recur while other societies retain their peaceful composure?
- To what extent ensuing conflict is a product of misperception and irrationality of agents?
- Can we have lasting peace if misperceptions, irrationality and intolerances are removed from a society?

An ethnic conflict is a violent contest/war between ethnic groups as a result of ethnic divisions and chauvinism. They are of great interest because of their prevalence and onslaught since the end of the Cold War and also because they frequently result in atrocious war crimes like genocide. Existing explanations of ethnic conflict generally fall into one of three schools of thought:

1. Primordialist view: This strand of thoughts on ethnic conflicts emphasises that there is a genuine source of ethnic and national diversity because people have *serious* differences in their traditions of beliefs and actions towards *primordial* objects like biological features and territorial location. The primordialist argues that there is a natural kinship based on physical and lingual resemblances between members within an ethnic group, which acts as a bonding force within a group. Between groups, the distance in terms of kinships drives the ethnocentric rivalry, which gets exacerbated by economic, social and political polarisations.
2. Instrumentalist view: The instrumentalist strand gained momentum in the 1960s and 1970s in the United States, especially in the context of the debate on (white) ethnic dominance in what was supposed to have been an effective melting pot. It explains such persistence in white dominance due to the conscious activities of community leaders, who utilise their ethno-cultural groups for mass mobilisation and as political constituencies and specific weapons in their competition for political and economic power and controlling resources. The leaders usually find ethnic divisions less costly, and more productive and effective than interest group formation along social classes. According to this view,

there are pre-existing ethnic divisions, or cleavages, that are exploited by community leaders to further their narrow and sectarian interests.

3. Constructivist views: On the contrary, this strand of thoughts believes that an ethnic grouping is not based on any real difference but on imagined and manipulated or socially contrived ones. As an example, one can look at the horrific genocide in Rwanda that was caused by the apparent Hutu–Tutsi ethnic cleavage. This strand tends to argue that the Hutu–Tutsi distinction is not based on any real ethnic or lingual differences. The division was artificially created by the Belgian Colonial Forces only in the 1930s on the ground of cattle ownership, physical features and church records. Official identity cards got issued on this artificial classification, and the 1994 genocide unfolded on the basis of this *imagined* and *artificial* division or cleavage.

The main contribution of our chapter is three-fold: first, we offer insights on the *economic rationale* for multiple ethnicity, or ethnic heterogeneity, in a contemporary society and measure the costs and benefits associated with ethnic heterogeneity. This is a first and valid step in posing the debate on whether ethnic fragmentation and polarisation are a source of peace. Secondly, we examine the consequences of incomplete enforceability and non-universality of the interpretation of the social contract within a heterogeneous society. Finally, we examine the impact of mutual intolerances between ethnic groups on the social dynamics that can fuel intolerances and conflicts in multi-ethnic societies.

In Chapter 3 entitled 'Cycles of Violent Conflicts and Peace in a Dynamic Model of the Global System', we examine the consequences of bounded rationality on the dynamics of peace and conflicts in a regional set-up, which determines the possibility and continuity of global peace. The existing literature places an overt emphasis on conflict as a contest between *fully* rational agents (see Grossman, 1991, 1994). The economic theory of anarchy and contest explains conflict by modelling *optimal* behaviours of participants and offering an equilibrium conflict. The equilibrium conflict is a product of optimal group decisions to produce economic output and to fight such that no individual has an incentive to unilaterally move away from an equilibrium configuration. Thus, one can view, following Hirshleifer (1991, 1995a), that the anarchy and conflict are a spontaneous order of a Nash equilibrium, which derives from the optimal choice of contesting agents. A serious problem bursts to the scene when economic agents do not harbour the *common* knowledge that every agent is fully and clinically rational. It is well known as Binmore (1988) articulated that

the fact some people are not smart enough to get their sums right does not mean that one should re-write the rules of arithmetic. Yet as aptly highlighted by Sugden (1988), what should be the optimal act of an agent if s/he confronts an irrational agent? The bounded rationality is a serious challenge to the application of the deductive equilibrium method to the study of conflict. The goal of this chapter is to examine the foundation of cyclical fluctuations in the level of conflicts when agents are not fully rational.

One can ponder that a low level of conflict is a peaceful composure, while a high-level conflict represents a lack of peace. However, admittedly, it is impossible to pin down a level of conflict as a threshold between peace and violent conflicts. There is no science that we are to apply to define this threshold, or boundary, and we will rather depend on the commonsense. Our simple definition of peace is somewhat tautological: peace is an absence of an unacceptable level of violent conflicts. What is an acceptable level of conflict in a society? It is important to note that it is virtually impossible to banish violence and conflicts from a society – especially at its current stage. We will thus externally impose a cut-off point for conflicts below which a society is taken as peaceful and beyond which the society descends into a state of conflicts and crisis. Our intention is to explore whether the system has its own internal dynamics to fluctuate between peace and violent conflicts.

The question of peace vis-à-vis conflict is neither well understood nor fully addressed by social scientists. Though intolerances are universal, serious and costly conflicts occur disproportionately in low-income countries and push these nations further down the poverty trap. An important consensus today is that serious conflict has a substantial economic dimension; hence, we expect economists to proffer a positive contribution to our collective bid to analyse conflicts. Central to the economic modelling of conflicts is the trade-off between production and appropriation as initiated in the literature by Haavelmo (1954). Thus, the key to conflicts rests upon a *rational* choice between production and appropriation. Hirshleifer (1995b) defined a system *anarchic* in which rivals seize and defend economic resources without an effective regulation from above. In the classic work, Hirshleifer demonstrated that anarchy arises as an economic equilibrium of spontaneous order and is not *chaotic* by any means. It is further argued that anarchy is a *fragile* equilibrium that can easily descend into formless 'amorphy' or chaos. Anarchy has also the tendency to become a more organised system such as hierarchy. In an anarchic system decision-makers have to divide current resources into two competing uses: (1) exploiting the currently held assets in

a productive manner and (2) seizing and defending a resource base. Thus, there are two technologies for each contender or rival claimant: one is a technology of production and the other is a technology of appropriation, conflict and struggle (Hirshleifer, 1991, 1995b). As opposed to the above, our central focus in this chapter will be to examine whether temporary human irrationality and bounded rationality can cause a permanent departure from a lasting peace.

In Chapter 4 entitled 'Politics of Defence Spending and Endogenous Inequality', we examine the spatial consequences of defence spending and their implications for peace and conflicts. Some interesting and powerful microeconomic models have been constructed to explain war and peace, yet it seems there are gaps that motivate the current research. The existing models are robust in explaining an equilibrium defence spending of a nation in a general equilibrium setting. Yet, there is little that we know about the regional distribution of defence spending that is likely to give rise to serious rent-seeking activities, politicking and economic consequences in terms of regional disparity and inequality.

The interrelationships between defence spending and economic growth of a nation have been extensively studied in the literature starting with the pioneering work of Benoit (1973) and others (see Benoit, 1973; Dunne & Smith, 1990; Dunne, Smith, & Willenbockel, 2005). The apparent inconclusiveness of the literature on growth and defence spending motivated economists to examine the spatial distribution of defence spending and its impact on the spatial, or regional, distribution of economic activities in a nation (see Atkinson, 1993). In the context of the United States, it is well recognised that the defence buildup of the 1970s and 1980s had a 'distinct spatial pattern benefiting some areas of the country while hurting others (Atkinson, 1993, p. 7). Economists have isolated three components of defence spending, which have serious regional implications. The first component of defence spending is the personnel expenditure that significantly impinges on the spatial distribution of (un)employment in the national economy, the second one is the operational spending (expenditure on defence bases and contracts, and investment and infrastructure expenditure) that drives the distribution of economic activities and the third one is the defence spending on research and development (R&D hereafter). The second and third components are shown to influence the regional distribution of public infrastructure and drive the mobility of private capital, which together unleashes the much-celebrated agglomeration process to build the production network of a regional economy. We

now look at the specific experiences of some nations in terms of the spatial consequences of their defence spending.

In the United States, the military's presence in the Tenth Federal Reserve District (Reserve District, hereafter) has been an important part of the American history. The most unique defence institutions in the Reserve District are part of the US Department of Energy that includes the Los Alamos and Sandia National Laboratories in northern New Mexico, which ensure the safety and reliability of the US nuclear weapons stockpile and undertake research on national security issues. It is important to note that Department of Defence contracts are relatively less important in the Reserve District than in the nation. However, the mammoth presence of a number of private defence contractors like the Boeing Company is believed to have more than compensated the lack of defence contracts in the region. The Reserve District is home to a disproportionately large number of national guardsmen and reservists, individuals who have played an increasingly important role in national defence in recent years. In the Reserve District, it has been firmly established that certain types of defence spending do boost the regional economy: investment type of spending like R&D and equipment procurement are a consistent source of regional economic growth (Mehay & Solnick, 1990), while spending on personnel and service contracts (operations-type spending) have positive impacts on regional employment.

The Reserve District is known to have significant concentration of defence spending: in 2006, defence spending accounted for an estimated 6% of overall GDP in the Reserve District – about 25% larger than the US average. The district state with the largest defence presence is New Mexico, where an estimated 11% of economic output is accounted for defence-related activities. The region also has a sizable presence in 'other defence expenditures', which are largely personnel or base related. The Reserve District is home to a sizable number of military installations, some of which are among the largest in the country. The overall picture is that the concentration of defence investment spending and private defence contractors have aided the Reserve District to maintain its strong economic growth, while the spatial concentration of operations-type defence spending has given stability to regional labour markets. The strong regional growth and buoyant labour markets are a source of regional disparity in favour of the Reserve District in the United States.

The Swiss experience of spatial consequences of defence spending has been examined by Bernauer, Koubi, and Ernst (2009). The results are instructive: for instance, the canton of Uri attracts 3% of the total

ArmaSuisse defence spending in Switzerland. In per capita terms this translates into a share of 640% above the average cantonal allocation. The canton of Bern, to take another example, receives 35% of ArmaSuisse spending, whereas its share relative to the national average is 276%. The distribution of defence spending across cantons has significantly impacted on the regional labour markets by stabilising unemployment at lower rates. Since the economic growth depends on a host of factors, other than defence spending, the distribution of defence spending has not contributed to the dispersion of cantonal growth rates; however, the authors recommend a further and more careful study.

Some European case studies have also highlighted the role of defence spending in boosting regional economies with strong spatial consequences. For example, Bishop (1992) studied the spatial, or regional, economic impact of a major dockyard and naval base in the counties of Devon and Cornwall in the United Kingdom. He observed that out of the 29,900 jobs that were supported directly or indirectly by the dockyard complex, 6,900 jobs directly depended on local expenditure by base and dockyard facility employees. The Devonport Complex was estimated to generate about 5% of annual total income in the sub-region. If the dockyard were closed, it was estimated that the sub-region would lose 3.7% of its income and 22,600 jobs. The regional unemployment rate will increase to 20% in that case.

Battistelli (1991) considered defence-dependent occupational groups in the Rome region in Italy in 1987. He identified 52 defence companies in the region, employing about 12,000 workers with a further 2,000 jobs in sub-contracting. He estimated that these defence-dependent jobs amounted to around 8% of all industrial employment in the Rome region. Huck (1991) studied the impact of defence spending on employment in the region of Munich (Germany) in 1986. He found that 8% of manufacturing employment and 11% of metalworking employment were directly dependent on defence spending.

In this chapter, we posit that defence spending is like a local public good that impacts on a regional, or local, economy. To be more specific, our model suggests that defence spending offers public infrastructure to a regional economy that, in turn, impinges on the costs of production of local firms, which thereby influence the competitive positioning of the regional economy in the national, or global, market. The goal of the current work is to explore how the politics of allocation of defence spending can create an equilibrium regional inequality within a nation, which may in turn drive internal conflicts. Since an allocation of defence spending impacts on regional inequality, the latter becomes endogenous in our model. We

establish an equilibrium inequality in our model that depends on the optimal allocation of defence spending across regions, which is driven by the electoral motive of an incumbent government.

Conflict models are usually cast as general equilibrium models with presumed perfectly competitive markets that involve a trade-off between economic, or productive activity, and unproductive activity entailing conflicts. This is the much-famed trade-off involving 'guns and butter' of economics.[1] The important work of Grossman (1991, 1998, 2004) further expanded the basic Hirshleifer model of optimal defence spending to more intricate situations. Conflicts are a product of rebellion that is akin to an industry that creates profit-making opportunities from an act of piracy or looting. The optimal defence spending of a nation is a Nash equilibrium of a non-cooperative game played out between a government and a rebel group. Skaperdas (1992) introduced the possibility of cooperation, as opposed to conflict, in a game that repeats over time. Garfinkel (1994) extended the analysis to the international arena by introducing domestic politics as a determinant of defence spending of a nation.[2] Against the backdrop of this strand of economic theory, political scientists traditionally argue that conflicts and rebellions are actuated by political protests that are driven by deep-rooted *grievances* of people. The grievances are precipitated by a host of social banes like inequality and racial, ethnic or religious intolerances.[3] The political science literature has highlighted two elements in exacerbating conflicts: first, the type of political regime has been isolated as a determinant of conflicts (see Hegre, Ellingsen, Gates, & Petter Gleditsch, 2001). There is some evidence to believe that more democratic countries have a lower risk of war (see Collier & Hoeffler, 1998, 2002a, 2002b). Secondly, economic inequality is believed to be an important determinant of intranational conflicts, though recent economic studies have not found any systematic relationship between inequality and conflicts (see Collier & Hoeffler, 2002b). However, in an important study, Collier and Hoeffler noted that low per capita income and low growth rates are contributing factors to conflicts. Our proposed model is therefore important in examining regional inequality and regional growth rates (or a lack of them), which can trigger and fuel intranational conflicts.

Let us now look for a niche for the economic model that we offer in Chapter 4: there is no doubt that we have excellent theoretical models that can explain an equilibrium defence spending in a competitive framework involving a group of rival nations. However, there is no further examination of the impact of defence spending on the economy and its constituent parts, since the only assumed role of defence spending is to extend the conflict

technology of a nation as per the Hirshleifer-type model. Our model starts where the Hirshleifer-type model left in explaining an optimal defence allocation: we explore the spatial component of the defence spending, which has not been examined in the literature prior to our modelling. In order to model the spatial aspects of defence spending, the simplified story of our model subsumes the following: we examine government, or public, policy seeking an allocation of defence spending between two different regions or locations. We postulate that defence spending brings a host of local public goods to the regional economy like roads, electricity, water supply and security to life and property. It is argued that the location of defence spending will therefore determine the short-run cost functions of firms in these locations where defence spending gets concentrated. These costs of production will, in turn, determine the nature of competition in the product market. As a result, government policy will endogenously determine the degree, or nature, of competition in the product market, which will determine the profitability of firms located in different regions. Thus, an allocation of defence spending also enables us to analyse the political cost: promotion of an industrial location/regions is an implicit taxation of firms in the other location/region. As the government increases defence spending in a location, voters from this constituency increase their political support for the incumbent government, whilst the government loses votes from the other location. An allocation of defence spending thus influences voters' evaluation of the government and this evaluation constrains government policy on allocation of defence spending that, in turn, impinges on voters' evaluation.

In Chapter 5 entitled 'Regional Integration, Development and Peace Process', we examine one of the most important features of conflicts, that is the regionalisation of conflicts in specific locations of our globe. Only in recent years, the geography of conflicts has seemingly become an important concern for lasting global peace. There are some issues of peace and conflicts that are independent of time and space while some are peculiarly local. Let us have a cursory glance at some of the more important issues. In his seminal work, John Maynard Keynes effectively highlighted the following factors for initiating a peace process regardless of time and geography:

1. During wars and economic crisis, political decisions modify the course of history.
2. Scientific knowledge of the economy can help modify our collective history.
3. Peace is ultimately a pre-condition for economic development.

4. Lasting peace is feasible if and only if peace treaties are fair.
5. Otherwise, peace will be replaced by renewed and armed conflicts.

To create the peace dividend by improving the economic situation, Keynes recommended reduced military spending along with arms limitations (see Keynes, 1921). Keynes dichotomised time into the short run and long run. In the short run, military spending will create its usual multiplier dynamics to give a boost to the regional economy and thus be a great economic asset. The same asset turns into a liability in the long run, since the military spending imposes a burden on the society because the spending is treated by Keynes as unproductive. Armament has a huge opportunity cost in the long run. Keynes believed security is delicately predicated on economic strengths for two sets of reasons that drove the research agenda of Chapter 5 of this book:

- A lack of economic strengths and consequent crises can lead to the downfall of democracies.
- Poor economic conditions invite the threat of outsiders to rule; in the Keynesian thoughts economic crisis can only invite communism to capitalist systems.

Thus, one of the major deterrence for peace and disarmament is economic sluggishness of various nations and regions within a nation. The Keynesian recipe for lasting peace and disarmament calls forth an international economic forum and solidarity and harmonisation of national and international economic interests. Our findings in this chapter are very significant for re-establishing the initial intuitions, ideas and ideologies of Keynes: the issue of international security must be multilateral and ought to be shared. How to pave the way for disarmament and peace? The Keynesian proposal is highly valuable for the modern world and akin to our theoretical model:

- In 1929, Keynes called for extensive financial support to establish a society of nations.
- Membership in this society should be limited to peaceful states.
- The society should be granted relevant powers to institute a penalty mechanism for non-peaceful states.
- In 1937, he recommended economic sanctions against Italy and Japan.
- In 1938, he asked for a European defence and conflict prevention pact, in essence a bloc of countries forming a military coalition, or alliance as in our theoretical model.

The most powerful observation of Keynes is the potential role of prisoners' dilemma setting the forces for an over-arming by individual nations, since each individual decision is correctly based on individual rationality, which unfortunately brings the collective disaster of an excessively armed world. The over-arming only hurts us by reducing our economic well-being, which clears the way for a violent conflict. How do we get out of this collective mess? Keynes suggested the role of negotiation, arbitration, and coalition formation and application of moral ethics and penalty mechanism to break the tyranny of the prisoners' dilemma – a strategic concept unknown to Keynes.

In the current chapter, the research will examine the theoretical issues concerning foreign direct investment (FDI) and how to achieve Pareto-improving economic integration (or what we choose to call 'win–win economic integration') with entry of foreign firms into a regional economy. Here, our focus will be on engineering economic integration by a national, or regional, authority by initiating privatisation of state enterprises. By the construction of the problem, the bidding firm is a foreign firm and we thereby highlight the roles that foreign firms play in creating linkages in regional economies, which gradually unleash the forces of economic integration in a region. This process of economic integration is closely associated with the globalisation of the world economy, which has significantly affected the regional economies like the Arab world.

In Chapter 6 entitled 'Snares and Quicksand on the Pathway to Peace: Role of International Tension in Local Conflicts', we examine a very major issue along the pathway to peace in our modern globe. The fundamental idea that we seek to establish in this chapter is that the establishment of regional, or local, peace calls forth global peace. In other words, our argument is that local and regional conflicts are partly driven by global factors, especially what is commonly known as international tension. In order to achieve meaningful and sustained peace, there is a reason to believe that it is mandatory to manage and contain international tensions. The main thesis of this chapter is to explain, or posit, conflicts as a product of continuing international chasms, splits and differences of political and social ideologies in our modern world. Thus, we argue that conflicts are, to some extent, driven by international tension, or global, ideological and geo-political factors. Notwithstanding the global influence, local factors – such as income inequality, income growth or lack of it, political institutions – can and do exacerbate conflicts and a peaceful resolution of conflicts becomes a difficult phenomenon.

In order to drive the point home, we will start our discussion with a detailed glimpse at the great global conflicts. Our main argument is that

our current conflicts still have some roots of global origin, which is a product of what is known as international tension. In this chapter, we will offer comprehensive models to capture the feedback between local factors and international tension, which can explain various subtle and intertemporal dynamics involving conflicts, violence and terrorist activities. The idea of ideological chasms and international/global tension is not new: Rattinger (1975) introduced an idea of international tension into the basic Richardson-type model. International tension was quantified in terms of verbal statements made by the nations embroiled in a conflictual situation. In an interesting work on Iraq–Iran conflict, Abolfathi (1978) introduced the US–Soviet Union world rivalry as an explanatory variable. In a differential game, international tension, as measured by the sum of military expenditure, has also been modelled by Zinnes, Gillespie, Schrodt, Tahim, and Rubinson (1978) to explain arms race. Our model differs significantly from these models as we focus on actual conflicts and not just arms race. It is also important to note that we will derive an endogenous measure/index of international tension-driven conflict, instead of an exogenous measure of international tension. As a result, our model and its empirical questions and findings are significantly different from the early attempts.

In Chapter 7 entitled 'Food Entitlements, Public Policy and Conflicts in Backward Societies', we argue that violent conflicts have a regional concentration since the late 1980s. Most of these regions that now experience continuing and violent conflicts are the poorer regions of our globe. At the same time, one witnesses unprecedented increases in food prices during 2006–2008. Prices of some food grains have more than doubled in two years. For the first time in several decades, violent riots spread from country to country: violent protests erupted in Senegal and Mauritania late last year. Indian protesters set ablaze hundreds of food-ration stores in West Bengal in October 2007. Rioters wrecked havoc through three cities in the West African nation of Burkina Faso in 2008, burning government buildings and looting stores. In 2008 in Cameroon, a taxi drivers' strike over fuel prices escalated into a massive protest against food prices, leaving around 20 people dead. Similar riots took place in Mexico and Pakistan. Food riots were controlled by armed forces in several of these nations. National governments are seemingly unable to crush the source of the problem, which is a mismatch between current demand for food and the current supply of food in the global and regional markets. The chapter examines the regional food market in the context of a developing nation to articulate how conflicts, food shortages and food speculation are

intricately associated to drive the poorer regions of our globe towards a precariously unstable and volatile situation.

The chapter constructively argues that the global picture of peace and conflicts hides some important changes in the pattern of conflicts and also its ferocity due to many global and regional factors. In other words, the picture is misleading if one tends to assume that the intensity, ferocity and incidence of conflicts have been showing disappearing tricks. On the contrary, we posit that the nature of conflicts has changed and so its location. Now let us have a cursory look at the regions of violent conflicts in our contemporary world and their relationship with the availability and distribution of foods: according to the 2006 Global Hunger Index of the International Food Policy Research Institute (IFPRI), of the 12 countries with the highest levels of hunger, 9 were affected by civil wars and costly and violent conflicts. The 10 countries that scored the worst are all in sub-Saharan Africa, but South Asia is also a hotspot of conflicts, hunger and malnutrition. The latest hunger index ranks 97 developing countries and 22 countries in transition; the data is not available for three nations: Afghanistan, Iraq and Somalia where violent conflicts have reached unprecedented and unfathomable depths. The index indicates that scores have improved in South Asia and in most other parts of Asia since 1981, though many countries in this region suffer from high levels of hunger. Several countries, such as Botswana and Namibia, do worse than expected on the index, relative to their level of development, or gross national income per capita. High income inequality is one of the major factors that push these countries towards high levels of hunger and malnutrition.

As a result, the major exception and continuing source of conflicts has been sub-Saharan Africa whose growth of real GDP per capita adjusted for PPP halved from the 1980s to the 1990s. A recovery since 2000 has started, which can reverse the trend in violent conflicts. The region is also known to have serious problems with fragile availability of foods and hunger. However, there are a host of other problems in these regions. According to the World Bank's World Development Indicators of 2005, the number of people living in extreme poverty (at less than $1 a day) doubled in sub-Saharan Africa from 1981 to 2001. Since the end of the 1980s, 80% of the world's 20 poorest countries (many in the sub-Saharan region) have suffered from a major war. Military expenditure as a proportion of GDP and the number of soldiers per 1,000 people changed little. Battle-deaths actually fell in sub-Saharan Africa through the 1990s (apart from an all-time high spike from 1998 to 2000 due to the Eritrean war). However, war-deaths in this region have vastly exceeded battle-deaths due to indirect deaths. Compared

with the wars from the 1950s to the 1970s, most of the recent conflicts are between badly equipped government troops and lightly armed, untrained rebel forces in poor countries. Most of these violent conflicts have been set in remote rural areas, where national governments have limited presence and where insurgent groups can find easier hideouts.

We model the equilibrium outcome of the food market in which the farmer–traders strategically hold stocks to distort market prices in their favour, while the government manipulates its own stocks and imports to keep the food price close to the 'desired level'. The equilibrium is characterised as a perfect Nash equilibrium of the proposed sequential game.

- This chapter establishes that such a market will be characterised by one of the four possibilities: in Case 1, there exist two equilibria – low-speculation and high-speculation equilibria. The low-speculation equilibrium is unstable while the high-speculation equilibrium is stable.
- Thus, the government can only goad the market to the high-speculation equilibrium. Also note that there is nothing sacrosanct about the stability of the high-speculation equilibrium, since it depends on the relative steepness of the slopes of the reaction functions.
- In Case 2, the possibility of a unique and stable equilibrium is the best that the government can aspire to achieve. Case 3 highlights the possibility and consequent instability of the non-existence of a pure-strategy equilibrium. Case 4 highlights the possibility of three equilibria – two stable equilibria separated by an unstable one. In this case, any momentary deviation of speculation beyond the critical level will have a lasting impact on the food prices, the levels of speculation and the economy.
- Government mismanagement will also have similar deleterious long-run impact on the market and the economy. This chapter also establishes that the selection of equilibrium in such markets is hinged either on the expectations or on the history. The government plays a crucial role in stabilising volatile expectations and burst of speculative activities through its hoarding and dishoarding of food.

In Chapter 8 entitled 'Costly Peace: A Study of the Dynamics of Negotiations for Peace and Disarmament', we turn our attention to the economics of negotiations of peace. The main thesis of the chapter is to introduce a new idea to the field of peace negotiations, which will require the development of a new model of negotiations to enforce peace. The existing models of peace negotiations highlight the existence of a positive peace dividend to parties involved in conflicts and peace negotiation. They, hence, usually highlight a gradual and dynamic adjustment, or movement, away

from a conflict-ridden outcome towards a peaceful outcome that offers a positive peace dividend to all relevant stakeholders. In comparison with the status quo, peace brings additional economic returns and therefore offers a win–win situation. Despite the fact that a win–win situation does not ensure the enforcement of peace, as agents can easily get locked into what is commonly known as the prisoners' dilemma, the possibility of Pareto improvement makes negotiations for peace somewhat artificial. At least in the short run, all agents involved in active conflicts are apprehensive of peace, as they expect that immediate (expected) returns from making peace can outweigh the expected returns from conflicts. An important work that sidesteps the win–win situation of peace dividends is by Isard and Azis (1999) who introduced the possibility of an immediate loss of economic returns from the peace process in their conflict management procedure. However, in the existing work on conflict management procedure, the long-run returns from peace outweigh those from conflicts. One therefore presumes that peace brings economic benefits to all. The existing conflict management procedures therefore assume away any possibility of lower economic returns from peace. There are some important models in which peace negotiations are also modelled as a zero-sum game in which the gain of a party represents a loss to others, which is known as win–lose negotiations. In this work, we introduce the possibility of bargaining and negotiations against the backdrop of potential immediate losses while peace is favoured simply for its intrinsic value and not for pecuniary returns. In the real world, there is evidence to believe that agents involved in conflicts are painfully aware of two things: firstly, the decision-making agents who choose between conflicts and peace are the leaders who get rarely affected by economic cost from conflicts or peace. It is usually the foot soldiers who bear the brunt of costly conflicts and can benefit from peace. Secondly, most people value peace for the sake of it, as peace has an intrinsic value that ensures the protection of rights and their lives and protection from violence. Thus, peace is a collective good that provides little extra economic returns to actual decision-makers who choose between courses of conflicts or peace. In this work, we offer a comprehensive treatment of peace as a collective good and thereby explain the negotiation process in which peace does not offer a win–win situation. Our work will lay down the principles and the precise path that can ensure peace among conflicting agents when peace is valued for its own sake and not for extra pecuniary returns for decision-makers. We hence call peace 'costly' peace in this chapter. The relevant question for us is how we can ensure the establishment of costly peace to protect property rights and lives of humans by a clever choice of suitable economic governance.

NOTES

1. Hirshleifer (1988, 1989, 1995b, 2000) put forward several models to explain conflicts in terms of three economic variables: (1) preferences, (2) opportunities within constraints and (3) prevailing perceptions. Hirshleifer explained an equilibrium conflict as a Nash equilibrium of the proposed contest such that efforts (guns) and the corresponding levels of defence spending are chosen by rivals as the mutual-best responses.

2. The famous result in a two-period model shows that electoral uncertainty in democracies can reduce the severity of international conflicts by inducing competing nations to reduce their defence spending as an equilibrium phenomenon. The negative impact of democracies on defence spending derives from the probability that the incumbent government will not be re-elected, which induces the incumbent governments to commit less on military spending.

3. The exploitation of one group by another has also received a serious attention from Hirshleifer (2000) who calls this proclivity of human beings to form a gang upon others as the Machiavelli's theorem that can shape preferences and stir up grievances and exaggerate opportunities from conflicts.

CHAPTER 1

A STUDY OF ENDOGENOUS FRAGMENTATION OF STATES AS DETERRENCE TO PEACE

1.1. INTRODUCTION

In this chapter, we attempt to explain the role of *fragmented* states in the war and peace in our modern society. In other words, we like to provide a new foundation to what is commonly known as intrastate conflicts. The fragmentation of a nation state connotes the following three common elements, which can often lead to what is usually termed as a 'failed state':

- At the local, regional or national level there appear powerful economic leaders or political actors, who wield significant control or power over specific groups of people based on their ethnicity or economic or political social backgrounds,
- Group members offer economic and political allegiance to these leaders and offer political support to their local leaders at the expense of the national interests, a relationship similar to that of patron–client develops,
- The leaders choose open or tacit, confrontation of violent nature with the state or other groups. They pursue narrow and sectarian interests by applying political and economic pressures on the nation state and other groups. Intrastate conflict and inter-group rivalry are characterised by mutual violence of these groups against each other or against the state.

The fragmentation can either lead to an all-out civil war as in Sri Lanka or a frozen conflict as in Georgia. One of the main characteristics of fragmentation is the control of group members by their respective leaders. The chapter applies standard models of non-cooperative game theory to explain the endogenous fragmentation, which seeks to model the equilibrium formation of rival groups. Citizens become members of these rival groups and some sort of clientelism develops in which political leaders control their

respective fragments of citizens. Once the divisions are created, the inter-group rivalry can trigger violent conflicts that may seriously damage the social fabric of a nation and threaten the prospect of peace for the people for a very long time. In other words, our main goal in this chapter is to understand the formation of the patron–client relationship or what is called clientelisation.

In order to motivate the discussion, it is imperative to clearly define a nation state first and explain the precise import of its fragmentation. To a student of politics, a state typifies as the 'Westphalian state', or the 'modern state,' or the 'sovereign territorial state'. In 1648 the Treaty of Westphalia in the North-Eastern Prussia marked an important step in the formation of states as the Treaty was a collective accord of a group of European *polities* to mutually respect each other's geographical territory and boundaries. The sociological definition of a state is important for our study as Max Weber highlighted:

> A state is a human community that claims the monopoly of the legitimate use of physical force within a given territory, where the dominated must obey the authority claimed by the powers that be. (see Brown, 2000, p. 147)

The definition poses a number of important contestable issues in the context of our time:

- A state's foundation is based on an authority,
- The authority of a state must be legitimate,
- The legitimacy of a state is rooted to the recognition and acceptance of its authority and concomitant power by the people within the state as well as outsiders,
- A state can make its people obey its laws by using physical force and a state can prevent outsiders from harming insiders by the use of the same physical force,
- A state has therefore a responsibility in raising a military and law enforcement mechanism as a means for using a physical force,
- In order to raise the above, a state levies a tax from its citizens,
- With the development of welfare states, it is the role of a state to provide local and global public goods (welfare measures) and protect property rights and enforce contracts and rules of the law.

The above definition is too simplistic for the modern world. It is also important to realise that the definition was found wanting even in the context of the society in the 16th century:

- The first problem is that there may not be a universal acceptance of state's authority within a state. In other words, a state can experience a rivalry between competing centres of authority (see Tilly, 1975),

- Within a state there can arise or persist, other legitimate actors of violence, like religious groups, royal families and organised groups like the former East India Company in England (see Thomson, 1994),
- The role of state and the sphere of a society become overlapped and at best fuzzy and can be seriously confronting for many sub-groups within a nation,
- The most burning and important issue is that a modern state today has various constituents who feel a victim to a historical accident of a state formation. A classic example can be learned from most African nations where a state was formed by the European colonisers. After several centuries, a typical African state today has constituents and groups who cannot come to an agreement about the legitimacy and university of the state power.

In this context, the fragmentation of a state means a virtual break-up of a state in different splinters, islands or archipelagos in which each group engages in active rivalry over others for the control of power and economic resources. Such fragmentation can be a minor one like a break-up of a society into diverse interest groups and lobbyists. Such fragmentation can take a deeper meaning when powerful lobbies engage in violent confrontation like gang wars. The most serious form of fragmentation takes place when different groups engage in violent civil wars as in Georgia, as we will examine later. What is important for us is to understand that the fragmentation of a state can pose a serious threat to a society. It can give rise to violent conflicts that may have self-perpetuating properties.

Let us further examine the important issue of fragmentation in a greater detail at this stage. It is by its nature that any state is pluralistic and does not imply a unitary institution. Every state can be 'disaggregated' in terms of its constitutive elements and various accompanying formal and informal institutions. These various constituting components or group, are typically understood as distinct political actors who have diversity of goals and interests. A state is not fragmented when these separate political actors can mediate through the political system to resolve their conflicts of interests within the precinct of the ground rules defined by their relevant constitutions. It is also important to note that these constituent elements are driven by a common *spirit* of nationhood, which is part of a national psychological make-up and the social mindset. Thus, the state becomes fragmented as different groups choose unconstitutional and violent means to settle their differences or pursue their self-interest and at the same time lack a nationalistic spirit.

The issue of fragmentation becomes important in what is known as hybrid regimes (see Zinecker, 2007). The literature on war and peace has made a simple classification of the political system, it is either a democratic

system or it is an autocratic system. Based on this simple dichotomy, the literature applies a powerful economic logic to establish why democracies promote peace and autocracies may promote violence. Since a democratically elected leader has a finite tenure in the office, the *cost* of violence outweighs the short-run *benefits* from violence at the margin and hence democracies have a lower incentive to engage in violence within or between democracies. On the other hand, autocracies can continue indefinitely and they have a greater incentive to engage in violent conflicts as the benefits from violence can outweigh the associated cost at the margin.

As a result, as we will examine soon, political scientists have strongly recommended to relevant decision-makers that democratisation is a pathway to peace. However, this simplistic view does not take into account myriads of political states between a democracy and an autocracy, which have come to be commonly called as hybrid regimes. These hybrid regimes can give rise to serious fragmentation and costly conflicts. In hybrid regimes, both elements of democracies and autocracies coexist together, especially in the context of developing nations. It is a *multi-layer system* that has various elements that are characteristic features of democracy, autocracy or completely independent (see the pioneering work of Rub, 2002; Karl, 1995), which can engender serious and violent conflicts in such societies. Let us set aside the hybridity of a political regime and examine some of the arguments linking democracy with peace.

It is widely held in the literature on the peace science that democracy is a collective good for achieving peace. The departure from a democratic system, like an authoritarian regime, is believed to be a sub-optimal political arrangement while democratisation is widely held as a positive development towards peace and prosperity. Democratisation has come to be viewed as a Pareto improvement, which is a harbinger of win–win situation for an autocracy. In 2006 there were 49 countries under autocratic rule and their combined population is 2.2 billion, which is about 35% of the global population (see World Bank, 2008). This simple observation is important in the context of the emerging literature that argues that political regimes do matter in achieving peace.

The political science literature has also highlighted two elements that critically exacerbate conflicts and thereby defy peace: first, the type of political regime has been isolated as a determinant of conflicts (see Hegre et al., 2001a). There is strong empirical evidence to believe that more democratic countries have a lower risk of interstate war (see Collier & Hoeffler, 1998, 2002a). Secondly, economic inequality is believed to be an important determinant of conflicts, though recent economic studies have not found any systematic

relationship between inequality and conflicts (see Collier & Hoeffler, 2002a). In their study, Collier and Hoeffler noted low per capita incomes and low growth rates are contributing factors to conflicts. If a departure from democracy enhances the likelihood of conflict, from the above global picture one can deduce that for at least 2.2 billion people the possibility of peace will depend on their prevailing political regimes and forces of democratisation. This forces us to raise the question in an unclear term.

What is the interrelationship between democracy, economy and peace? The field is extremely complex:

- First and foremost, a vast literature has examined the effects of economic growth, national income, on the act of democratisation. At the core of the literature is the *modernisation hypothesis* that argues that democracy arises only with economic development. Thus, economic development acts as a harbinger of peace.
- Thus the modernisation hypothesis presumes that higher incomes and long-term growth will increase the likelihood of democratisation that will pave the way for the establishment of peace within a society and between countries. Thus, a change in political regimes is rooted in the economic factors, mainly the long-run growth in GDP.
- At the same time authors have argued that growth slowdowns in the short run can act as a precipitating factor for regime changes. In rational voter models of democracies, voters believe that economic growth is a function of both good governance (competence) and exogenous shocks (good luck). If citizen voters do not directly observe luck and competence, then they use economic growth as a signal of competence of a political regime. As a result, their support for a political regime is predicated on the short-run economic growth. In such models, growth slowdowns can trigger a regime change.
- It is also widely held that non-democracies have a clientelistic nature and these regimes survive by creating and offering economic rents to important factions/clients of the incumbent governments. In good times, the autocratic regime can overcome democratic pressures and will succumb to such pressures in bad times. The argument is simple as authoritarian governments are expected lose their power to satisfy different clienteles with diverse goals when economic growth slows down.
- In many work economic crises create a window of opportunity for the proponents of democracy to resist and defeat the incumbent authoritarian regimes. This works as an economic crisis reduces the opportunity cost of resistance, as citizens have nothing to lose from resistance.

In face of increased revolution and possibility of violence, autocratic governments allow democratisation as a means to stop impending revolution.
- However, the above argument is not wholly correct as increased economic growth can create greater political instability that can trigger democratisation and regime changes.

An important issue in the study of the economics of peace seeks to examine how participatory democracy influences the efficiency and the equity associated with the utilisation of economic resources. The main research agenda begs a question of whether and to what extent democratisation helps to allocate economic resources by serving the interests of the majority of voters. The issue is at best complex as there are mutually opposing views:

- It is widely recognised that democratisation can promote the welfare of the majority by enhancing flows of information between citizens and policy-makers and by increasing the accountability of policy-makers to citizen voters.
- On the other hand, it has been widely held that democratisation can adversely impinge on the welfare of the majority by triggering and increasing unproductive rent-seeking activities in a democracy.
- Early empirical evidence on the welfare effects of democracy and democratisation has been primarily at the cross-national level and have focused on GNP growth as the outcome of interest (Barro, 1996; Minier, 1998). The results have been ambiguous, and suffered from a myriad of problems with regard to interpretation of national-level data. It also offered little explanation of the mechanisms by which democratisation affects the policy choices that, in turn, impinge on economic performance.
- It is also widely believed that the capture of public policies by interest groups can thwart the efficacy and the equity of the allocation of resources.

1.2. ECONOMICS AND POLITICS OF MARGINALISATION AND CLIENTELISATION: SOME EXAMPLES

Let us take a close look at the European experience to understand a few features of mild forms of marginalisation of outsiders and clientelisation of insiders in the context of the European labour markets, which seems to have

given rise to 'Euro and welfare *sclerosis*' leading to a great chasm between people. This mild form of clientelism is widely recognised to be menace for the economy in many European nations. It is the shared contemporary history of persistent and ethnic-based mass unemployment in nearly all European welfare states that created a concern about the causes and consequences of marginalisation and clientelisation of people that can have far-reaching ramifications for social cohesion, peace and prosperity in Europe.

There is a view currently gathering momentum that the welfare state is incapable of preventing the split of a European society by eradicating persistent unemployment of specific ethnic groups of people. These developments in the labour market are considered as potent threats to welfarism in Europe:

- Persistence of high unemployment leads to social marginalisation, creation and exclusion of an underclass with a distinct ethnic branding in many European nations. These people rely on the welfare policies of states for survival and do low-paid menial jobs and live at the outskirt/ margin of the opulent European societies. Most of often than not, these are the new emigrants or refugees, from the old colonised nations of the specific European states, an example will be the Algerian people in Paris.
- There is also a clear trend in the early exit and/or early retirement of workers, which creates a pool of new outsiders and also undermines the economic capacity of a welfare state in offering the safety net for all.
- The presence of strong labour unions further the inequality, chasms and divisions between insiders (those who have stable jobs) and outsiders (those who don't have such jobs) tend to generate new cleavages that seems to threaten the legitimacy of the welfare state even in Europe. The apparent seriousness of the social exclusion problems has triggered several important studies in the European context as it is widely held that many European nations are plagued with a sort of *welfare sclerosis* that can threaten its integrity and continuity in the modern time. The spontaneous riots on the streets of Paris are a grim reminder to the potential dangers of *welfare sclerosis*.

It is only recently European social thinkers have placed an overt emphasis on marginalisation as a multidimensional problem and came to address various forms of marginalisation of people in the embedded system of clientelisation. We now know that Europe has various types of group-based marginalisation like labour market marginalisation, economic marginalisation,

social marginalisation and political marginalisation. It is only recently we are able to detect possible and complex interrelationships between these dimensions. It is widely recognised that one type of marginalisation does not automatically cause another. However, the continuing cleavages between social groups in Europe have highlighted the fundamental importance of eradicating and minimising social and political marginalisation of social groups and clientelisation of social groups, which seems to develop its own dynamics, violent characters and persistence beyond recognition.

On the policy ground, it is necessary to recognise the problem of marginalisation and clientelisation. This field of research is still evolving since there is a veil of ignorance as to whether the European institutions of welfare states are robust enough to respond to the consequences of grave social, economic and ethnic changes. It is also uncertain if the European welfarism will change itself due to these fundamental changes in group dynamics.

What is the source of social marginalisation and clientelism in Europe? To answer the question let us now give a short shrift through the theory of welfare states in Europe to glean some important lessons from the womb of history. According to Polanyi's language, the 'great transformation' in Europe created and catapulted the need for social protection for the vulnerable. At the heart of this argument lies the problem of commodification of labour that is believed to create insecurity for the masses. Market capitalism, according to Polanyi, cascaded insecurity through a process of separating the economy from society by the commodification of labour. A complete commodification of labour can cause extreme vulnerabilities for the masses and the purpose of European social and welfare policies is to prevent the vulnerable from economic ruins from the vagaries of the market forces/mechanism. Driven by the union movement, welfare and social policies initiated labour market legislation, re-defined factory laws, constituted unemployment insurance as preventive and protective measures to protect workers from the market.

In the classic language of Polanyi, these social and institutional details prevented the complete commodification of labour. Workers became integrated to the relevant society through these social and institutional arrangements (Polanyi, 1944, pp. 175–177). The current storm in the European labour markets with immigrant workers has re-opened the debate on the adequacy and consequences of welfare states in achieving a desirable integration of the workforce within a European society. There seems to be a reason to believe that the new changes in labour markets are a source of splintering of the European society. Esping-Andersen (1990, 1999) builds

further on this idea of social protection Polanyi. We now know from his work:

- Welfare regimes are a direct consequence of the development of European capitalism,
- Welfare regimes hence 'denote a degree of decommodification through state action – a measure of protection against total dependence on market forces' (Gough & Wood, 2004, p. 4).

Esping-Andersen's original work (1990) stressed three main patterns or regimes, in the European context, namely a liberal, conservative and social-democratic regime. The liberal regime relies on the market-driven outcomes to provide social welfare. State protection is limited to a selected group who are temporarily in dire needs of help. The conservative position is based on the ideology of a traditional family with a male breadwinner. This male is protected through inclusion in professional networks of solidarity and risk pooling. The social-democratic regime articulates the need for a universalistic approach with the state as the main provider of protection.

1.3. THEORIES OF STATE FRAGMENTATION IN THE DEVELOPING WORLD

This classification of welfare states was drawn in the European context and meant to apply to the European society. This classification of states has been extended to the developing world (see Gough & Wood, 2004). In most developing countries, Polanyi's 'great transformation' did not materialise in the same way as in developed capitalist countries:

- The economy is not completely commodified,
- Labour is not 'free',
- Decommodification is not an issue,
- Security of workers and people is a rampant problem,
- Demand for protection from market and extra-market forces is ubiquitous,
- States with adequate mandate, power and resources to protect poor people are a non-entity,
- Citizens rely on a complex network of institutions and relationships as an insurance mechanism,
- Family and community networks play an important role that leads to clientelisation,

- Gough and Wood (2004) highlighted an informal regime in which insecurity is lessened by informal rights through kinship and/or other social/community relationships. Patron–client relations or clientelisation, develop that allows citizens to exchange short-term security in return for longer-term vulnerability,
- This security regime through clientelisation is believed to cause political instability and chaos in developing nations (Bevan, 2004).

In developing nations non-state and informal relationships are important for the economic well-being of people when the market mechanism falters. However, the interrelationship between formal and informal relationships is highly complex in the developing nations. Informal arrangements are a pre-condition and a base for the formal economy to build upon. As a result, the informal arrangements express themselves in the formal and state intervention, which leads to a complex rivalry and conflict over market spoils in developing nations. Some authors have addressed the rivalry as a rent-seeking activity. For us the presence of informal relationship and the dependence of formal interventions of the informal structure can create a significant fragmentation of the society in a developing nation. These fragments or social and interest groups, can wield significant power to stifle the economy and more importantly can threaten the very existence of the state in some situations.

The issue of state fragmentation has many other ramifications in the developing world:

- The fragmentation of states often leads to weak, failing or collapsed states in the developing world,
- Some of their governments fail in fulfilling the core of state functions,
- Besides providing territorial security the state must have legitimacy from all constituting citizens and enforce the rule of law, and provide the minimal welfare to its citizens.

Many states in the developing nations fail to fulfil the above roles of a nation state, which put increasing pressure on the dismemberment of several of these nations into contesting groups, which create enormous difficulty in peacefully resolving intrastate conflicts.

1.4. CLIENTELISATION, INTER-GROUP RIVALRY AND VIOLENT CONFLICTS

1.4.1. Violence without Civil Wars: Examples from Central America

In Central America Honduras, El Salvador and Guatemala are the countries that experienced high levels of violence over the years. In terms of the same measure Nicaragua and Costa Rica have displayed relatively low levels of violence. Guatemala recorded a highly violent civil war in the 1980s and 1990s. On the 29 December 1996 the civil war between the URNG (a leftist guerrilla organisation) and the authoritarian state came to an end in Guatemala. It was a common expectation that Guatemala will have a chance to prosper in peace. This simple expectation was belied as the country has got engulfed in violent crimes. With the implementation of the peace deal, Guatemala has taken serious measures along the roadmap towards democracy. After 10 years of peace Guatemala is still a violent society: rates of homicide today are higher than the rates during the civil war. During the civil war political violence was the main cause of deaths, and in the peacetime violent crimes became the menace for the citizens of Guatemala.

After El Salvador, Honduras is the country with the highest incidence of violence in Latin America. El Salvador and Honduras have an unenviable record of homicide rates that are seven to five times higher than the global average. In 2006 the homicide rate in Honduras was 43.8 per 100,000 inhabitants. This puts Honduras after El Salvador (56.2 homicide per 100,000 inhabitants), but still in front of Colombia and Guatemala in the Latin American league of violence. El Salvador, Guatemala and Honduras are the violent countries in the region. In the region we also see countries like Costa Rica and Nicaragua, which enjoy a low level of violence.

This high rate refers to a violence which is mostly violent crime. The violent crime has little to do with political violence associated with political conflicts and civil wars. It is important to have the correct perspective here: it is true that in Honduras the welfare measures in terms of poverty index, Gini coefficient and the human development index (HDI) all plummeted since 1970s, which many argue as a cause of violence. However, there are holes in these arguments in explaining violence since Nicaragua is another country from the region, which is as poor with a more skewed distribution of income but with a significantly lower incidence of violence. It is also important to note that the geographic location of violence in Honduras does not take place in the poorest regions.

There are several important arguments for explaining the present high level of violent crimes in Central and Latin America:

- It is a saga that is often related to the momentum of earlier wartime violence,
- Consequences of regime changes, specifically due to sudden transitions into democracy,
- Due to the opportunity for high intensity violence in the post-transition phase,
- Due to the history of persistent economic backwardness, poverty and general inequality of income distribution which cause high levels of violence,
- Lack of a coherent security strategy and policy,
- Poor performance of the police and judiciary systems – a reflection of endemic corruption.

Powerful observations have been made in the context of criminology research that highlights an act of crime as a deviant behaviour in a society with 'conspicuous social structures' in which some people are very rich and others woefully poor. In such systems there are in-built mechanisms or incentive structures, for choosing a deviant behaviour while the security mechanism offers the preventive measure for violent crimes. It is the complex interplay between these two contrasting forces that determines the crime rates and levels of violence in developing nations. Ceteris paribus, if the preventive mechanism develops problems due to corruption, fragmentation and weaknesses of the political regime, the crime rate and violence can reach an extraordinary height in such societies.

1.4.2. On the Formation of Violent Groups and Fragility in Fragmentation: An Example of Maras and Violent Crimes from Guatemala

For many researchers violent crimes are different from violent conflicts between groups. However, they cause the same trauma to victims and a civil society must address the problem of violent crimes. There is some reason to believe that violent crimes are more likely to happen in societies that experienced violent conflicts. Usually, violent crimes cover any act of violence and the statistics on violent crimes are taken from the police record of a nation.

Political violence, on the other hand, causes wars, massacres and genocides that are driven by political motives of the perpetrators. In violent

crimes political motives are usually absent. Yet one can argue that a peaceful society must put a lid on violent crimes. An interesting case from the history is Guatemala that experienced a horrific political violence during the period 1960–1996. Since the establishment of peace between rebels and the state, the political violence has given way to violent crimes. In the post-conflict era, the country still remains one of the most violent states in South America, mainly because of unprecedented violent crimes. In Guatemala violent crimes are intimately associated with the crime gang popularly known as the Maras.

Maras represent various criminal gangs from Guatemala who enjoy their fields of operation spread across many nations like the United States, Canada, El Salvador, Honduras, Mexico, Spain and the list goes on. They also represent a well-organised gang and pose a security problem for the entire region. Some estimates put the membership of the gang above 50,000 who are heavily armed and well-trained militia like agents. It is important to note that 50% of their violent crimes are against rival members and roughly one third against the law enforces. As a result, their violent crimes, in some sense, caricature some form of inter-group or intrastate, conflict. According to government reports Maras are responsible for most of current violence in the post-war society of Guatemala.

But Guatemala has historical roots of the culture of violence even before the onset of the civil war. In the 1970s the culture of violence took an exalted social status, as it was a violent protest against the violent behaviour of the military dictatorship. The rebel group was formed from two distinct types of agents. The first is the group of educated and politically inclined members who wanted to change the existing political regime. The second group came from the gangs of streetfighters. The marriage between these two dissimilar people came to be called the 'warriors' – the only common element between these two distinct groups was their passion for violence.

Around that time, similar formation of violent groups took place in Los Angeles from streetfighters of the Central American origin. In the 1980s the US government expelled many US gang members and deported them back to Guatemala, which gave a further fillip to the acceleration of group formation along the criminal line in Guatemala. Initially, members of the Maras in Guatemala chose a copycat strategy and emulated their gang members from the more glorified part of the world like the streets of LA. To many it appeared as an exported fashion good from LA with distinctive clothing, apparel, body piercing, music, specific lingual expression and body languages. There is a reason to believe that the initial members of the Maras came from single-parent families – mainly families without a father. In the

late 1980s, more and more youth joined the gang both in the United States and in Guatemala due to a bizarre historical reason: due to economic pressure as more and more women participated in the workforce, more and more children were left alone to fend for and protect themselves during daytime. It was partly caused by the relative absence of childcare facilities in the United States and Guatemala and the youth sought safety in numbers. The law enforcement agency came heavily on the Maras, which in turn augmented the solidarity within the Maras.

However, the Maras quickly bifurcated into MS 13 and MS 18 sub-groups and got heavily engaged in intergang conflicts. Since 2002 these rival gangs entered into a pact of mutual tolerance that quickly dissolved into violent warfare between these sub-groups within the Maras. Maras are more like criminal gangs operating in several American and European nations. They expropriate the common people and control the drug trade. They also suffer from irreconcilable differences and mutual hostility between fragments known as MS 13 and MS 18. It is also important to note that these differences are more often than not artificial and minor and vague differences, which still drives their bloody conflicts.

1.4.3. External Intervention in Internal Conflicts and Potential Dangers of Clientelism between External and Internal Players: Some Basic Lessons from the Fragmentation of Yugoslavia

In the context of intrastate conflicts, analysts have usually strained the *Clausewitz* model to argue that political differences, under certain conditions, can lead to violent conflicts. However, there is an alternative and emerging view that posits a reverse causation: conflicts are instrumentally utilised by powerful gangs/groups to advance their political goals. It seems there is sufficient reason to believe that there is an interrelationship between politics and violent conflicts with mutual feedbacks and causation and reverse causation.

The upshot is that the relationship between conflict and politics is highly complex and very fragile that can result in irreversible damages between groups within a nation. As a result, the management of intrastate conflict will need a scalpel and not a hatchet, which has been often tried by the international community in various contexts. It is also important to highlight the need for changing the mindset and allaying the psychological foundation of intrastate conflict. Intrastate conflict represents a tenuous relationship between two or more powerful clans/groups within a nation

and efforts must be made to iron out their differences by non-violent methods. However, we must admit that intrastate conflicts are one of the most difficult areas of conflict negotiation that we will examine in Chapter 8.

It is also important to note that intrastate conflicts have multidimensional political implications. First, as we will establish in Chapter 6 that many intrastate conflicts derive from the ideological and political differences that are driven by multinational and international factors. Therefore, the international community must be extremely careful in forming an opinion about the source of such conflicts. There is an important political interpretation of the ensuing conflict in the context of intrastate conflicts and incorrect understanding can irrevocably complicate the internal scenario with an external intervention. In the context of the post-intervention peace building the international community must adopt a non-partisan stance in building peace. As we will argue in Chapter 8 there are effective economic means to build bridges to create durable peace.

Let us fetch some lessons from the Balkans expedition: in 1999 the United States militarily intervened in the ensuing conflicts in the former state of Yugoslavia. In the US involvement, NATO and other elements of the international community played an integral part. The US involvement started with the 1995 signing of the Dayton Peace Accords for Bosnia. Against the backdrop of the Dayton Peace Accord, an international opinion gradually formed that increasingly relied on a violent intervention from the United States and its allies to manage civil wars and conflicts between powerful ethnic groups in the Balkans. The Balkans became a learning ground for gleaning important lessons for international roles in stopping conflicts by an active military operation by the Western allies.

For centuries the Balkans offered a classic example of fragmentation of people and fragmentation of states, which caused waves of violence. The Balkans also offered important lessons for global diplomacy as the international community also showed divisions along the fragmented lines of the Balkans. The US intervention in the Balkans remained a classic example of benevolent wars to end wars. However, the argument of benevolent war is a dangerous option.

What we suggest here is that a benevolent war by an international community can act as a dangerous precedent since an alliance can be formed between internal and external parties on the basis of incorrect and even manipulated information. The 'war of mass distraction' is a classic example in which interested parties initiated an invasion of Iraq on the basis of inappropriate and partly misleading information.

What we want to purport is that internal conflicts between fragments/ groups can easily get politicised and the international community must act responsibly. The strategy of an international military option on any local conflict is a blunt weapon that creates insurmountable problems by triggering low-intensity terrorism and proxy wars, which can take centuries to get gradually burnt out. It seems an international military intervention can also divide people and trigger counterattacks in the form of low-intensity wars like terrorism.

As a result, it is far more important for the international community to try to resolve the internal conflicts by exerting political pressures and changing the psychological make-up of the people involved in a conflict. Following the sign of the Dayton Accords, the US Army actively started collecting, and analysing information from hundreds of incidents and activities. On the basis of the intelligence report, the subsequent invasion of the former Yugoslavia by the US Air Force was launched. In the context of the ensuing peace process following the air attack, we now know that the interstate conflict is a multidimensional problem with politics, economics, inequality, fractionalisation, envy, group identity, fear psychosis being determinants of such conflicts. The field is therefore rife with dangerous mindgames between groups, which can only be addressed in a prolonged dialogue and not by temporary peace keeping operations by an international or hired, army. Unless the psychological chasms are overcome, the conflict will re-open the moment the international army will leave the deck. We address these major issues in Chapter 6.

1.4.4. Clientelism with Corruption and Violence: Some Other Lessons Case of Georgia

The *Rose Revolution* in Georgia has a very special place in our contemporary history, which shows how peaceful transitions can take place in fragmented nations. It also shows how momentary such transitions can be. This peaceful revolution started in November 2003 and the background to the revolution is important to reiterate:

- In the Georgian national election there appeared a strong evidence of electoral fraud and vote-rigging by powerful clans,
- Unprecedented demonstration took place on the streets demanding the expulsion of the corrupt administration,

- On demand from the masses, a new administration under Mikheil Saakashvili was sworn in, which has been traditionally viewed as a victory for democratisation as democratic consolidation had virtually stopped since 2001.

In order to understand the implications and importance of the Rose Revolution, let us have a cursory look at the events that shaped the history of Georgia:

- Georgia's democratic aspirations and a meaningful transition towards a democratic regime had their roots before its independence,
- The democratic root is enmeshed with parliamentary elections of October 1990 in which the national opposition headed by Zviad Gamsakhurdia was elected,
- However, the initiation was relatively smooth while the journey had been rocky: the first elected president of independent Georgia, Gamsakhurdia, was ousted in a violent coup d'état in January 1992,
- The successor, Shevardnadze, restored and maintained law and order, enforced a security mechanism, and attained political stability,
- The means to achieve the above was to control the violent non-state actors who fragmented the state of Georgia into competing groups,
- The main failure of this new administration to stall or retard a progressive political and cultural fragmentation of the country,
- Shevardnadze violated electoral norms of a democracy and the source of stability of this regime was based on the creation and perfection of clientelistic networks in Georgia,
- As a consequence, rampant corruption and economic backwardness took over the positive developments like political, economic and legal reforms,
- In order to achieve political stability the Shevardnadze administration chose authoritarian measures to feed the clientelistic networks that fuelled corruption and created further splits in the society,
- As a disciplining measure the international donors who called off the financial support packages and programmes in 2003.

The new administration of the Rose Revolution led by Mikheil Saakashvili announced and embraced two strategies to advance the national interests, which are of immense significance in the context of fragmented states. The first strategy is to re-establish the rule of law by fighting corruption tooth and nail. Secondly, it became an immediate task to end fragmentation of Georgia by establishing the territorial integrity of Georgia. The new government made many symbolic gestures and political gimmicks

to make it clear that the territorial integrity is the ultimate goal of the new administration.

Accordingly, new attempts were made to integrate the two breakaway splinters – South Ossetia in the north and Abkhazia in the northwest – to bring the finalisation of the nation building exercise. Since July and August 2004 through to March 2008, many actual and proxy wars have been undertaken to end the fragmentation of the Georgian state. The task of the new administration has been made a Herculean one due to apparent interventions by Russia in some of these contested regions.

An ongoing economic dependency of South Ossetians and Abkhazians on Russia and a 'Russification' of bordering regions of South Ossetians and Abkhazians, and series of violent and open attacks of the Russian army in the region made the region as a hotspot for future violent conflicts. The history of the region has played an important role in fragmenting Georgia. Let us have a cursory look at the most recent history:

- As the last Soviet President Mikhail Gorbachev gradually unveiled the Glasnost plans, towards the end of 1980s, there was already a strong demand for autonomy and self-determination in the region. The Abkhazian and Ossetian nationalists wanted autonomy from the former USSR,
- The independence of Georgia was accompanied with violent conflicts in South Ossetia over independence from Georgia. By the early 1990s the new Administration in Georgia virtually lost sovereignty over the Northern Georgia as on 20 September 1990, South Ossetia declared its independence,
- Both North and South Ossetia sought a separate federation as part of Russia after the end of USSR,
- In the referendum of 1992, a large majority voted in favour of becoming a part of the Russian Federation. The South Ossetian Supreme Council,
- After the autonomous republic of Abkhazia declared independence in July 1992, the demand for secession became intense, while the secessionist and violent conflicts became common in the region until the ceasefire agreement of 14 May 1994,
- On a moderate estimate 250,000 people became refugees in their own country and most of them were ethnic Georgians, it is a chasm between people that will take a while to disappear. On the contrary, there is an unfortunate possibility even a further escalation.

Shevardnadze was not able to prevent the de facto independence of Abkhazia and South Ossetia, yet he played an important role in stopping further fragmentation by limiting the power of the parallel states: he

destroyed the most important 'Zviadist formations'. The armed structures in Ajara were disbanded after the victory over the Abashidze's regime in May 2004. It became an unprecedented law and order issue as massive police operations were mounted to liquidate the Georgian underground forces.

In some sense this is a first step to build nationhood or statehood, by enforcing the power of the state on the people without military challenges from groups of citizens. Yet the common spirit of nationalism remains a difficult task and an elusive hope. Another problem is the weak governance in the context of the armed forces as reflected in a revolt of around 200 troops in 1998 and an uprising of the Guard in Mukhravani in May 2001. Even a more serious problem is with the enforcement of the discipline on the national government to provide local public goods to the citizens, which will be a long way. Therefore, it seems the building of nationhood will take a long time in this fragmented state.

1.5. FORMATION OF CLIENTELISM IN AGRARIAN SOCIETIES: SOME THOUGHTS ON FRAGMENTATION OF STATES IN BACKWARD ECONOMIES

We develop theoretical models to understand the forces that allow a handful of people to control the masses within a group. This is the most abiding feature of intrastate conflict in the modern world, as an example, a few ethnic leaders control the passion and the future of millions of their people.

From time immemorial, down through various phases of history, in rural markets in developing nations the landed aristocracy have wielded a considerable influence on millions of small farmers. Small farmers rely on the aristocracy for both consumption and production loans, which leads to some kind of market fragmentation. This credit market leverage spills easily into product markets where the aristocracy takes on various exploitative roles in order to extort extra rents, both in kind and cash, to force reservation utilities upon small farmers (see Braverman & Stiglitz, 1982; Basu, 1983). This section develops an overtly simple model to capture the relationship between the aristocracy and small farmers in order to understand the full implications of the credit market leverage in deterring entry into product markets.

We examine a simple rural scenario peopled by two distinct types of economic agents. The first one is a landed aristocracy who has a total

control over an input, called *credit*, needed for producing an agricultural
product. The second one is an agent who relies solely on the first agent for
procuring credit for producing an agricultural product. Credit is an essential
ingredient of production for both these agents. That is, both these agents
produce an agricultural product by using credit. The decision-making has a
simple sequence: in the first stage, the second agent secures credit at an
interest rate and both these agents engage in production of the final good,
say corn. In the second stage both these agents sell corn and compete against
each other in the corn market. It is simple to see that the first agent can exert
significant vertical restraints/leverage in the corn market by an appropriate
action in the credit market. This leverage of the first agent will influence
upon the equilibrium prices (and volumes of trade) in credit and corn
markets, which is a form of interlinkages between credit and product
markets (see earlier papers of Bhaduri, 1973; Bardhan & Rudra, 1978;
Braverman & Stiglitz, 1982; Basu, 1983).

The offer of credit to the second agent by the first agent (landed
aristocracy) is akin to the case of fragmented credit market (see Basu & Bell,
1991). The role of credit as the sole input in the agrarian production
function is from Gangopadhyay and Sengupta (1986, 1987). This work is
mainly concerned with the possibility that the first agent can *strategically*
choose the interest rate in the credit market to limit *potential* competition in
the corn market. In an interesting paper Mishra (1994) examines entry issues
in fragmented duopolies. However, the main concern of Mishra's paper is to
examine how and when landlord–creditor (landed aristocracy in our model)
can block entry into the credit market, he did not consider the possibility of
entry into the corn market.

Rural credit and product markets in developing nations often display
interlinkages and fragmentation (see Basu, 1983; Gangopadhyay &
Sengupta, 1987, 1986). Some of these interlinkages cause significant market
distortions (see Braverman & Stiglitz, 1982; Mitra, 1983). Interlinkages have
been shown to bear on both equilibrium prices and volumes of trades. It is
however a moot point if these distortions are always harmful (Braverman &
Stiglitz, 1982; Basu, 1983). Our model is the first one that highlights the
strategic use of credit markets in deterring entry into the retail corn market.

Our model of entry deterrence in the context of rural markets is similar to
the vertical market models in which upstream firms wield natural monopoly
power in the supply of key inputs while downstream firms are competitive in
the supply of the final product. Such an industry is characterised by vertical
integration between 'naturally monopolistic and potentially competitive'
activities. The critical feature of the economy is that the naturally

monopolistic firm of the upstream input market competes with competitive firms in the downstream market for the final products. It has been commonly argued that such monopolistic power of the vertically integrated firm may lead to serious market distortion and consequent marginalisation of the downstream non-integrated firms by the vertically integrated monopolist. However, an important issue in this context is potential competition, which is driven by the entry of new firms in the downstream market. A critical gap in the existing literature on modelling is the neglect of the impact of entry into the retail market on potential competition. Our work can successfully fill this gap in the context of industrial organisation. We endogenise the determination of rural interest rates and optimal extortions to understand the potential competition in the context of a simplified vertical arrangement.

1.6. A STATIC MODEL OF RURAL MARKETS

We call the first agent a *rich farmer* (landed aristocracy) who wields a total control on the availability and pricing of credits – a necessary input for producing corn. The second agent is called a *small farmer* who relies on the rich farmer for credits. Due to the fragmented nature of the credit market, the small farmer obtains credit from the rich farmer for producing the final good corn. We postulate that the corn market has a single final product. Corn is produced by using credit. The rich farmer is akin to an integrated firm, which has a monopolistic control over the supply of credit and competes with the small farmer (downstream firm) in the market for the final product corn.[1] The small farmer behaves competitively in the credit market as he takes the interest rate as a datum. The precise market structure in the corn sector entails a duopoly. We postulate the Cournot type of quantity competition in the corn market while the rich farmer has monopolistic power in the credit market. Production takes place in two discrete stages: in the first stage the key input credit is offered and priced by the rich farmer wherefrom the production decisions are taken by both these agents. The second stage is potentially competitive as these agents engage in the Cournot quantity competition.

1.6.1. The Static Framework

We assume a highly stylised framework that is the bedrock of the modern analysis of the vertical markets (see Vickers, 1995; Armstrong, Cowan, & Vickers, 1994). The rich farmer faces a duopolist in the corn market while he

wields naturally monopolistic power in the credit market. In the first stage or Stage I, rich farmer gives credit to the small farmer at an interest rate. In Stage II both of them will compete as Cournot duopolists in the downstream market to sell corn. If the information is complete in the static market, in the relevant rational expectations equilibrium both these agents correctly predict the Cournot–Nash equilibrium of Stage II and they will seek to maximise their profits in Stage II given the interest rate of Stage I. We need the following preliminary to characterise the market equilibrium:

Definition 1. The production function of agent i, with a quantity of credit K_i, is

$$q_i = \sigma K_i \tag{1a}$$

For simplification we assume, without any loss of analytical bite,

$$\sigma = 1 \tag{1b}$$

Eq. (1a) is a linear version of the production function in Gangopadhyay and Sengupta (1987). The total profit accruing to the rich farmer (Π^m) is composed of net returns from lending (Π_2^m) and net returns from selling corns (Π_1^m) is given as:

$$\Pi^m = \Pi_2^m + \Pi_1^m = (A - w)q_n + (P(Q) - c - w)q_m \tag{1c}$$

where $Q(= q_m + q_n)$ is the market output of corn, q_m the output of the rich farmer and q_n the output of the small farmer. A is the gross interest rate, w the opportunity cost of credits to the rich farmer, c the cost of marketing/trading corn and identical for both agents, $P(Q)$ the inverse market demand.

Definition 2. The profit accruing to the small farmer from the corn market:

$$\Pi^n = (P(Q) - c - A)q_n \tag{2}$$

Assumption 1. We assume the inverse demand function to be linear:

$$P(Q) = a - bQ \tag{3}$$

Based on the above, we derive the Cournot–Nash equilibrium of the duopoly at Stage II.

1.6.1.1. Cournot–Nash Equilibrium of the Duopoly in the Static Corn Market
In Stage II the rich farmer earns Π_1^m from the sales of corn:

$$\Pi_1^m = (P(Q) - c - w)q_m \tag{1a'}$$

Substituting (3) in (1a') and simplification would yield:

$$\Pi_1^m = q_m(a - c - w) - bq_nq_m - bq_m^2 \tag{1b'}$$

Similarly, the profit function of the small farmer is:

$$\Pi^n = (a - c - A)q_n - bq_mq_n - bq_n^2 \tag{2a}$$

Maximising the profit function (1c) yields the reaction function of the rich farmer, which is essentially the first-order condition to maximise (1c) with respect to q_m taking q_n as datum. This would yield,

$$q_m = \left[\frac{a - c - w}{2b} - \left(\frac{q_n}{2}\right)\right] \tag{4a}$$

Similarly from the maximisation of (2a) with respect to q_m we obtain the reaction function of the small farmer as:

$$q_n = \left[\frac{a - c - A}{2b} - \left(\frac{q_m}{2}\right)\right] \tag{4b}$$

The Cournot–Nash equilibrium of the downstream duopoly is determined by the solution to the simultaneous equation system (4a) and (4b). Table 1.1 presents the Cournot–Nash equilibrium.

Eqs. (5a) and (5b) are derived from the solution to the simultaneous equation system (4a) and (4b). We derive Eq. (5c) by adding (5a) and (5b). Substituting (5c) into Eq. (3) we obtain the Cournot–Nash price of the final product as given by Eq. (5d).

We substitute Eqs. (5a) through (5d) into Eq. (1) to yield the maximised profit of the rich farmer as the following:

$$\Pi^m = \left[\frac{(a - c - 2w + A)^2}{9b} + A\frac{(a - c + 3w)}{3b} - \frac{2}{3b}A^2 - \frac{w(a - c + w)}{3b}\right] \tag{6a}$$

The profit accruing to the small farmer, Π^{n*}, from the corn market is:

$$\Pi^{n*} = (P^* - c - A)q^{n*} \tag{6b}$$

Table 1.1.   The Cournot–Nash Equilibrium of the Corn Market (without Entry).

$$q_n^* = \left[\frac{a - c - 2A + w}{3b}\right] \tag{5a}$$

$$q_m^* = \left[\frac{a - c + A - 2w}{3b}\right] \tag{5b}$$

$$Q^* = \left[\frac{2(a - c) - (A + w)}{3b}\right] \tag{5c}$$

$$P^* = \left[\frac{a + 2c + A + w}{3}\right] \tag{5d}$$

Substituting q^{n*} by (5a) and P^* by (5d) into (6b) yields:

$$\Pi^{n*} = \frac{(a - c + w - 2A)^2}{9b} \tag{6c}$$

Eqs. (6a) and (6c) represent the profits of the incumbents/sellers in a static market characterised by fixed number of competitors, stable demand and cost conditions. The excess profits of these incumbents attract new firms in the retail market, which opens up the dynamic issues that we now turn to.

1.7. THREATENED MARKETS OF RURAL OLIGARCHY AND ENDOGENOUS FRAGMENTATION AS STRATEGIES OF ENTRY DETERRENCE

In this section, we concentrate on the corn market. To an outsider, the corn market has two incumbents who are both making profits in excess of normal profits that may attract new firms to sell corns. The concern of this section is to examine entry-deterring strategies that incumbents can adopt.

1.7.1. Post-Entry Competition in the Corn (Retail) Market

Suppose there is a single potential entrant who decides whether to enter the corn market. Let us also assume that E be the entry cost. The game unwinds

in a market in which the demand and cost conditions remain invariant through time. If the potential entrant decides to enter the corn market, there are three competitors in the corn market who engage in quantity competition that leads to the following post-entry market configuration.

Statement 1. The post-entry Cournot–Nash outputs and prices are given by:

$$q^{m**} = \frac{a - c + 2A - 3w}{4b} \tag{7a}$$

$$q^{n**} = \frac{a - c - 2A + w}{4b} \tag{7b}$$

$$q^{e**} = \frac{a - c - 2A + w}{4b} \tag{7c}$$

$$P^{**} = \frac{a + 3c + 2A + w}{4} \tag{7d}$$

$$Q^{**} = \frac{3a - 3c - 2A - w}{4b} \tag{7e}$$

where q^e is the output of the entrant.

Proof. The derivation is exactly similar to that of Section 2.3. Instead of having two sellers and two reaction functions, we now have three sellers and three reaction functions, which form the simultaneous equation system. The solution to the system gives the optimal outputs of the sellers as represented by (7a), (7b) and (7c). The price follows from the demand function (Q.E.D.).

Statement 2. The post-entry profits of the three Cournot competitors are as follows:

$$\Pi^{m**} = n_1 + n_2 A + n_3 A^2 \tag{8a}$$

where

$$n_1 = \left[\frac{(a - c - 2A + w)^2}{16b} - \frac{3w(a - c + w)}{4b} \right], \ldots$$

$$n_2 = \frac{(3a - 3c + 5w)}{4b}, \ldots n_3 = -\frac{3}{4b}$$

$$\Pi^{n**} = s_1 + s_2 A + s_3 A^2 \tag{8b}$$

where

$$s_1 = \frac{(a - c - 2A + w)^2}{16b}, \ldots s_2 = -\frac{a - c + w}{4b}, \ldots s_3 = \frac{1}{4b}$$

$$\Pi^{e**} = \frac{(a - c - 2A + w)^2}{16b} - E \tag{8c}$$

where E is the entry cost of the entrant.

Proof. We get (8a) by substituting (7a)–(7d) into (1). We get (8b) by substituting (7b) and (7d) into (6b). (8c) is arrived at in the same fashion as (8b) (Q.E.D.).

1.7.2. Entry-Preventing Interest Rate

From Eq. (8c) one can argue that the potential entrant will stay away from the corn market if his post-entry profit is below a threshold (usually, infinitesimally close to zero). Given the entry cost, E, the rich farmer can choose interest rate A in such a fashion that the post-entry profit of the potential entrant is negative (or, below the threshold). Thus, entry is forestalled by an interest rate A^* such that

$$\Pi^{e**} = 0 \tag{8d}$$

Substitution of (8c) into (8d) yields the entry-preventing interest rate A^*:

$$A^* = \left[\frac{a - c + w}{2} \right] - 2\{\sqrt{bE}\} \tag{8e}$$

Thus, if the actual interest rate that rich farmer charges to the small farmer is less than equal to A^*, then the potential entrant has an incentive not to enter the corn market. The rationale for this role of interest rate is simple but compelling: the interest rate affects the marginal cost of production of the small farmer and thereby affects the competitive position of the small farmer in the corn market. By lowering the interest rate the rich farmer can transfer profits from the entrant to the small farmer. For a sufficiently low interest rate the small farmer's marginal cost is appropriately low what causes the net profits of a potential entrant infinitesimally close to zero that in turn prevents entry. It is also important to note that the lowering of interest rate lowers the total profits in the corn market and the rich farmer has an incentive to choose A^* (and not less than A^*) to prevent entry. From (8e) one can see that the entry-preventing interest rate (A^*) is positively related to the marginal cost of production in the corn market (c), and negatively to the market buoyancy (a) and the opportunity cost of credits for the rich farmer (w). The entry cost (E) and the entry-preventing interest rate (A^*) bears a positive relationship in equilibrium.

1.7.3. Power and Extortion: Choice of Interest Rate and Entry Prevention

In rural set-ups the landed aristocracy (especially landlords-cum-money lenders) are believed to wield significant market and extra-market powers over labourers and farmers as highlighted in Newbery (1975); Braverman and Srinivasan (1981); Braverman and Stiglitz (1982); Basu (1983); Desai (1984); Rudra (1984). Basu (1986) offers several cases of the *non-dyadic* relation, which in turn explain the existence of extortionate landlords in equilibrium with an exploitative nature of voluntary exchanges between landlords and labourers. In this work we simply posit that the rich farmer, due to his leverage in the credit market, can extort in cash or in kind, some extra rents from the small farmer. From Rudra (1982, pp. 71–72), Bardhan (1984) we know how moneylenders engage in extortions from small farmers because of a lack of accessibility for small farmers to organised credit markets (see Gangopadhyay & Sengupta, 1986, 1987).

Let us label the extortion as M, from (8b) the net profit of the small farmer is

$$\Pi^{n**} = s_1 + s_2 A + s_3 A^2 - M \tag{9a}$$

Observation 1. The rich farmer, by the choice of optimal extortions M^* and interest rates A^*, can reduce financial returns of his competitors to:

$$\Pi^n = s_1 + s_2 A^* + s_3 A^{*2} - M^* = 0 \qquad (9b)$$

$$\Pi^{e**} = \frac{(a - c - 2A^* + w)^2}{16b} - E = 0 \qquad (9c)$$

The story is simple: the rich farmer charges a sufficiently low interest rate A^* to the small farmer order to block entry in to the corn market – as per Eq. (9a). He uses the extortion 'M^*' to appropriate most of the lost profits due to this low interest rate A^* – as per Eq. (9b) (Q.E.D.).

Braverman and Srinivasan (1981), Braverman and Stiglitz (1982) clearly established the role of power (M in our model) in forcing the small farmers and labourers to their reservation utility. Eq. (9b) sets the reservation utility at zero (infinitesimally larger than zero). On the other hand, A^* drives the profits of the potential entrant to zero that render entry an unprofitable option for the potential entrant. The intuition is very simple: the rich farmer chooses a low interest rate A^* to lower the marginal cost of the small farmer that enhances the competitive positioning of the small farmer (captive market) against the potential entrant. By so doing the rich farmer transfers the profits from the entrant (if he decides to enter) to the small farmer. For A^* the net profit of the potential entrant, upon entry, is zero and he therefore stays away from the corn market. This is the entry-preventing role of A^*. The role of the optimal extortion, M^*, is to snatch these extra profits from the small farmer.

Observation 2. If the rich farmer has no concern for potential competition and future (potential) entry the myopically optimal interest rate is A^0 that forecloses the market to the small farmer:

$$A^0 = \frac{(a - c + w)}{2} \qquad (9d)$$

A^0 is the interest rate that maximises the profit of the rich farmer as given by (8a). At A^0 the profit of the small farmer is exactly equal to zero that is his reservation utility and $A^0 > A^*$ (Q.E.D.).

1.7.4. Entry Accommodation and Power to Enforce
the Stackelberg Outcome

The rich farmer enjoys a significant leverage in the corn market by means of his twin instruments of interest rate (A) and extortion (M). In such a scenario, the rich farmer may allow the potential entrant enters the corn market as long as this option generates the optimal size and distribution of profits in the corn market from the point of view of the rich farmer. He has various options: by choosing the interest rate and the extortion, he can force the small farmer exit from the corn market – kind of vertical foreclosure. Alternatively, he can create a *triopoly* by choosing A and M appropriately. In this context the following results are of significance.

Observation 3. If the rich farmer has the choice of forming a duopoly and playing the Cournot–Nash game, it has an incentive-based on his profits solely from the corn market – to form the duopoly with the small farmer than with the new entrant.

Proof. See the appendix.

Observation 4. In case of entry accommodation, the rich farmer can optimally choose A and M to ensure the following:

- The rich farmer's profits are equal to the profits of the leader in the Stackelberg duopoly game of the proposed corn market.
- The small farmer receives the reservation profits, zero.
- The entrant receives the profits of a Stackelberg follower in a duopoly game of the proposed corn market.

Proof. See the appendix.

Since the profits of a Stackelberg leader are larger than the profits of a Cournot–Nash duopolist, we expect Observation 4 to be of significance if the incumbent finds it optimal to allow entry in the corn market. Thus, we can argue that the leverage in the credit market can be utilised by the rich farmer to influence the corn market equilibrium. The upshot is that the rich farmer can establish himself as a Stackelberg leader in the corn market by optimally choosing A and M. This is a new result in the theory of interlinkages: the control over interest rates in the credit market gives an extortionate landed aristocracy the power to influence the equilibrium

outcome in the product market such that this landlord achieves the profits and power of a Stackelberg leader in the product market.

1.7.5. Subgame Perfection and Entry Deterrence

We examined the various options available to the rich farmer faced with the possibility of entry. The question is which option is the most preferred option for the rich farmer? Since he has the first-mover advantage, he would implement the most preferred option as the subgame perfect Nash equilibrium. Here we offer two results, which can be taken as the necessary and sufficient conditions for establishing either of the two perfect Nash equilibria.

Observation 5. The rich farmer will choose the interest rate A^* and optimal extortion M^* in order to forestall entry in the corn market if the entry-preventing interest rate, A^*, is above a threshold rate, r^*:

$$A^* > r^* \tag{10a}$$

The rich farmer's most preferred option will be to accommodate entry by enforcing the Stackelberg outcome if

$$A^* > r^* \tag{10b}$$

where r^* is endogenously derived as

$$r^* = \frac{2(1 - c_1 - 2c_3)}{3} \tag{10c}$$

Proof. See the appendix for the proof and details (Q.E.D.).

The intuition behind these results is of significant relevance: the rich farmer has an incentive to lower interest rate in order to reduce the marginal cost of the small farmer so that profits are transferred from the potential entrant to the small farmer. If the interest rate is sufficiently reduced, the entrant's profits are sufficiently low so that the entrant finds it unprofitable to enter the corn market, given the entry cost. The rich farmer, by using extortion optimally, appropriates all these profits from the small farmer. However, as the interest rate goes down, the marginal cost of production of the small farmer declines and, as a result, the total profits from the corn

market decline. The entry-preventing interest rate can forestall entry but it will also reduce the overall profits from the corn market. From these twin and opposing effects of interest rates on the profits in corn market we derive the threshold interest rate r^* below which the cost of using interest rates for preventing entry is greater than its benefits.

Note that the most preferred option of the rich farmer is to forestall entry by setting $A = A^*$ and $M = M^*$ if $A^* > r^*$. Thus, the strategy of entry prevention is a subgame perfect Nash equilibrium if $A^* > r^*$. On the contrary, $A^* < r^*$ the preferred option of the rich farmer is to allow entry and create the Stackelberg outcome as the subgame perfect Nash equilibrium of the proposed game.

Observation 6. It is instructive to note that when $A^* < r^*$, the rich farmer chooses the post-entry game as the Stackelberg one. From Basu and Singh (1990) we know that incumbents can use an array of precommitment strategies that can effectively deter entry where the post-entry game is Stackelberg. This result of ours can be combined with the findings of Basu and Singh (1990) to examine relevant precommitment strategies to deter entry in the downstream product market.

1.8. INCOMPLETE INFORMATION AND SIGNALLING ISSUES

We now assume that the corn market be characterised by information asymmetry: incumbents have full information about the cost and demand conditions while the potential entrant has sketchy information about the cost of production. The potential entrant infers about the cost of production from the price statistic. From Observation 6, we know that the incumbents can deter entry by increasing corn output if the post-entry game is Stackelberg. In order to avoid re-proving the results of Basu and Singh (1990), we consider entry deterrence in a situation where the post-entry game is not Stackelberg. The game unfolds for two periods: in period 1 the rich farmer chooses a first period interest rate A and a first period price of corn P. By the choice of A, the rich farmer can foreclose the market for the small farmer. The entrant then decides to enter or stay out, in the second period. If it enters, there is a duopolistic competition of Cournot type. Otherwise, the rich farmer retains his control over the corn market (Fig. 1.1).

Period 1
Rich Farmer Chooses

P^D P^*

Period 2
Potential Entrant Chooses

Enter   Don't Enter   Enter   Don't Enter
R_1, R_2 R_3, R_4 R_5, R_6 R_7, R_8
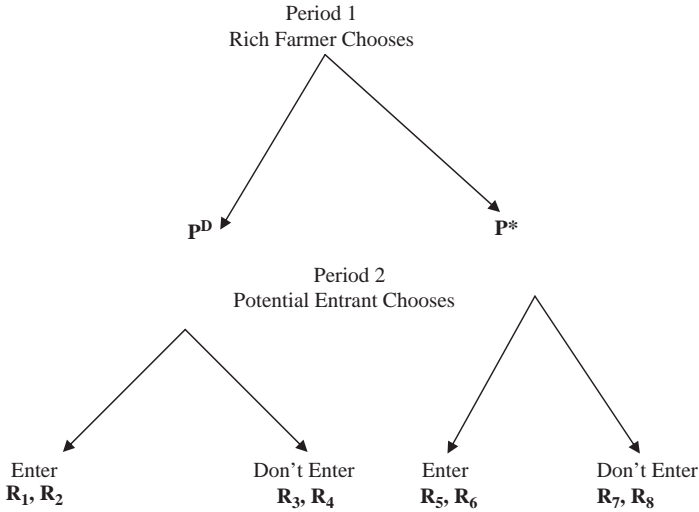
Fig. 1.1.   The Time Structure of Decisions.

Note: R_i, for i = odd numbers, denotes the profits of the rich farmer (creditor) and R_j, for j = even numbers, denotes the profits of the entrant. P^D is the price that the rich farmer chooses to deter entry by signalling that it is a high-cost industry – the strategy of upward price distortion. On the other hand, P^* is the profit-maximising price that forecloses the market to the small farmer. By construction, we know that if the rich farmer chooses P^*, there are sufficient profits to attract entry relative to the entry cost. On the other hand, if P^D is chosen and if the potential entrant believes it is a high-cost industry, then there is no entry. Thus the candidates for perfect Nash equilibria are (R_3, R_4) and (R_5, R_6). Being the first mover, the rich farmer can choose the one that brings the higher profits for himself. P^D will be chosen if $R_3 > R_5$ and P^* will be chosen if $R_3 < R_5$.

1.8.1. Entry Prevention by Upward Price Distortion where the Post-Entry Game is the Cournot Type Quantity Competition

If entry occurs then the post-entry solution is assumed to be a three firm-oligopoly outcome (triopoly) as outlined Section 1.8.2. This is so since we do not want to consider the Stackelberg case. All information before entry is a common knowledge except for the cost of production in the corn market that remains as private information of the incumbents. Since the incumbents have full information on cost, their pre-entry outputs and the resultant market price contain information about the cost and demand parameters. As a result, the entry decision is critically hinged on the pre-entry price

(see Milgrom & Roberts, 1982). Thus, the post-entry profit of the potential entrant is decreasing in the pre-entry price of the corn market. The rationale is that a high pre-entry price brings a signal to the potential entrant that this is a high-cost market that will in turn signal low post-entry profit. The intuition is that the incumbents may have an incentive to strategically distort price upward in the corn market to signal high cost and low post-entry profits (see Harrington, 1986, 1987). The rest of the section is devoted to the analysis of the rationale and feasibility of such price distortion.

Proposition 1. The distorted price signal, P^D, that conveys a message of high cost and, hence, low profitability to the potential entrant that will, thereby, forestall entry is given by:

$$P^D = (a + A + w - \beta) \tag{11a}$$

where

$$\beta = \frac{8\{\sqrt{(bE)}\}}{3} \tag{11a'}$$

Proof. Since the potential entrant does not know the unit cost of production c, hence the incumbents set a price P such that the profit accruing to the entrant, Π^e, is reduced to the entry cost E and, hence, the potential entrant will stay away from the market. Thus, the potential entrant does not enter if:

$$\Pi^e - E = 0 \tag{11b}$$

We substitute (10c) into (11b) to yield:

$$\frac{(a - 2A + w - c^*)^2}{16b} - E = 0 \tag{11c}$$

where c^* is the distorted cost that will signal zero profitability in the concerned market. From (11c) we derive:

$$c^* = a - 2A + w - 4\sqrt{(bE)} \tag{11d}$$

Substituting (11d) into (7d) yields the distorted price signal P^D:

$$P^D = a - A + w - 3\sqrt{(bE)} = P^D = (a - A + w - \beta) \tag{11a}$$

The distorted price signal P^D is determined by Eq. (11a) which signals a high cost c^*, as given by Eq. (11d), that will convey low (zero) post-entry profits to the potential entrant. Hence, the potential entrant will be deterred by this price statistic P^D if he believes the price does not have any *strategic* content (Q.E.D.).

1.8.2. The Rich Farmer and Upward Price Distortion

We turn to the important question of whether the incumbents have an incentive to adopt the strategy of upward price distortion as laid out in Proposition 1. In order to find that we need to compare their profits from such distortion with their profits from the no-distortion market equilibrium. The strategy of upward price distortion is optimal only when it yields higher profits to the incumbents vis-à-vis their profits from the no-distortion equilibrium. We set up the stage by giving the following results.

Proposition 2. The rich farmer chooses the distorted price P^D and shares the market demand at price P^D equally with the small farmer if there is no entry. In the corn market the profit, Π^{m***}, accruing to the rich farmer from the strategy of upward price distortion is given by the following:

$$\Pi^{m***} = m_1 - m_2\, A - m_3\, A^2 \tag{12a}$$

where

$$m_1 = \frac{(2A\beta - aw + \beta w - \beta^2 - (\beta - w)c)}{2b} \tag{12b}$$

$$m_2 = \frac{1}{2b} \tag{12c}$$

$$m_3 = \frac{(a + w - c - \beta)}{2b} \tag{12d}$$

The interest payments that the rich farmer receives from the small farmer is U^*:

$$U^* = \frac{A(\beta - w)}{2b} - \frac{A^2}{2b} \tag{12e}$$

Proof. At price P^D the quantity demanded, Q^D, in the corn market is:

$$Q^D = \frac{a - P^D}{b} \tag{13a}$$

We assume the incumbents have a tacit agreement about market shares, we simplify the analysis by an equal output share. Hence, the profit of the rich farmer from the corn market is:

$$\Pi^{m***} = \frac{(P^D - w - c)Q^D(P^D)}{2} \tag{13b}$$

Eq. (13b) is expanded to yield (12a).

The rich farmer receives the interest payments U^* from the small farmer:

$$U^* = \frac{AQ(P^D)}{2} \tag{13c}$$

Substituting for P^D yields (12e) (Q.E.D.).

1.8.3. The Incentive to Adopt Upward Price Distortion

Ignoring extortions (for the time being), the small farmer sells $Q^D/2$ at a price of P^D if he colludes to distort the price upward. From the quantity sold and the price we are to determine his profit Π^{n***}, from the strategy of price distortion.

Proposition 3. The small farmer sells $Q^D/2$ at a price of P^D and, hence, its profit, Π^{n***}, from the price distortion strategy is given by:

$$\Pi^{n***} = \frac{[(a + w - c - \beta)(\beta - w) - (a + w - c - \beta)A]}{2b} \tag{14a}$$

Proof. We know that the profit accruing to the farmer firm from the price distortion is:

$$\Pi^{n***} = \frac{(P^D - c - A)Q^D}{2} \tag{14b}$$

Substituting P^D by Eq. (9a) and Q^D by Eq. (13a) we arrive at (14a) (Q.E.D.).

Proposition 4. The rich farmer uses the optimal extortion M^{**} to force the small farmer to the reservation payoff, 0:

$$\Pi^{n***} = \frac{(a + w - c - \beta)(\beta - w) - (a + w - c - \beta)A}{2b} - M^{**} = 0 \quad (14c)$$

Thus, the small farmer still receives the reservation payoff even from the collusive set-up of upward distortion of the corn price due to the leverage of the rich farmer. Hence, the total profits of the rich farmer from the upward distortion of price are π^*

$$\pi^* = \Pi^{m***} + \Pi^{n**} + U^* \tag{14c'}$$

$$= h_1 - h_2 \, A - h_3 A^2 \tag{14d}$$

where $h_1 = m_1 + (a+w-\beta-c)(\beta-w)$, $h_2 = (1+a+2w-2\beta-c)/(2b)$, $h_3 = (a+w-c+1-\beta)/(2b)$, $m_1 = [2A\beta-aw+w\beta-\beta^2-(\beta-c)]/(2b)$.

Proof. Substitution of (13b), (13c) and (14c) yields (14d) (Q.E.D.).

Proposition 5. If the rich farmer chooses the interest rate, A^0, that forecloses the market to the small farmer, his total profits from two periods are:

$$\pi^{***} = \frac{(a - c - w)^2}{4b} + \frac{(a - c - w)^2}{9b} \tag{14e}$$

Proof. Simple substitutions yield (14e) (Q.E.D.).

Theorem 1. The rich farmer will adopt an upward distortion of the corn price, P^D, to forestall entry if the chosen interest rate is less than a threshold rate A_1^*:

$$A < A_1^* \tag{15a}$$

where

$$A_1^* = \frac{-h_2 + \sqrt{h_2^2 + 4(h_1 - \phi)h_3}}{2h_3} \tag{15b}$$

Proof. The farmer is indifferent between the price distortion strategy and the vertical foreclosure if

$$2\pi^* = 2(h_1 - h_2 A - h_3 A^2) = \pi^{**} \tag{15c}$$

$$h_1 - h_2 A - h_3 A^2 = \frac{\pi^{**}}{2} = \gamma \tag{15d}$$

Thus, there are two roots of the quadratic Eq. (15d) for which the farmer is indifferent between these two alternative strategies. The smaller root is negative whilst the larger root is given by (15b). If the actual interest rate, A, is less than A_1^*, then $\pi^* > \pi^{**}$ which makes the price distortion strategy as the perfect Nash equilibrium of the sequential game (Q.E.D.).

Statement 3. An upward distortion of price of corn is chosen by the colluding incumbents to deter entry and the potential entrant does not enter the retail market if the following condition holds:

$$A_1^* > A \tag{16a}$$

Statement 4. The collusion to strategically deter entry fails if the following condition holds:

$$A > A_1^* \tag{17a}$$

1.8.4. The Separating and Pooling Equilibria

The rich farmer prefers to adopt an upward price distortion to have a control over the corn market. The rich farmer attempts to keep the potential entrant out by conveying the message that the corn market is a high-cost industry and hence has low profits. Since there is no direct way, the indirect way is to charge a higher price P^D. Both high- and low-cost rich farmers will charge P^D to ward off entry. The crucial question is whether the potential entrant will stay out when he observes P^D. The potential entrant also knows that the rich farmer has an incentive to lie in this manner to convey the information that the corn market is unprofitable. The potential entrant may, hence, conclude by observing P^D that the cost structure is possibly low and the rich farmer is only bluffing. The rich farmer knows that the entrant knows that and it continues ad infinitum. One way to resolve the problem is to look for

the separating equilibrium (Milgrom & Roberts, 1982): the high-cost type does not want to pick the P^D that a low-cost type will choose to deter entry.

Theorem 2. There exists a separating equilibrium in which the high-cost firm chooses an interest rate A^H that is greater than the threshold rate A_1^* and adopts an upward price distortion that deters entry as the potential entrant gets the message that the corn market is truly unprofitable. The low-cost firm does not have an incentive to choose A_1^* since the profits from the price distortion strategy at this interest rate A_1^* is less than the profits from the strategy of non-price distortion. The sufficient condition for the existence of this separating equilibrium is:

$$-\left(\frac{dh_2}{dc}\right) + \frac{1}{2}\sqrt{h_2^2 + 4h_3(h_1 - \gamma)}\left\{2h_2\left(\frac{dh_2}{dc}\right) + 4\left(\frac{dh_3}{dc}\right)(h_1 - \gamma) + 4h_3\right\}$$
$$\left[\frac{d(h_1 - \gamma)}{dc} > \left(\frac{dh_3}{dc}\right)\right] - h_2 + \sqrt{\{h_2^2 + 4h_3(h_1 - \gamma)\}}$$

(17b)

Proof. What we intend to show is that the A^H – that makes a high-cost firm indifferent between the price distortion and no-distortion strategies – is greater than A_1^*. We show the result in Fig. 1.2. It is instructive to note that $A^H > A_1^*$ if (17c) holds. We obtain the result by differentiating (15b) with respect to c and set the differential greater than zero (Q.E.D.).

If the above inequality (17c) holds, then there exists a unique-separating equilibrium: the low-cost type adopts the non-distortion and vertical foreclosure strategy and allows entry. The high-cost type deters entry by setting $A = A^H$ and $P = P^D$ so that the cost of deterring entry is outweighed by the benefit from so doing. Because of asymmetric information the rich farmer raises the interest rate and the corn price. Despite the possibility that the rich farmer has an incentive to manipulate the interest rate and the corn price, the entrant is not fooled – he learns the cost in the corn market perfectly.

Theorem 3. If the inequality (17c) is reversed, then $A^H > A_1^*$ and both types of agents (high cost and low cost) choose $A = A^H$ and distort the price upward to P^D. The entrant does not learn anything about the cost condition from the interest rate and P^D. By manipulating the price the incumbent deters entry.

Proof. See Fig. 1.3.

Fig. 1.2.   Existence of a Unique-Separating Equilibrium.

Note: The marginal cost of production of the rich farmer can be either low, C^L or high C^H. $OB = h_1 - \gamma$ for $c = C^H$, $OC = h_1 - \gamma$ for $c = C^L$. If inequality (17a) holds, we know $A^H > A_1^*$. For a low-cost rich farmer, $Y(C^L) > 0$ for $A > A_1^*$, thus he has no incentive to adopt a price manipulation strategy if $A \geq A_1^*$. For a high-cost one, $Y(C^H) < 0$ if A lies within the region $\{A_1^*, A^H\}$ and the price manipulation strategy is a preferred option for $A \in \{A_1^*, A^H\}$. If inequality (17a) holds, the high-cost rich farmer will adopt an upward distortion of the price by setting $A = A_1^*$ to convey the message to the potential entrant that this is a high-cost industry. The low-cost rich farmer does not have any incentive to manipulate the price.

1.9. ENDOGENOUS FRAGMENTATION WITH MULTIPLE SMALL AND RICH FARMERS IN THE ABSENCE OF THE SWITCHING COSTS

One may typically view the fable of market fragmentation as a special case of an oligopoly with serious switching costs as expounded by Klemperer (1987a, 1987b) and Bulow, Geanakoplos, and Klemperer (1985). If the small farmer has a prohibitive search/switching cost in obtaining credit, once the relationship between small and rich farmers has been established, then the
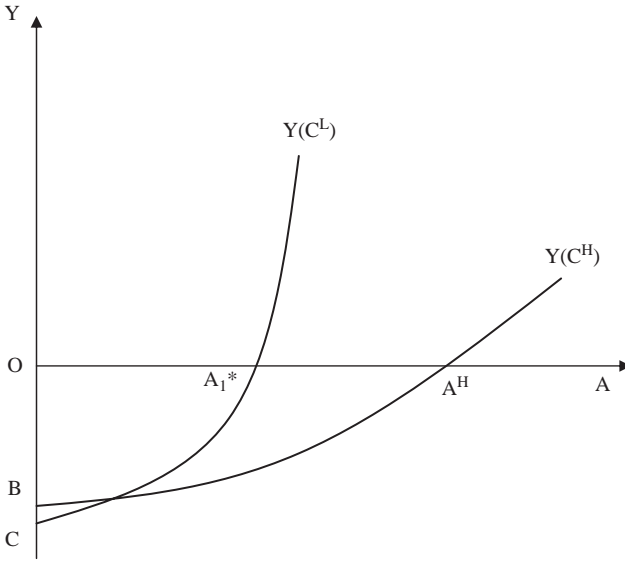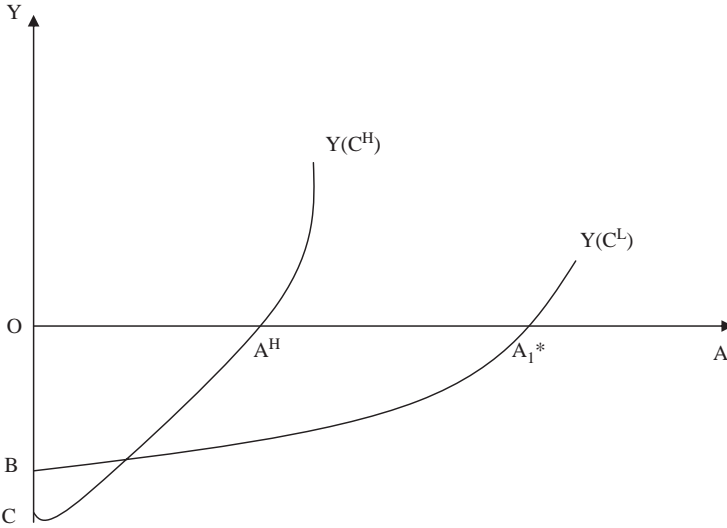
Fig. 1.3. Existence of Pooling Equilibria.

Note: The marginal cost of production of the rich farmer can be either low, C^L or high C^H. OB = $h_1 - \gamma$ for $c = C^H$, OC = $h_1 - \gamma$ for $c = C^L$. If inequality (17a) does not hold, we know $A^H < A_1^*$. For a low-cost rich farmer, $Y(C^L) > 0$ for $A > A_1^*$, thus he has an incentive to adopt a price manipulation strategy if $A < A_1^*$. For a high-cost one, $Y(C^H) > 0$ if A lies within the region $\{A^H, A_1^*\}$ and the price manipulation strategy is a preferred option only for $A \in \{A_1^*, A^H\}$. If inequality (17a) does not hold, both the high- and low-cost types will have an incentive to adopt an upward distortion of the price by setting A within the region $(0, A^H)$ to convey the message to the potential entrant that this is a high-cost industry. Thus, by reducing the interest rate below A^H, the incumbents can deter entry.

study of captive market may be viewed as an oligopoly with prohibitive switching costs (see Basu & Bell, 1991). In this segment we attempt to explain market fragmentation or captivity, without explicit switching costs.

We consider a scenario in which multiple small farmers and rich farmers interact freely when small farmers can obtain credit from all these rich farmers. Upon accepting credits from rich farmers, small farmers are liable to pay extortion to each creditor. Since a small farmer receives credits from various sources, it becomes difficult for a rich farmer to know precisely how much profit a small farmer makes. This creates problems for setting the optimal extortion for a rich farmer. This also creates an opportunity for a small farmer to hide his economic means (profits) and manipulates his profit

figures to reduce extortions by rich farmers. Typically, rich farmers can detect and punish manipulation, albeit with a probability, provided they cooperate in detecting manipulation. The story here is akin to that of crime and punishment. From what follows we argue that a game – involving multiple small and rich farmers with possibility of manipulation of profits by small farmers and costly detection – can be devoid of a pure-strategy Nash equilibrium. As a result, the fragmentation of a market may be seen as a means to avoid the non-equilibrium outcome.

To make the analysis tractable, we consider a 2 by 2 model: there are two small farmers who can seek and receive credits from two rich farmers. Rich farmer i sets extortion M_i, and interest rate A_i. A_i determines the cost of production of small farmers while M_i acts like an impost. We assume that M_i is extortion on each dollar that a small farmer makes, just like a tax rate. The penalty that rich farmer i imposes on a small farmer upon detecting manipulation is T_i and the probability of detecting manipulation is ρ. For small farmer i X_i is the output, $C(X_i)$ is his cost of production and $R(X_i)$ is before extortion revenue, Π_i is after extortion profits, φ_i is manipulation of revenues where S_i is the true revenue. We assume $M_1 > M_2$. An act of manipulation φ_i by small farmer i is to understate the profits due to the credit from rich farmer 1 and overstate the profits from the credit from the large farmer 2 – akin to some kind of a tax evasion scheme.

We write profit functions of small farmers as:

$$\Pi_1 = (1 - M_1)(\varphi_1 X_1 + S_1 - C(X_1)) + (1 - M_2)(R(X_1) - S_1 - \varphi_1 X_1) \tag{18a}$$

$$\Pi_2 = (1 - M_2)(\varphi_2 X_2 + S_2 - C(X_2)) + (1 - M_1)(R(X_2) - S_2 - \varphi_2 X_2) \tag{18b}$$

In this section we do not need the cost $(C(X_i))$, output (X_i), reported revenue $(R(X_i))$, actual revenue S_i explicitly, we hence do not derive them explicitly. Also note that these functions will be different from the ones when we consider one small and one rich farmer in the rest of the work.

Assumption 2. We define ρ as the common probability of detecting manipulation and assume ρ to be:

$$\rho = 1 - \varphi_1 \varphi_2 \tag{18c}$$

Assumption 3. The penalty on manipulation, T_j, imposed by rich farmer j, is assumed to be

$$T_j = \frac{\varphi_j^2}{2} \tag{18d}$$

Definition 3. We define a full-disclosure equilibrium as an equilibrium such that $\varphi_1 = \varphi_2 = 0$.

Definition 4. A fully non-disclosure equilibrium is defined as one with $\varphi_i = (C(X_1) - S_1)/X_1$ and $\varphi_2 = (R(X_2) - S_2)/X_2$ when $M_1 > M_2$.

The economic problem of small farmer i is to maximise expected profits $(E(\Pi_i) = (1-\rho)\Pi_i - \rho T_i))$ subject to constraints (18c) and (18d) and φ_i and $\varphi_j \geq 0$. It is important to note that the expected profit function $E(\Pi_i)$ is a nonlinear function of φ_i. For simplification we assume $S_1 = S_2 = 0$ without any loss of analytical bite. The first-order condition of profit maximisation from manipulation for small farm i yields the reaction function of small farm i as a function of φ_j:

$$\frac{\varphi_i}{\varphi_j} = F(\varphi_i) \tag{19a}$$

$$F(\varphi_i) = 2\varphi_i(M_j - M_i)X_i + 1.5\,\varphi_i^2 + [(1 - M_j)\,R(X_i) - (1 - M_i)\,C(X_i)] \tag{19b}$$

The second-order condition for the maximisation of expected profits is reduced to:

$$\varphi_i < \left[\frac{1}{3\varphi_j}\right] - \frac{2(M_j - M_i)X_1}{3} \tag{19c}$$

We examine the Nash equilibrium in Theorem 3.

Theorem 3. The proposed game has no pure-strategy equilibrium for $\varphi_2^1 < \varphi_2 < \varphi_2^2$ since small farm 2's reaction function is discontinuous for $\varphi_2^1 < \varphi_2 < \varphi_2^2$.

Proof. See the appendix (Q.E.D.).

Our argument is simple: if φ lies within a region then the postulated game of 'hide and seek profits' does not have a pure-strategy equilibrium. As a

result, the rich farmers face an intrinsic uncertainty and fail to reach an equilibrium that is mutually consistent, self-confirming and mutual-best responses. These rich farmers thus have an incentive to kill off this game by tying small farmers to a single rich farmer by offering a credit relationship.

Statement 4. What is the rationale behind fragmentation of markets? We answer it simply by saying that fragmentation helps to remove intrinsic uncertainty that a lack of pure-strategy equilibrium can create.

We now examine other possibilities.

Theorem 4. The proposed game can be characterised by three stable Nash equilibria separated by an unstable Nash equilibrium and a zone of no pure-strategy equilibrium (discontinuity in the reaction function of Firm 2). This leads to the usual coordination problem.

Proof. See the details of Theorem 4 in the appendix. Fig. 1.4 summarises this scenario. The first stable Nash equilibrium (E_1) entails $\varphi_1^* = \varphi_2^* = 0$.
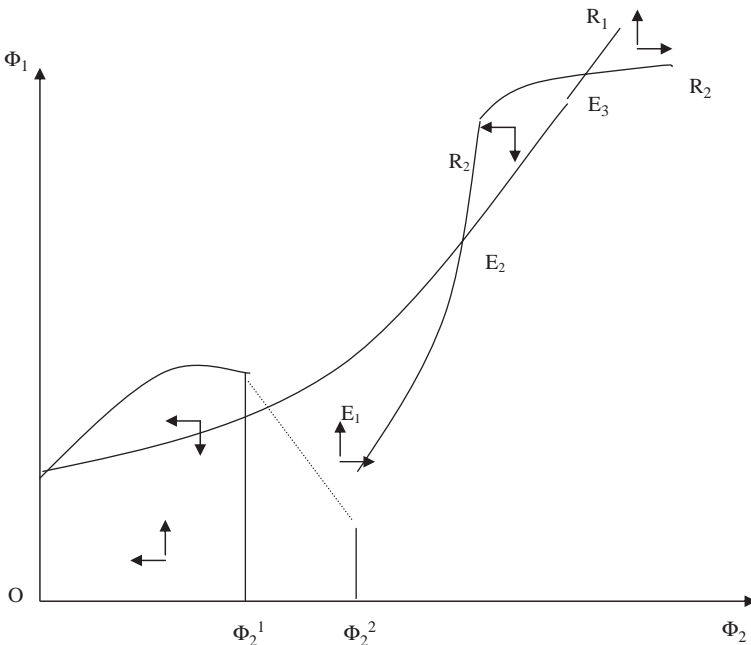
Fig. 1.4. The Case of Three Stable Equilibria.

The existence of this full-disclosure equilibrium is trivially obvious from (19a) and (19b). The other stable equilibrium (E_4) is the fully non-disclosure equilibrium when both small farmers transfer their revenues to the rich farmer with the lowest extortion rate. The other stable equilibrium involves partial disclosure given by E_2. The unstable equilibrium is given by E_3 and the relevant zone of discontinuity is $\varphi_2^1 < \varphi_2 < \varphi_2^2$ (Q.E.D.).

Theorem 5. The proposed game can be characterised by two stable (partial disclosure) equilibria that are separated by a zone of no pure-strategy equilibrium. Both full-disclosure and fully non-disclosure equilibria are unstable and cannot be reached.

Proof. Fig. 1.5 provides a heuristic proof (Q.E.D.).

On Fig. 1.5 a momentary leftward departure from E_2 can take system to the full-disclosure equilibrium. Similarly, a rightward deviation from E_3 can take the system to the fully non-disclosure equilibrium. History or
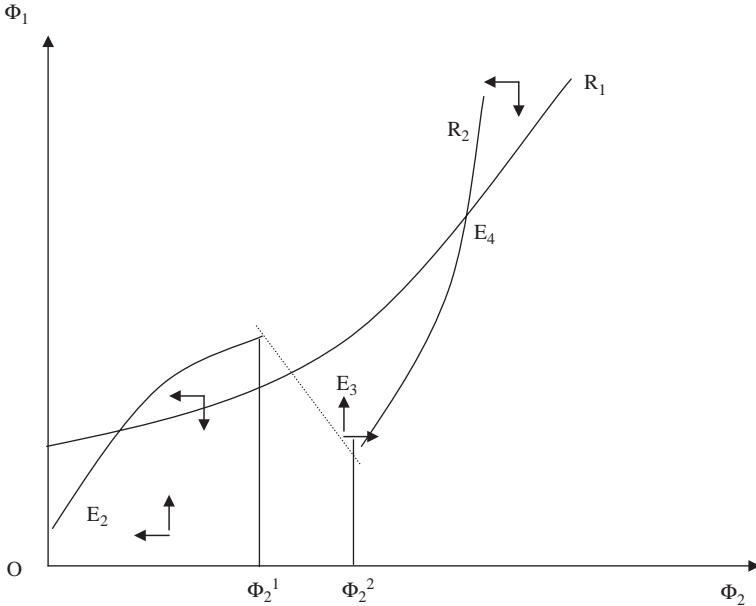
Fig. 1.5. The Case of Two Stable (Partial Disclosure) Equilibria.

expectations, can play important roles to establish the stable and partial-disclosure equilibrium E_3 or E_2. Multiple equilibria can cause significant instability by creating endogenously driven limit cycles. Similarly, on Fig. 1.5 E_3 acts as a separatrix for stable equilibria E_2 and E_4. History or expectations, play important roles in establishing the equilibrium.

> **Statement 5.** What is the rationale for fragmentation? Fragmentation can be thought of a means to end the instability and coordination failure due to multiplicity of equilibrium because of the inherent nature of the 'hide and seek profit' game.

1.10. RELEVANCE OF OUR MODEL IN THE CONTEXT OF MODERN INDUSTRIAL ORGANISATION THEORY: A DIGRESSION

The static models adequately explain pricing, market shares, regulation of access price and allocation of profits among fixed number of competing incumbents in vertical markets (see Vickers, 1995; Armstrong et al., 1994). If one may need to examine the contribution of our work to the industrial organisation, it is important to note that we offer the *dynamic* analysis of the vertical market and posits the market as a formation whose privileges are constantly threatened by entry. We follow Bain (1956), Sylos-Labini (1956), Milgrom and Roberts (1982), Harrington (1986, 1987), Bagwell and Ramey (1991) among others to adopt the theory of limit pricing to examine the dynamics of entry and extend the analysis to vertical markets.

We examine an industry where an integrated upstream firm has monopolistic control over the supply of a key input and competes with non-integrated firms in the downstream market. The downstream retail market is characterised by Cournot competition while the integrated firm enjoys monopolistic power in the upstream input market. The key question for these incumbents is how to ward off entry in order to maintain the status quo (see Bagwell & Ramey, 1991). This is a time-honoured problem in the theory of oligopoly: Bain (1956), Modigliani (1956) and Sylos-Labini (1969) advanced the notion of limit pricing which involves incumbents choosing a low price to convince a potential entrant that entry will be unprofitable. The limit price signals a lower post-entry profit to the entrant.

Thus, the main intuition of limit pricing is that the current price may signal the probable nature of the incumbent's policy if entry occurs. The

incumbent firm indicates its *commitment/threat* to maintain output consistent with low limit price. If the threat is credible then the potential entrant is deterred by a low price and high output.[2]

The seminal paper of Milgrom and Roberts (1982) highlighted the likelihood that incumbent firms may control the entry decision, through prices, by influencing a potential entrant's 'perceptions of the profitability' when prices convey critical information about the exogenous determinants of post-entry profitability. The fundamental notion turns on an informational asymmetry between incumbents and potential entrants: the incumbents have a relevant piece of information, which potential entrants do not possess. Matthews and Mirman (1983) examined the case where a potential entrant does not have critical information about the demand conditions. Milgrom and Roberts (1982), Salop (1979) developed signalling models where prices convey information about the cost conditions. These works demonstrate the rationale behind an incumbent's decision to set prices below the short-run profit-maximising level in order to forestall entry.

These models firmly establish interdependence between pre-entry price and the expected post-entry profit of the potential entrant and also spell out the rationale behind downward distortion of price. The only exception is the pioneering work of Harrington (1986, 1987) who postulates positively correlated cost functions of the incumbent and of the entrant in order to reverse the limit pricing result. In his works the incumbent firm prices above the simple monopoly price or Nash–Cournot price, to signal high-cost and, hence, low post-entry profitability. Our basic premise is similar to that of Harrington (1986, 1987) since the entrant relies on the price signals to learn about the cost conditions.

This work of ours extends the literature by applying the model of informational linkage to vertical markets with multiple incumbents. We adopt a particular form of information asymmetry: following Harrington (1986, 1987) we assume that an entrant does not know the cost of production and expects the cost to be positively correlated with the cost of production of the incumbents. The potential entrant observes the price statistic to infer about the cost of production. As a result, the incumbents have an incentive to distort price upward in the retail market to signal high cost and, hence, low post-entry profit to the potential entrant.[3] We develop a model to examine the effects of this informational asymmetry in vertical markets. We establish that an equilibrium exists in which the incumbents can strategically deter entry by conveying to the potential entrant that this industry is a high - cost one with limited post-entry profit. Our primary contribution to the literature is two-fold: first, we extend the information-based model of price

manipulation/distortion to the important case of vertical markets. Assuming a particular type of informational asymmetry we establish that the price in the upstream market (interest rate in our model) plays a critical role in deterring entry into vertical markets. A precommitment to a low interest rate (input price) by the integrated firm acts as a *commitment linkage* in such markets that can effectively deter entry and, thereby, limit competition. We are thus able to identify the threshold on the input price below which an upward price distortion will act as a collusive device to deter entry and would, thereby, limit potential competition – under a sufficient condition. Secondly, we note that a simple rule of input price (interest rate) regulation may fail to prevent incumbents from adopting price manipulation to deter entry.

1.10.1. An Example of Mild Form of Fragmentation of States: Local Governance and Fiscal Failure

The second important ingredient for the fragmentation of a state is the failure of nation state to create adequate opulence for the people and restrict inequality and provide adequate local and global public goods. A failure to offer the above is a pre-condition for the breakdown of the smooth functioning of a state that can easily lead to a failed state. In this section, we document a form of local government failure from India to establish how the gale storm of globalisation might have posed serious threats of minor form of state fragmentation, as nations states are unable to fulfil their basic obligations even in economically prospering states like India.

We highlight an inherent and serious contradiction that the gathering momentum of globalisation has unleashed for many nations in the developing world. On the one hand, these nations have witnessed significant acceleration in their GDP growth in recent years, which induced rapid increases in the pace of urbanisation and urban population growth. On other hand, governments at regional levels – due to privatisation and sales of state-owned enterprises and assets, and declining fiscal revenues, unsuccessful reforms, corruption and inappropriate accounting practices – have accumulated huge debts. Many regional governments in these countries are finding it difficult to service their debts, which force them to stick to severe austerity measures. This has an adverse impact on the provision of local goods and infrastructure in the urban areas, which can have serious welfare implications for millions of people who rely on these local goods for the continuation of their existence. The failure of the local

and regional governments is an expression of state failure and minor form of fragmentation in a society between go-getters and no-getters.

In most of the developing world there has emerged a widening gap between demand for and supply of local goods and infrastructure in urban areas, for example urban water supply, roads, basic public health facilities, primary schooling, housing and other social infrastructure. This is despite the fact that large cities, which are the focus of globalisation, accumulate urban wealth and wealth and business infrastructure. Richardson (2004) discusses the implications of globalisation for cities at the receiving end. His findings are that large cities, on balance, benefit from globalisation even in developing countries, although in some cases at the expense of widening regional disparities.

The special institutional structures of local governments in developing nations have been inherited from the colonial rubrics of these nations in which national/state governments offer finances to municipalities (local governments) for supplying local goods and local infrastructure. The urban crises are partly a spin-off from the indebtedness of national/regional governments that forces them to cut back on all local expenditures. More importantly, local governments traditionally levy low tax rates on local residents and businesses.

We take the recent experience of India as a test case with following features. First, GDP growth has been remarkable during the last decade, second, reform programmes at the national level have been appropriately implemented, third, in terms of Sachs–Warner index, the economy is moderately globalised and fourth, the pace of urbanisation is moderate, to low, in comparison with other developing nations. We show empirically that economic growth with increased pace of globalisation has made most of the Indian states (regional governments) heavily indebted. We establish that local governments have been forced to offer an (per capita) expenditure on local goods and social infrastructures below the absolute minimum or norm, recommended by Zakaria Committee (1963). This serious problem has not gone unnoticed: the Government of India introduced a series of measures since 1992 to devolve more power to local governments to redress this problem (the Eight and Ninth Five-Year Plans). The World Bank and the Asian Development Bank (ADB) recommended a string of policy measures and introduced a number of projects to improve the quality of local goods and social infrastructure in the urban areas under several schemes. According to the Government of India Infrastructure Report (1996), an annual investment of the order of US$60 billion would be required for 10 years in order to close the gap between demand for and supply of urban water supply,

sanitation and road networks. To put it baldly, the Government of India does not have necessary resources to fund these investment projects. The First Urban Development Plan of 1996 recommended a gradual reduction of traditional funding to local governments and a complete withdrawal of traditional funding by 2020 due to endemic budget deficits at the national level. The emphasis of the Government of India is on commercialisation of urban development projects, private partnership/participation in financing and delivery of the infrastructure at the municipal level, external assistance, foreign direct investment into urban development, tax-free municipal bonds, and expanding the local tax powers for local governments.

1.10.2. Globalisation and Provision of Local Public Goods

The economic consequence of an increased integration due to globalisation is two-fold: first, nations become more interdependent in economic terms. Secondly, there arises a *perception* that trans-border trade and investment offer tremendous and often unprecedented economic opportunities for a nation. The first transition thus results in an increased integration of the world economy – through a mesh of multinational investment, trade flows and flows of financial capital – with an equally important transition in the *perception* about the importance of trans-border trade and investment as a vehicle of economic progress and prosperity for a nation. The second transition impacts on the realm of *national management* as national governments actively respond to this new perception that trans-border trade and investment offer great benefits to those nations that entertain relevant openness to foreign trade and investment. With the growing dose of competition, policy-makers tend to agree that the main barrier to the access of these spoils would stem in the labyrinth of controls that has been a by-product of the Keynesian era of lack of globalisation. This leads to the third transition that paves the way for homogenisation of economic ideologies, convergence of macroeconomic and trade policies and the consequent adoption of measures of domestic liberalisation, privatisation, decentralisation and devolution. For any national government, options are pretty limited – either it chugs along with the pre-existing regime of economic control with limited global trade as pursued by China and India in the 1960s. Alternatively, the nation must ditch the *olden* economy and substitutes it with a functional market mechanism, openness to trans-border trade, liberalisation of domestic and external sectors and exchange rates, and privatisation of state-owned enterprises.

1.10.3. Adverse Impacts of Globalisation on Sub-National Governments: A Case Study of Indian States

Economic globalisation has resulted in a gradual reduction in restrictions on the free movement of capital along with harmonisation and increasing standardisation of the rules of the game that underpin global trade and investment and the regional dynamics. The driving force behind globalisation is the mobility of corporate capital facilitated by the spread of modern technology. This aspect of globalisation with a central role for corporate capital is having a profound impact on the functioning of governments in all countries. Large business corporations and multinational enterprises, in their quest for the maximum return on their capital, locate themselves in nations that provide the best environment for their operation such as easy enforcement of contracts, flexible labour laws, relative job insecurity of workers and friendly tax regimes. The most visible outcome has been that governments are obliged to provide public goods and services to corporate capital at taxes (prices) that do not meet the cost of their production and delivery. The citizens are therefore forced to accept fewer (and lower quality) governmentally provided goods and services than before. Not surprisingly, globalisation is accompanied by a transfer of the task of supplying goods and services that hitherto were the responsibility of the public sector to the private sector.

The uncomfortable fact remains that the propagation of decentralisation and privatisation as the way to make governments more efficient has accompanied the gathering momentum of globalisation. Thus, devolution of powers to sub-national governments has serious implications: first, the goal of devolution not only is to lessen the weights carried by higher levels of government but it also aims at fostering an *opinion* that lower-level government means less and more efficient government. Secondly, the ability of governments to have a *rational design* of their public sector, in consonance with the wishes of their people, is being constrained by the dictate of fiscal harmonisation in many matters particularly in taxation and also by a gradual erosion of tax bases. Finally, since sub-national debt and deficits have been a contributory factor in macro imbalance in developing countries, attention has to be given to reforms at the regional level with prescriptions that further chisel the policy space of sub-national governments.

Globalisation episodes improved fiscal discipline at all levels of government for macroeconomic stability, measures initiated by the IMF and World Bank – the Washington Consensus, privatisation and liberalisation

constitute the key elements of the economic framework that attracts both foreign and domestic investment. Does this trend imply an increased indebtedness and a resultant vulnerability for sub-national governments in the developing world? If it does, globalisation can impinge on the ability of regional governments to design their public sector in an irreversible and serious fashion. To understand the impact of globalisation on the indebtedness of sub-national governments, we cast a look at the Indian experience.

We conduct simple empirical exercises for Indian sub-national governments to shed lights on this important issue of indebtedness. To do this we posit Eq. (A): the task of the equation is to explain state indebtedness sub-national governments in India. SDEF measures the fiscal deficit of a state as a percentage of gross state's domestic product (GSDP). Two types of explanatory variables are used: annual inflation rate (INF) as a proxy for federal budgetary indiscipline and annual import growth (M) as a proxy for globalisation. It is important to note that globalisation in India in the 1990s meant a gradual dismantling of the impediments and barriers to imports. The sample period begins in 1989 and ends in 2002. The basic postulated equation is

$$\text{SDEF} = c + a_1\, M + a_2\, \text{INF} + u \tag{A}$$

Where c is a constant and u the typical error term. Inflation figures (INF) are collected from RBI (2004) and import growth (M) is collected from import figures given by RBI, DGCI&S (2004). Fiscal deficits of 19 important states of India (out of 26) are collected from the 11th Finance Commission, Government of India (2000, Annex II.4, pp. 180–185). Table 1.1 presents a summary of the findings. The Indian Government offers a three-tier classification of Indian states: High-Income states, Middle-Income states and Low-Income states. We also call them High (H), Middle (M) and Low-income states (L). We have taken the same classification and excluded states where urban sectors are less important.

Before we discuss these findings, we must keep in mind that these estimates are based on a small number of observations. Both the inflation rate and growth rate of imports have the expected sign on the indebtedness of sub-national governments (H, M and L alike). An increase in unanticipated inflation rate increases the indebtedness of sub-national governments – given the pre-committed budgetary transfers and tax allocations by the Central Government. An increase in import growth, as a proxy for increasing pace of globalisation, increases the indebtedness of sub-national governments. Both these effects are statistically significant for

15 out of 19 states and also in groups as the results show. It is also interesting to note that the magnitude of the effect of mismanagement of budgetary affaires, measured by inflation on sub-national debt (a_2) is larger than the magnitude of the effect of globalisation (a_1) for all states. It is to be noted that we could not establish causality due to insufficient data. However, we are able to establish that all the states included in our analysis are major states and represent the status of significant indebtedness along with an increased pace of globalisation as reflected in an increase in import growth.

How are individual states coping with debt repayments? Are the poor states more indebted than the rich? The picture is complex as depicted in Table 1.2. We classify states as H, M and L and use a five-tier classification of degree of indebtedness of sub-national governments. These are High (interest payment as a percentage of revenue receipts in excess of 25%), high-medium (20–25%), medium (15–20%), low (10–15%) and very low (less than 10%).

Table 1.3 shows that there is little correlation between the economic status of a state and its level/degree of indebtedness. Out of the four most indebted

Table 1.2. Globalisation and Fiscal Deficits of Indian States (1989–2000).

States	Coefficient a_1 (Globalisation)	Coefficient a_2 (Inflation)	R^2
5 High-income states	0.02	0.05	0.48
5 Middle-income states	0.025	0.08	0.40
9 Low-income states	0.05	0.23	0.34
19 Overall	0.037	0.24	0.38

Sources: Computed from RBI (2004) and DGCI&S (2004); The 11th Finance Commission, Government of India (2000, Annex II.4, pp. 180–185).

Table 1.3. Economic Status of Indian States in 1996–1998.

	High	High-Medium	Medium	Low	Very Low
H	1	0	0	3	1
M	1	0	2	2	0
L	2	2	1	2	2

Source: From Table 11.4, p. 102, Chapter XI, 'Debt Position of the States and Corrective Measures,' in Report (2000), The 11th Finance Commission, Government of India.

states one is high-income (H), one is middle-income (M) and two are low-income (L) states. Out of the three least indebted states, one belongs to the group of high-income states (H) and two are from the group of low-income states (L). The message is, at best, mixed. Whereas there is no trend, it would be instructive to analyse the link between sub-national debts and provision of local public goods.

1.10.4. Ghettos, Local Public Goods and Urban Crises: Evidence from India

If one looks at the US history, at the very outset, the formation of ghettos and racial segregation in the United States were caused by the migration of newly freed slaves from the South to move northward to establish themselves in mostly white cities of American midwest and northeast. The segregation was a natural by-product of exclusion dictated by the racial prejudice of the majority of white populace in cities of American midwest and northeast. Since the 1950s we have seen appearance of similar segregation on the European soil as Algerian and Turkish ghettos started dotting the urban landscapes of France and Germany respectively.

In contrast with the evolving racial segregation in the United States and Europe over the centuries, the latest phenomenon of segregation in the developing world is mostly based on segregation by income. The sprawling ghettos of large Asian cities, the *favelas* of Brazil, and the *gecekondu* settlements around Turkey's large cities represent the informal sector that is ubiquitous in cities of developing nations. These urban ghettos are informally built settlements, mostly in the outskirts of large cities, the formation of which is often driven by rural to urban migration, as poor migrants cannot afford to pay the premium price for the formal urban housing. At the risk of repetition, segregation by income is a time-honoured phenomenon as highlighted by none-other than Socrates who put forward the classic comment on segregation in Greek *Polis* in his 'The Republic':

> For, indeed any city, however small, is in fact divided into two, one the city of the poor the other of the rich; these are at war with one another; and in either there are many smaller divisions, and you would be altogether beside the mark if you treated them as a single State. (see Jowett, p. 137)

Segregation by income breeds inequality, divisions, ill feelings and serious social heat that can grossly weaken a city State. Our work will follow these basic notions of Socrates to model some unprecedented phenomena in the

context of segregation in the developing world. Our main contributions will be three-fold: first and foremost, segregation by income in developing nations seems to have created very deep cleavages between the rich and the poor, which seems to be as deep and as intense as the traditional racial division of the medieval European communities into Jewish and non-Jewish splits and the split of some of the US cities into blacks and whites following the emancipation and migration of the slaves. Traditionally, in the context of the United States and Europe social scientists and observers have relied on the rhetoric of racial hatred to explain involuntary formation of ghettos (see an early work by Bailey, 1990). However, in developing nations such strong racial cleavages are absent, we will therefore develop a special model that helps explain the deep cleavages in cities of developing nations in terms of economic and political factors. Secondly, the segregation in developing world created a dichotomy: on one side we see the chaotic world of ghettos and the on the other side we see the organised advanced sector. This dichotomy has led to reactions from regional and local governments to physically isolate ghettos from the organised sector: as an example, the government of Rio de Janeiro State proposed to build a 3-m tall concrete wall around its sprawling favelas in order to separate the chaotic favelas from the picture postcard city-centre. This effort is akin to the Israeli action of walling off Palestine to protect Israel from terrorist and suicidal bombings, despite the declaration of the wall as illegal by the International Court of Justice.

Globalisation, urbanisation and ghetto formation went unabated in India. Globalisation in India has been accompanied by a rapid era of urbanisation since the early 1990s – 60% of Indian GDP is currently generated in the urban sector of India with about 350 m urban population (30% of Indian population). The rapid urbanisation and under-investment in urban infrastructure have resulted in serious gaps in demand for and supply of local goods in Indian cities. Urban households have limited access to potable water and adequate sewerage, drainage, sanitation and waste disposal facilities. To improve the supply of local goods and to prevent further environmental degradation, the Indian Government is accordingly increasing priority to the urban infrastructure development and to strengthening of local governments. The 74th Constitutional Amendment, passed in 1992, embodies a commitment to devolve greater authority and responsibility for urban management from the states to municipalities/local governments. Despite the recent trends of decentralised governance, the gaps between demand and supply of local goods with limited infra-structural services has widened in urban areas. It is contended urban crises

are partly a spin-off of the indebtedness of state and federal and local governments.

In the previous section, we have shown that economic growth with increased pace of globalisation has made most of the Indian states heavily indebted. The Indian Government in its pursuit of macroeconomic stabilisation packages has reduced its commitment to local funding. The obvious corollary is that urban bodies have little resources and enormous responsibilities. In this section, we establish that local governments have been forced to reduce expenditure on (per capita) the core local goods and social infrastructures in real terms. This serious problem has not gone unnoticed: the Indian Government has introduced a series of measures since 1992 to devolve more power to local governments to redress this problem (the Eight and Ninth Five-Year Plans). The World Bank and the ADB recommended a string of policy measures and introduced a number of projects to improve the quality of local goods and social infrastructure in the urban areas under several schemes. How serious is this problem of under-provision of urban local goods? We offer a very grim picture in Table 1.4 that clearly shows a serious under-provision of local goods and some kind of a local government failure in the 1990s in India. To convey this message, we explain the following detail.

> **Definition 5.** Following the recommendation (norms) of Zakaria Committee (1963) we define D as the minimum per capita expenditure on core (urban) local goods in India.

This is an absolutist approach to define the basic minimum local goods (urban water supply, roads, basic public health facilities, primary schooling), which are *acceptable* to the Indian society (see Gangopadhyay & Nath, 2001a). The Government of India has upgraded this norm of minimum per capita expenditure in 1997–1998. We have used the inflation data and figures of urban population growth to calculate D as given in Table 1.4.

> **Definition 6.** We define S as the actual per capita expenditure on core local goods. The data on local expenditure was collected the Report of the 11th Finance Commission, Government of India (2000) and the population figures were collected from the Population Census (2001) published by the Registrar General of India.

> **Definition 7.** We define a shortfall as the difference between the minimum (D) and the actual per capita expenditure (S). If $(D-S)>0$, then there is a shortfall and a surplus if $(D-S)<0$.

Table 1.4. Index of Local Government Failure.

	1990	1991	1992	1993	1994	1995	1996	1997	Percentage Change
D (INR)	220	239.8	269.38	293.6	320	348.8	380.25	414.47	
High-income states (5)									
S (INR)	116.39	148.31	181.5	198.6	188.96	200.25	239.88	277.83	
$D-S$	103.61	91.49	87.88	95	131.04	148.8	140.37	136.64	
$G=(D-S)/D$	0.479	0.381	0.326	0.324	0.409	0.425	0.369	0.329	31.30
S^*	46.18	55.08	65.66	70.46	71.25	87	98.84	109.77	
$D-S^*$	173.82	184.72	203.72	223.14	248.72	261.8	281.41	304.7	
$G=(D-S^*)/D$	0.79	0.77	0.756	0.76	0.777	0.75	0.74	0.735	6.90
Middle-income states (5)									
S	40	48.15	52.5	61.81	65.53	84.53	97.63	129.07	
$S-D$	180	191.65	216.88	231.78	254.47	264.27	282.62	285.4	
$G=(D-S)/D$	0.81	0.8	0.805	0.789	0.795	0.7576	0.74	0.6885	15
Low-income states (9)									
S	37.8	43.24	53.8	54.79	62.47	68.13	78.14	82	
$S-D$	182	196.56	215.58	238.81	237.53	280.67	302.11	332	
$G=(D-S)/D$	0.82	0.819	0.8	0.813	0.8047	0.8046	0.7945	0.801	2.30
Overall picture (all states)									
S (all states)	64.47	63.6	70	72	62.91	69.68	76.17	70	
$S-D$	155.53	176.2	199.38	221.6	257.1	179.12	304.08	344.47	
$G=(D-S)/D$	0.734	0.74	0.754	0.803	0.8002	0.7996	0.83	0.84	−14.50
Maharashtra									
S	327	428	529	583	542	540	663	782	
$(D-S)<0$	−107	−189	−259.6	−289.4	−222	−191.2	−282.75	−367.53	
S/D	1.48	1.78	1.96	1.98	1.69	1.57	1.74	1.88	27
Years	1990	1991	1992	1993	1994	1995	1996	1997	Improvement in G

Note: S^*, per capita local expenditure in high-income states excluding Maharashtra; INR, Indian Rupee.
Sources: Computed from the Report of 11th Finance Commission (2000), Government of India and Population Census (2001), Registrar General, Government of India.

Definition 8. We define an index of local government failure G as $(D-S)/D$, which represents the inadequacy of a local government to supply the (updated) minimum per capita expenditure on core local goods as recommended by the Zakaria Committee (1963). Note that if $D-S>0$ then $G<1$ and the higher (lower) the value of G the larger (smaller) is the local government failure. For $D \leq S$, there is no local government failure. As value of G increases, it indicates rise in the level of government failure.

During the 1990s Table 1.3 demonstrates that all Indian states (except Maharashtra that homes the mega city Mumbai) experienced some kind of serious local government failure in providing the basic minimal (urban) local goods to urban residents. One can safely state that all local governments (except that of Maharashtra) could only provide less than one third of the per capita expenditure on local goods deemed as the basic minimum. During this phase, the Indian economy experienced considerable globalisation, increased pace of urbanisation and an era of unprecedented economic growth. Nevertheless the picture of urban life is pretty dismal – the basic minimum of local goods was not offered to 300 million plus people. The shortfall or gap, in the provision of local goods against the backdrop of the Zakaria norm is also amazingly high (75%+). This serious under-provision of local goods below the (recommended) absolute minimum is christened as *urban crises* in this work. This study does not argue that there is a statistical causality that runs from globalisation to urban crises. However, the study highlights the possibility of serious urban crises because of privatisation, decentralisation, tax competition and devolution that typically accompany various doses of globalisation.

Table 1.4 also points out an important dimension of interstate comparison of local government failure. During 1990–1997, the local government failure improved by 31.3% in five high-income states. If we exclude the exceptional performance of Maharashtra, this increase in local government failure is 6.9% for four high-income states. For five middle-income shows improvement in local government failure by 15% during the same period. It is important to note that nine low-income states posted 2.3% improvement in local government failure. While there is improvement in local government failure, in low- to high-income states, the picture is very bleak for the very poor states (not reported in the table). This conclusion is based on the overall picture of all Indian states showing 14.5% deterioration in local government failure. In the following section, we try to understand the theoretical foundation of urban crises.

1.11. CONCLUDING COMMENTS

In 2006 there were 49 countries under autocratic rules and their combined population is 2.2 billion, which is about 35% of the global population (see World Bank, 2008). This simple observation is important in the context of the emerging literature that argues that political regimes do matter in achieving peace. It is usually agreed that these 2.2 billion people will be vulnerable due to state failure to protect them from the ravages of conflicts and violent crimes since autocracies and hybrid systems breed intrastate violence. It is also widely acclaimed that:

- The fragmentation of states often leads to weak, failing or collapsed states especially in the developing world,
- Some of their governments fail in fulfilling the core of state functions,
- Besides providing territorial security the state must have legitimacy from all constituting citizens and enforce the rule of law, and provide the minimal welfare to its citizens.

Our work provides a comprehensive examination of two major issues concerning the fragmentation of state and possible state failure, which will be one of the major deterrence for achieving peace in our world. There are two important sources of conflicts – one is for the rural society and the other is relevant for the urban society. In the rural set-up we argue the fragmentation of markets leads to clientelism between rich farmers and their subjugated clients, small farmers. We show this as an equilibrium phenomenon in which a handful of rich and powerful farmers can effectively control millions of small farmers, which can easily challenge the authority and the mandate and the jurisdiction of a nation state. This element of clientelisation can effectively fragment the state in a developing nation. In the urban set-up, we argue that the era of globalisation has resulted in a mild form of fragmentation as the unbridled urbanisation has led to the formation of urban ghettos in the developing world. The local and regional governments have failed to provide the basic welfare programmes for the ghetto dwellers, which created several chasms in the urban society to pose a threat to peace.

The first issue at hand is to explain how a handful of political and economic leaders can wield a significant control over a large number of group members, which can effectively split up a nation into rival groups that can easily precipitate violent intrastate and inter-group conflicts. This kind of clientelism lies at the heart of ethnic cleansing and violent conflicts between ethnicities. Ours is one of the very first attempts to explain the formation of clientelistic groups what is commonly known as clientelisation.

By so doing we shed new lights on the dangers of intrastate conflict and prospects for peace in fragmented states. The second issue at stake is about the inadequacy and ineffectiveness of governments in developing nation in fulfilling their minimal responsibilities, which have created huge chasms between haves and have-nots, or go-getters and no-getters. The cleavage will act as a threat to the future prosperity and peace in developing nations. We marshal evidence to argue that the era of globalisation has caused serious problems for developing nations to pursue welfare policies and thereby exacerbated the cleavages between social groups, which resulted in a mild form of fragmentation of a state that can act as a serious source of problems for peace.

The theoretical work offers an alternative to recognised ways in which powerful players can retain their exalted economic positions by deterring entry if markets and societies are fragmented and interlinked. In standard models, powerful players undertake irreversible capacity costs to lower their variable costs and thus influence the industry equilibrium. By an assumption the incumbents do not have irreversible costs in our model. But, as constructively argued in this work, entry deterrence can be achieved profitably by suitably choosing the interest rate by an extortionate and rich farmer in a model in which credit and product markets are interlinked and fragmented.

We establish that the rural oligarchy or rich farmer, has an incentive to lower interest rate (A) in order to reduce the marginal cost of the small farmer so that profits are transferred from the potential entrant to the farmer. If the interest rate is sufficiently reduced, the entrant's profits are sufficiently low so that the entrant finds it unprofitable to enter the corn market, given the entry cost. The rich farmer, by using extortion (M) optimally, appropriates all these profits from the small farmer. However, as the interest rate goes down, the marginal cost of production of the small farmer declines and, as a result, the total profits from the corn market decline. The entry-preventing interest rate can forestall entry but it will also reduce the overall profits from the corn market. From these twin and opposing effects of interest rates on the profits in corn market we derive the threshold interest rate r^* below which the cost of using interest rates for preventing entry is greater than its benefits. Fragmentation in a rural society arises as an equilibrium phenomenon in which the landed aristocracy exercises a strict control over a myriad of small farmers, which also ensures the landed aristocracy its leverage in the product market by limiting entry. We note that the most preferred option of the rich farmer is to forestall entry by setting $A = A^*$ and $M = M^*$ if $A^* > r^*$. Thus, the strategy of entry

prevention is a subgame perfect Nash equilibrium if $A^* > r^*$. On the contrary, $A^* < r^*$ the preferred option of the rich farmer is to allow entry and create the Stackelberg outcome as the subgame perfect Nash equilibrium of the proposed game.

Why does fragmentation exist in rural markets of developing nations? We provide a new *rationale* for fragmentation in this context. We establish that rural markets, in the absence of fragmentation, can be beset with significant and intrinsic uncertainty due to twin factors: first, we find that these markets may not have a pure-strategy Nash equilibrium. Secondly, we find that these markets may be beset with problems of multiple equilibria and coordination failure. Fragmentation acts as a means to remove the intrinsic uncertainty caused by these twin factors.

We have examined an extension of the information-based approach to entry deterrence to the important case of fragmented and interlinked markets. Assuming an information asymmetry about the cost of production, we find that the rich farmer and the small farmer can effectively deter entry in the corn market by an upward distortion of the price of corn. Under a set of conditions an effective collusion among the incumbents is feasible if the rich farmer can freely commit to an interest rate before an entry occurs. Thus, we establish a new commitment linkage whereby the rich farmer is able to pre-commit to an input price (interest rate) to block entry. We also find that the regulation of the interest rate may fail to control such anti-competitive price distortion and, hence, and fails to promote potential competition in fragmented and interlinked markets.

Finally, we established that the forces of globalisation have created enormous problems on the urban landscape of developing nations as local and regional governments have suffered from some sort of government failure in providing the basic welfare programmes to the masses of people who live in urban ghettos of the developing nations. The cleavage between ghetto and non-ghetto dwellers in urban areas of developing nations will act as a cleavage between people and a flash point of conflicts in the future.

NOTES

1. In order to simplify the analysis we assume that there is a single farmer in the downstream corn market and, hence, this market is postulated to be a duopoly. The conclusions will extend to the case with a finite number of farmers.

2. These early works highlighted a *commitment linkage* whereby the incumbents are able to pre-commit to a higher output if entry occurs (see Bagwell & Ramey, 1991). However, such a threat by the incumbents may not be credible since the

incumbents may have an incentive to deviate from the committed output once entry occurs. Friedman (1979) forcefully argued that such a commitment cannot be sustained in a perfect Nash equilibrium. However, most of the earlier studies ignored the credibility problem (see Kamien & Schwartz, 1971, 1975; Gaskins, 1971; Pyatt, 1971). Subsequently, the commitment to maintain low price is justified in terms of irreversible decision such as plant investment, advertising (see Flaherty, 1980; Friedman, 1979, 1983; Salop, 1979). Dixit (1980), Fudenberg and Tirole (1983) introduced strategic capacity choices to ensure credibility of commitment. Gilbert and Vives (1986) examined output commitment in multiple-incumbent model. Bonanno (1987) theorised the entry-deterring power of product differentiation. Another plausible way out is to introduce imperfect information to beat the *chain store paradox*, which has initiated a fresh lease of research (see Milgrom & Roberts, 1982).

3. Harrington (1987) writes, 'By virtue of having been a supplier in past periods an incumbent firm generally possesses some advantages over a potential entrant. One obvious source of advantage is that an incumbent firm has first hand experience with the production process; while a potential entrant does not … it is then reasonable to assume that an incumbent firm will hold private information on cost function.' (p. 211).

APPENDIX

Proof of Observation 3.

To show the result it is sufficient to focus on the corn market. To simplify calculations suppose the marginal cost in the corn market is identical for each seller and equal to c. The profit of the rich farmer from the duopoly with the small farmer is Π^m (small farmer):

$$\Pi^m = \frac{(a - c + A)^2}{9b} \tag{A.1}$$

The rich farmer can foreclose the small farmer by choosing A or by not lending credit, and can have a duopoly with the entrant and his profits from this duopoly is Π^m (entrant):

$$\Pi^m(\text{entrant}) = \frac{(a - c)^2}{9b} \tag{A.2}$$

For $A > 0$, Π^m (entrant) $< \Pi^m$ (small farmer) (Q.E.D.).

Proof of Observation 4.

Setting $w = 0$, and the identical marginal cost for the rich farmer and the entrant, we know that the Stackelberg outcome will be given as:

$$\Pi_s^m = \text{Stackelberg profits of the rich farmer} = \frac{(a-c)^2}{8b} \qquad \text{(A.3)}$$

The Stackelberg profits of the entrant is

$$\Pi_S^e = \frac{(a-c)^2}{16b} \qquad \text{(A.4)}$$

The output of the rich farmer and the Stackelberg price are

$$q^m = \frac{a-c}{2b} \qquad \text{(A.5)}$$

$$P^S = \frac{a+3c}{4b} \qquad \text{(A.6)}$$

Now the rich farmer, by offering a credit contract to the small farmer, can enforce the Stackelberg outcome as the following. The rich farmer can lend an amount of credit (L):

$$L = \frac{a-c}{2b} = q^n \qquad \text{(A.7)}$$

$$A = 0 \qquad \text{(A.8)}$$

$$M = \frac{(a-c)^2}{8b} \qquad \text{(A.9)}$$

$$\Pi_S^m = M == \frac{(a-c)^2}{8b} \qquad \text{(A.10)}$$

$$\Pi^n = 0 \qquad \text{(A.11)}$$

$$\Pi_S^e = \frac{(a-c)^2}{16b} \tag{A.4}$$

The lending L by the rich farmer to the small farmer acts as a commitment that gives rise to the first-mover advantage to the rich farmer. The profits are recouped from the small farmer by using extortion as given by (A.9).

Proof Observation 5.

For the ease of calculation set $a = 1$, $b = 1/9$ and let us denote the constant marginal costs of the rich farmer, entrant and small farmer as c_1, c_2 and c_3, where $c_1 < c_2 < c_3$. We call the cost differences as

$$\Delta = c_2 - c_1, \ \Delta_1 = c_3 - c_1, \ \Delta_2 = c_3 - c_2 \tag{A.12}$$

The Stackelberg profits of the rich farmer is given by

$$\Pi_S^m = \frac{9(1 - c_1 + \Delta)}{8} \tag{A.13}$$

The profits of the rich farmer from blockaded entry, with appropriate optimal rate A^* and extortion M^*, and is Π_{BE}^m:

$$\Pi_{BE}^m = \frac{9[(1 - c_1 + \Delta + \Delta_1)^2 + (1 - c_3 - \Delta - \Delta_2)]}{16} \tag{A.14}$$

$9(1 - c_3 - \Delta - \Delta_2)/16$ is the profits transferred from the small farmer by extortion and $9(1 - c_1 + \Delta + \Delta_1)^2/16$ is the profit of the rich farmer with interest payments.

The rich farmer will be indifferent between entry accommodation and entry deterrence if

$$\Pi_S^m = \Pi_{BE}^m \tag{A.15}$$

Using

$$\theta_1 = 2 - c_1 - c_3, \ \theta_2 = 2 - 2c_1 + 2\Delta \tag{A.16}$$

(A.15) is reduced to

$$Y(A) = A(2\theta_1 + 2\delta - \theta_2) - 3A^2 = 0 \tag{A.17}$$

Where we further assume the following to get (A.17) as a simple expression:

$$\Delta_1 = c_3 - c_1 = A, \ \Delta_2 = A - \delta, \ \delta = \Delta \qquad \text{(A.18)}$$

(A.17) makes sense only if $(2\theta_1 + 2\delta - \theta_2) > 0$.
   From (A.17) we know if $A = r^*$ then $Y = 0$ where

$$r^* = \frac{(2\theta_1 + 2\delta - \theta_2)}{3} = \frac{2(1 - c_1 - 2c_3)}{3} \qquad \text{(A.19)}$$

where by assumption $a = 1$, $b = 1/9$.
   $Y > 0$ for $A < r^*$ and $Y < 0$ for $A > r^*$. When $Y < 0$ then entry deterrence is a preferred strategy of the rich farmer. If $Y > 0$ then the Stackelberg outcome is a preferred option for the rich farmer (Q.E.D.).

Proof of Theorem 4. The slope of the reaction function of firm 1 (R_1) is arrived at from (19b) and (19c) as:

$$\left(\frac{d\varphi_1}{d\varphi_2}\right)\bigg|R_1 = \frac{F_1(\varphi_1)}{1 - \varphi_2 \, F_1'(\varphi_1)} \qquad \text{(A.20)}$$

From the stability condition, $E''(\Pi_1) < 0$, we know that the denominator is positive and since $M_1 > M_2$, by assumption, the numerator is always positive. Hence

$$\left(\frac{d\varphi_1}{d\varphi_2}\right)\bigg|R_1 = \frac{F_1(\varphi_1)}{1 - \varphi_2 F_1'(\varphi_1)} > 0 \qquad \text{(A.21)}$$

The reaction of small farmer 1 is drawn as R_1 in Fig. 1.5. The slope of the reaction function of small farmer 2, R_2, is

$$\left(\frac{d\varphi_2}{d\varphi_1}\right)\bigg|R_2 = \frac{F_2(\varphi_2)}{1 - \varphi_1 F_2'(\varphi_2)} \qquad \text{(A.22)}$$

The second-order condition ensures the denominator of (A.22) to be positive. The numerator can be of any sign since $M_1 > M_2$ and, therefore, determines the sign of the slope of the reaction function of small farmer 2,

R_2. By setting $F_2(\varphi_2) = 0$, we get two roots φ_2^1 and φ_2^2:

$$\varphi_2^1 = \frac{2(M_2 - M_1)X_2}{3} - L^{1/2} \qquad (A.23)$$

$$\varphi_2^2 = \frac{2(M_2 - M_1)X_2}{3} - L^{1/2} \qquad (A.24)$$

with L is being determined by the coefficients of the quadratic equation $F_2(\varphi_2) = 0$. We know that $F(\varphi_2^1) = 0$ and $F(\varphi_2^2) = 0$ and $F_2(\varphi_2)$ reaches its minimum for $\varphi_2 = \varphi_2^C = 2(t_2 - t_1)X_2/3$. Hence for $\varphi_2^1 < \varphi_2 < \varphi_2^2 (d\varphi_2/d\varphi_1)|R_2 > 0$. For $\varphi_2 < \varphi_2^1$ and for $\varphi_2 > \varphi_2^2 (d\varphi_2/d\varphi_1)|R_2 > 0$. To see why there is no pure-strategy equilibrium for $\varphi_2^1 < \varphi_2 < \varphi_2^2$, note that $F_2(\varphi_2) < 0$ for $\varphi_2^1 < \varphi_2 < \varphi_2^2$. Hence, the optimal manipulation $\varphi_1 < 0$ is from Eq. (19b). From Eqs. (19b) and (20b) we know the optimal $\varphi_2 < 0$. If the optimal is $\varphi_2 < 0$, then the optimal is $\varphi_1 > 0$. Hence, there does not exist any pure-strategy Nash equilibrium for $\varphi_2^1 < \varphi_2 < \varphi_2^2$. Hence, the reaction function of small farmer 2 is discontinuous for $\varphi_2^1 < \varphi_2 < \varphi_2^2$. We depict this situation in Fig. 1.5 (Q.E.D.).

CHAPTER 2

AN ECONOMIC STUDY OF ETHNIC HETEROGENEITY AND ITS IMPLICATIONS FOR CONFLICTS AND PEACE

2.1. INTRODUCTION

We can divide the humanity into 5,000 ethnic groups who reside in 160 distinct states in the world. On an average this implies that only one randomly picked state out of every 10 states is ethnically homogenous. In other words the borders between different ethnic groups do not accord with national borders. We, hence, live in a melting pot of ethnicity and most countries are ethnically heterogeneous. In an alternative fashion, we can make a statement about our ethnic diversity by making a simple observation that there are over 600 living language groups in 184 states in the world. There is thus a reason to believe that the human race confronts a serious and endemic ethnic diversity, which is also increasingly accompanied with unprecedented ethnic rivalry, competition, conflicts, violent clashes and all-out wars. Our chapter provides a comprehensive investigation into the economic causes and consequences of ethnic heterogeneity in our modern world. In order to understand the basic economics of ethnic diversity, we will focus our attention to what is commonly known as 'global firms' who employ people from diverse ethnic backgrounds. The consequences will be examined in the context of modern societies where the global firms play an important economic role.

The concept of ethnicity has been extant in anthropological studies since the 1960s and is still an important topic in the research on social anthropology. Ethnicity refers to special characteristics and aspects of relations between groups, on the basis of which people think of themselves as being different and also are perceived as culturally different by others. Thus, ethnicity is a set of

characteristic features of a group of people that make these people think that they are different since others believe they are different.

In some sense, ethnicity can be construed purely as a *mental* model – people believe they are ethnically different since others believe so. In the field of sociology, a broader definition has been adopted: besides cultural praxis and cultural values, a collection of precise characteristics such as languages, historical heritages, religions, clothing and customs is also included to profile people along ethnic lines. Ethnicity can also derive from a collective consciousness – the so-called 'we-feeling', which is not based on any primordial characteristics like language, regional background, religion, common heritage. In this sense ethnicity could be a purely subjective feeling that creates walls between 'we' and 'they'. Once there is actual or perceived ethnic grouping, it usually leads to ethnic cleavages: there arises an external threat to the group of people, there can quickly arise ethnic bonding within groups that can intensify a struggle for material resources and cultural survival.

An ethnic group is therefore reduced to a collection of people who form a *common* group to collectively pursue their *common* or collective goals. The group formation takes place in the context of a similar formation of rival ethnic groups. It is in this sense a competitive group formation takes place on the basis of physical similarities, or homogeneity in customs, or common history and heritage or a combination of all or some of these characteristics. In the modern world ethnic groups have origins that are locally rooted and their group/social/cultural identities are predicated on their regional social and ecological peculiarities. A modern society is either ethnically homogenous or heterogeneous. If citizens of a society belong to one and the same cultural and linguistic tradition, then it is a homogenous society. On the other hand, if there is a division of the population in different cultural and linguistic groups, the society is heterogeneous. As we argue below ethnic heterogeneity does not necessarily imply inter-ethnic conflicts. We now turn to the question of conflicts in a heterogeneous society.

2.1.1. Ethnicity, Need for Autonomy and Inter-Ethnic Conflicts

Why do people display intolerances and sometimes get into serious conflicts? It is a question that is neither well understood nor fully addressed by social scientists. Though intolerances are universal, serious and costly conflicts occur disproportionately in low-income countries and push these nations further down the poverty trap. In this work we define conflict as a high level of intolerance that imposes serious costs on at least one involved party. An

important consensus today is that serious intolerance, or conflict, has a substantial economic dimension, hence we expect economists to offer a positive contribution to our collective bid to analyse intolerances and conflicts. In order to understand intolerances – and also conflicts – we will ask the much-abused questions of an economist: what are the constraints on and incentives for conflicts? Why in some societies conflicts recur while other societies retain their peaceful composure? To what extent ensuing conflict is a product of misperception and irrationality of agents?

An ethnic conflict is a violent contest/war between ethnic groups as a result of ethnic divisions and chauvinism. They are of great interest because of their prevalence and onslaught since the end of the Cold War and also because they frequently result in atrocious war crimes like genocide. Academics explanations of ethnic conflict generally fall into one of three schools of thought:

- Primordialist: This strand of thoughts on ethnic conflicts emphasises that there is genuine source of ethnic and national diversity because people have *serious* differences in their traditions of beliefs and actions towards *primordial* objects like biological features and territorial location. The primordialist argues that there is a natural kinship based on their physical and lingual resemblances between members within an ethnic group, which acts as a bonding force within a group. Between groups the distance in terms of kinships drives the ethnocentric rivalry, which gets exacerbated by economic, social and political polarisations.
- Instrumentalist: The instrumentalist strand gained momentum in the 1960s and 1970s in the United States, especially in the context of the debate on (white) ethnic dominance in what was supposed to have been an effective melting pot. It explains such persistence in white dominance due to the conscious activities of community leaders, who utilise their ethno-cultural groups for mass mobilisation and as political constituencies and specific weapons in their competition for political and economic power and controlling resources. The leaders usually find ethnic divisions less costly and more productive and more effective than interest group formation along social classes. According to this view, there are pre-existing ethnic divisions, or cleavages, that are exploited by community leaders to further their narrow and sectarian interests.
- Constructivist: On the contrary, this strand of thoughts believes that an ethnic grouping is not based on any real difference but on imagined and manipulated or socially constructed ones. As an example, one can look at the horrific genocide in Rwanda that was caused by the apparent

Hutu–Tutsi ethnic cleavage. This strand tends to argue that the Hutu–Tutsi distinction is not based on any real ethnic or lingual differences. The division was artificially created by the Beligian Colonial Forces only in the 1930s on the ground of cattle ownership, physical features and church records. Official identity cards got issued on this artificial classification, and the 1994 genocide unfolded on the basis of this *imagined* and *artificial* division or cleavage.

Yet it is an agreement among scholars that ethnic conflicts are a common phenomenon today. Research papers on internal conflicts attempt to explain conflicts in the light of the precise roles of the state, the state-structure and policies within states and even social justice. One of the increasingly popular measures to address ethnic conflicts is to grant autonomy to ethnic groups in a multi-ethnic set-up. *Autonomy* is a popular mechanism for resolving conflicts, yet the concept of autonomy and means to achieve it are all highly controversial, which can further fuel conflicts in a multi-ethnic society.

Ethnic groups, when they are politically charged and motivated, are defined according to their own political goals. Within these groups, kinships, ties and social networks play an important role in mobilising political support, financial resources, social movement and also triggering violent conflicts. Leaders of a threatened people appeal to the specific economic and social privileges for their ethnic groups. A lack, real or perceived, of these specific privileges usually triggers conflicts that gradually develop its own momentum. A major problem arises when ethnic groups seek territorial rights along with cultural autonomy for a specific ethnic group, which more often than not threatens the stability of a nation, or region, and thereby precipitates serious, violent and costly conflicts.

It is important to recognise that cultural diversity becomes a problem usually under poor economic governance: when a state tries to assimilate previously self-governed and territorially concentrated cultures within a larger area. The culture will demand some autonomy or self-governance to protect their existence as specific communities in a pluralistic society. As an example, cultural diversity can become a problem when migrants do not integrate with the host society. It is important to note at the outset that ethnically heterogeneous societies have diverse experiences in terms of inter-ethnic hostilities and demand for autonomy:

- There are several migrant societies like Australia, the United States and the United Kingdom where there are clear images of inter-ethnic rivalry and cleavages – yet there are no serious implications for violent conflicts. There is an emerging literature that marshals evidence of economic

discrimination along racial lines – yet there is no ground to discuss the idea of autonomy to ethnic groups and inter-group hostility and violence.

- There are several countries that have relatively stable ethnic arrangements as many ethnic groups have some well-defined autonomy – examples are Canada, India and Spain. However, some of these nations have over time developed serious cleavages between ethnic groups with open or hidden inter-ethnic rivalry and conflicts.
- There are nations, or societies, that have simply collapsed under the cascading burden of serious inter-ethnic violence – a burning example for us is the former Yugoslavia.
- There are countries that have experienced continuous, violent and seemingly endless inter-ethnic conflicts, important examples are Cyprus and Sri Lanka.

If an ethnically diverse society develops serious hostilities between ethnic groups, the right to autonomy and self-determination becomes a common demand. The idea of autonomy pivots on three major issues:

1. Minority rights
2. Indigenous rights
3. The right to self-determination

Autonomy is viewed instrumentally as a means to achieve specific approval for ethnic or other groups to maintain their distinct characteristics or identities in a regional set-up. In its stricter form, autonomy calls forth a direct control of a group over certain issues that are of *special* interests for the group. The demand for autonomy in governance is usually the strongest when a nation passes through a process of transformation, which threatens existing privileges of a specific group and thereby precipitates group conflicts. In the aftermath of World War II, as colonial boundaries were being redrawn demands for various autonomous regions became visible in India, Nigeria, Papua New Guinea and Indonesia.

2.1.2. Ethnic Diversity, Globalisation and the Enforcement of the Social Contract

Globalisation has shrunk the world and put various nation states and people of diverse races and backgrounds in a close proximity. With the development of modern technologies, the real distance between people has lessened, as different communities have to come to be more interdependent

on each other and also in their common pursuits of sharing our common planet. Globalisation has also homogenised our collective attitudes to a great extent as highlighted in our earlier work (see Gangopadhyay & Chatterji, 2005). Yet there are serious differences between ethnic communities and there is little institutional mechanism to productively resolve these differences. In the absence of an international arbiter and mediator, the progress and prosperity of globalisation have been accompanied by heightened risks of serious conflicts between nation states.

Our concern, however, is focused on the consequences of globalisation on social issues within a nation state. People from different stocks and/or religions live as a minority and thereby expose themselves to the dangers of intolerances of varying degrees by the majority. This is increasingly becoming a common feature of modern societies; especially in advanced nations today. In Chapter XIII of *Leviathan*, Hobbes suggests that men are quarrelsome by nature. If this is so, globalisation has given unprecedented opportunities to the majority to dump their acts of intolerance on the minority. Hobbes then suggests that there are three main causes of intolerances and conflicts: first, the underlying theme of competition for limited resources motivates men to invade others. Secondly, the mutual distrust induces men to invade for safety. Finally, men lock horns for achieving glory – invasion for reputation. It is the *social contract* and the enforcement of this social contract that is believed to banish serious conflicts from organised societies. However, if there is a problem in enforcing the social contract at a reasonably low cost – it is not possible to keep these causes of conflicts at bay.

In abstract economic theorising serious and costly conflicts have been kept at bay by two powerful arguments: first, all agents are construed as instrumentally rational and secondly all relevant information is made common knowledge. Now, one will only need the Harsanyi doctrine to argue that all agents will come to share the conclusion about how equally informed and rational agents will play out the end game involving conflicts (Harsanyi, 1961). If conflict is costly, intelligent agent will stay away from it. It is akin to the case of two chess masters – who at some stage of the game clearly predict the end game as a dull draw – decide to declare it as a draw before it reaches the end game. In the animal world, competition for food, mating and space is terribly intense – yet we hardly come across serious conflicts. In the animal world, a conflict gets resolved within a few minutes when two animals get into a situation of conflict by the size asymmetry. The smaller one recognises the higher cost and dissolves into the blue leaving the larger one with the prize.

In the context of humans the social contract is to prevent the vulnerable from being molested by the powerful (Rousseau, 1964). In *Social Contract*,

Rousseau popularised this idea of the social contract, which is recognised as the major difference between the animal world and the world of humans. Here lurks Rousseau's famous paradox: in entering society man sacrifices all his rights, but really he gives up nothing (see Cobban, 1934). Rousseau's solution is that man can be both a legislator and a subject and undertakes his *civil burden* most diligently to express the true interests of his society by voicing its 'general will'. His solution does not necessitate an enforcement of the social contract by an omnipotent and omniscient state since agents, driven by their civil duties, ensure its enforcement. Hobbes in Chapter XIII of *Leviathan* realises that it is not an easy task to protect the vulnerable from the powerful in any society simply because the powerful will willfully take on his civil burden. The Hobbesian suggestion is to create a 'common power' by the social contract 'to keep all in the awe'. It is widely recognised that there is a need to enforce the social contract by a legislative mandate. Wherever such a mandate is impossible, a society strives to tackle the enforcement problem by erecting customs and social norms that influence individual behaviours in the social context. Thus what action a man chooses can be seriously influenced by existing social customs and norms. An example may be helpful: consider the wage bargaining problem as outlined in Akerlof (1980) in which union leaders are bound by their members' normative expectations to hold out against a management whose social position makes concessions equally unacceptable to their stakeholders. This idea of Akerlof is akin to the market in gifts that is governed by the norms of gift giving – what is appropriate to give and to whom and at which occasion. Typically these norms are cast in iron, which uniquely determine individual actions wherefrom a social outcome evolves – given a well-defined and enforceable penalty mechanism.

In the context of intolerance and conflicts the same action can have different social interpretations, a suicide bomber may appear as a martyr for one group and a criminal for the other. Such a clear separation of interpretations does not pose a problem; however a serious problem arises when an action and its social reception and subsequent consequences are not clearly defined. Our major innovation in this work is to argue that social customs and norms may allow multiple possible *social interpretations* of the same action that an agent takes. As a result, an action can lead to multiple possible outcomes and thus entails an uncertainty that can seriously impinge on the social outcome. To rephrase it, in our model the social contract is not fully enforceable and its rules are subject to interpretations by the majority. We also entertain the idea that social norms and customs, which fill out the gaps in the social contract, are also subject to interpretations by the majority.

The incompleteness of the social contract and a malleability of customs and social norms give rise to an uncertainty that can profoundly influence the individual decision-making, which will in turn shape the social outcome in the context of intolerance. We proffer a new name for this kind of behaviour – *anti-social capital*. Social capital typically highlights those attributes, or virtues, in a society that convert a people into a community (see Putnam, 1993; Bowles, 1999; Durlauf, 1999). These attributes dictate interrelationships among people wherefrom a course of actions gets chosen. The term anti-social capital in the context of intolerance purports the notion that a zoa politica, that is a social agent, displays vices (a type of attributes that influence the choice of action) that split up the society into groups. An agent from the majority metes out a lack of trust and commitment; a sheer hostility and even economic harms to the minority as long as his reference/peer group (the majority) allows, tolerates and possibly rewards his efforts. We call these attributes (vices) anti-social capital since they typically open up chinks in a social order and create insider–outsider kind of conflicts. The syntactic import of anti-social capital is similar to the highly abused term of antihero who has superficial, not real, qualities of a hero. In natural sciences we also know a similar term called *pseudomorph* to label minerals possessing superficial, not real, qualities of some minerals.

The main contribution of this work is three-fold: first, we offer insights on the economic rationale for multiple ethnicity, or ethnic heterogeneity, in a contemporary society and measure the costs and benefits associated with ethnic heterogeneity. Secondly, we examine the consequences of incomplete enforceability and non-universality of the interpretation of the social contract within a heterogeneous society in the context of intolerances and conflict. Finally, we examine the impacts of anti-social capital on the social dynamics involving intolerances and conflicts. The upshot is that the incentives and constraints of intolerances will be altered with the incompleteness of enforceability and anti-social capital, which will give rise to equilibrium intolerance.

2.2. ECONOMICS OF ETHNIC HETEROGENEITY: MODELS AND EMPIRICAL FOUNDATION OF 'GLOBAL FIRMS'

The so-called 'global firms' and their multicultural teams are a relatively new phenomenon and fast becoming a fact of life in the United States and in many

other developed and migrant societies. A global firm, in terms of the composition of their employees, employs workers from different cultures, legal systems and languages, and this diversity is believed to impose a cost in comparison with organisations without such international mixing. Yet there exists only a scanty body of literature that documents the economic foundation of multicultural teams (see Lazear, 1999a, 1999b). In order to understand the productivity of multicultural teams, we solely focus our attention upon economics disciplines of Australian universities since a typical Western university and its disciplines represent one of the earliest forms of multicultural teams. While we know a great deal about the outcomes of research pursuits of different universities and their various disciplines, the mechanism which gives rise to their research productivity is less clear. In order to understand the mechanism we raise the following questions:

- What features make a discipline in a university particularly successful in its research outcomes?
- Can we explain why transitions occur so rapidly in some disciplines in some universities?
- Finally, why does (high or low) research productivity of a discipline in a specific university persist over time?

To better understand these questions this chapter develops, proposes and tests a simple model in which research productivity of individual members of a multicultural team can arise through the decentralised decisions of many academic economists who optimally choose their research efforts given their stocks of human capital and the local university and discipline-specific factors that promote or inhibit their research pursuits.

A central theme of the proposed model is the extent to which academic economists meaningfully interact with their colleagues, which can seriously impinge on their research productivity – ceteris paribus. The model gives the most realistic predictions if economists interact locally, that is we solely weigh interaction with their colleagues within a department while both the level and the quality of these interactions are predicated on the degree of ethnic heterogeneity, or fragmentation. The proposed model seeks to establish that the research productivity of economists in Australian universities depends on their a priori given stocks of human capital (their caste), local degree of ethnic diversity/fragmentation and local research cultures within their respective departments. The empirical test of the model is conducted using a new dataset for the economics departments of Australian universities which tracks the research productivity of 555 Australian economists and their ethnic composition and research cultures

at 30 economics departments between 1990 and 2002. The evidence suggests that the caste, culture and ethnic diversity are important determinants of their research productivity.

The plan of this empirical work is as follows. In Section 2.2.1 we provide the research backdrop and set out the context for the research questions. In Section 2.2.2 we survey the existing literature on the research productivity of Australian economists. In Section 2.2.3 we offer the postulated model and define the relevant variables. In Section 2.2.4 we explain the methodology, data and measurements of relevant variables. In Section 2.2.5 we offer a theoretical model to explain an important empirical observation that nearly 30% of Australian economists have zero research productivity during 1990–2002. In Section 2.2.6 we offer the preliminary results. Sections 2.3–2.5 offer an extension of the model and Section 2.6 concludes.

2.2.1. Economic Consequences of Ethnic Fragmentation: A Case Study of Australian Higher Education

Australian universities seem to offer an interesting case study with a laboratory of valuable data for understanding the effect of globalisation on local/regional labour markets that are characterised by a significant dose of ethnic diversity. In order to set the stage ready it is important to highlight three major elements of the economics departments of Australia: first, most economics departments in Australia combine academic economists with diverse ethnic and educational backgrounds and thereby represent a classic case of a global firm. Secondly, it is also important for us to realise that not all economics departments share a common research goal, or culture – there is a wide spectrum of research aspirations for economics departments. Finally, not all economics departments are equally successful in employing economists with significant stocks of human capital. Our research context is to unravel various forces that shape up research productivity of academic economists working in multicultural teams. In order to do that we take a close look at the major changes in the Australian higher education since the early 1990s.

Until early 1990s most Australian universities acted as specialised teaching colleges (see Neri & Rodgers, 2006). Since then a series of structural reforms has been unleashed by most universities to create world class research and teaching capabilities. In this pursuit, most universities are hamstrung by several knotty problems:

- Most universities lacked adequate resources to build their capabilities in all pursuits. As a result, it seems universities have chosen to develop their

research strengths in a handful of specific disciplines and, thereby, willingly sacrificed other disciplines. This has led to inequity between disciplines within a university.

- In the 1990s most universities found it difficult, if not impossible, to build the necessary institutional system and incentive mechanisms and inculcate and spread an appropriate research culture to promote academic research across disciplines.

- What is commonly referred as the turbulent 1990s also witnessed a serious withdrawal of funds from the Australian universities, which prompted universities to promote education as a mass product that led to an unprecedented increase in student numbers and also full fee-paying students in various disciplines. In many disciplines, disappearance of real resources along with unprecedented increases in student enrollments, and multiplication of administrative loads have put a serious handicap on Australian researchers working in the university sector. It is important to note in this context what Fox and Milbourne (1999) estimated: a 10% increase in teaching load lowers the research output of an Australian academic economist by 20%. There thus seems to be a reason to believe that the sweeping changes in Australian universities in the 1990s had serious and long-term consequences.

It is also important to emphasise that the 1990s witnessed an important *cultural* shift in Australian universities towards research in order to claim a bigger stake on the emerging global market for higher education. Decision-makers in Australian universities adopted two important measures to augment research productivity of their disciplines: first and foremost, concerted efforts were made to recruit academics of Asian origin from the global market (mainly from the United States and Europe) due to the geographic proximity of their home nations to Australia. At the same time, some efforts were made to recruit high-achieving students from some Asian countries to research programmes of many universities in Australia. Both these strategies led to a greater ethnic fragmentation of disciplines within universities, which had been somewhat unusual during the previous era. As is well known, ethnic diversity brings a significant increase in productivity in creative fields but also creates a fragmentation within a small community, which can be seriously counter-productive (see Alesina, Angeloni, & Etro, 2005). At the same time, serious efforts were also mounted to retrieve bright Australian (mainly early) researchers back home from leading global universities. All these efforts, in conjunction with the globalisation of Australian universities and revolution in communication and IT, resulted in

recruitment and retention of young academics from leading universities of the world. These high-calibre researchers, though small in number, created a new 'caste' in the Australian academia in terms of their research performance and funding successes (see Pomfret & Wang, 2002).

The subject matter of this research pivots on three important ingredients of Australian universities during the 1990s: caste (research), culture and ethnic heterogeneity of the faculty members within the discipline of economics. What is important to note is that the ethnic diversity is an unintended consequence of the recruitment drive. The ethnic diversity, as we will argue, can seriously warp research productivity by inducing researchers from a discipline to avoid local public goods – like discussion, social learning and social copying, as extensively studied by Alesina et al. (2005) in the provision of local public goods in heterogeneous communities.

Another important goal of this research is also to understand the dynamics of a multicultural team. In economics it is a common premise that argues exchanges between individuals are aided when all traders share a common culture and language, which allows trade without intermediaries, translators and costly contract enforcement. However, it begs a question of what kind of economic sense one can attribute to the role of common culture and language in the context of academia and economics departments per se. There are several ways one can rationalise the role of common culture and languages in the research pursuits: first, one can argue that a common culture, language and common ethnicity can induce agents to have 'common expectations and customs, which enhance trust' (see Lazear, 1999a). If trust and reciprocity can enhance the 'social capital' of a department, one can expect the prevalence of a common culture – ceteris paribus – can promote research productivity of the members of a group. Secondly, the work of Edward Lazear (1999) further suggests that language is not just a means of communication but also a device for *coordinating* economic behaviour of humans. One can strain the coordinating role of a common culture, language and ethnicity to explain why a mono-cultural and mono-lingual department – ceteris paribus – can help enforcing the research goals/policies of an economics department and thereby augment the research productivity. Finally, one may like to think of a common culture, language and ethnicity as a focal point as highlighted by Schelling (1960), which can explain a specific group behaviour.

In the Frank Paish Lecture of Royal Economic Society, UK in 1998, Edward Lazear made one of the very few attempts to understand the rationale behind the existence of a 'global firm'. A global firm, in terms of the composition of their employees, is an employer that combines workers

from different cultures, legal systems and languages, the diversity imposes cost in comparison with organisations without such international mixing (see Lazear, 1999b). Thus, a multicultural team for our study is akin to a global firm that is composed of diverse people from different countries and different cultures. In his work Lazear (1999a, 1999b) made attempts to explain why such a firm exits: on the benefit side, he argues, there are gains from a multicultural team when the skills and the knowledge sets of workers are culture-specific. This is feasible when:

- Ethnic and cultural groups have disjoint information/knowledge sets
- The knowledge sets are mutually reinforcing, at least relevant for other groups
- The cost of learning any of these skills is low for each group

The upshot of this line of reasoning is that the skills of one cultural group must be complementary with the skill sets others have, otherwise the cost associated with cross-cultural bridging will outweigh the gains from the cultural diversity in a team.

It is obvious from a casual look at the ethnic fragmentation of economics departments in Australia, one can perceive a typical economics department somewhat akin to a global firm, which employs culturally diverse academics to service culturally diverse cohorts of Australian students. It is not clear whether the ethnic fragmentation has been a product of any *rational* design of attaining an optimal dose of complementarities between different cultures and ethnicities. One can rather argue that the ethnic fragmentation in economics departments reflects the ability of Australian universities to take advantage of the cheap source of academic labour as the real wage rate in the higher education sector has steadily declined over the last 30 years. The real wage rate in academic in Australia has declined to the extent that the domestic supply has become inadequate to stay abreast with the demand. As a result, the ethnic fragmentation can be due to a compulsion, which is not driven by any rational design. If this is the case and if cultural diversity is costly, ethnic fragmentation can impose serious costs on the research output of an economics department, which can easily outweigh the gains in research productivity from appointing high-calibre researchers. Our study will be one of the first few to empirically understand whether ethnic diversity can impose a cost on a multicultural team. By so doing, we will be able to shed light on the impact of ethnic fragmentation on the research productivity of an Australian economist.

The research productivity of academics is one of the important facets of higher education, which attempt to provide a consistent ranking of

universities in terms of their quality of educational products. It has been a long tradition in the academic world to accord credence to the ranking of universities: this ranking is meant to provide a guide to prospective students about the quality of higher education that different universities offer and thereby help students to make an informed choice. Towards this end, the ranking is usually based on an index of quality of research and teaching, class size, student facilities, student satisfaction and their financial returns from the degree. A typical international ranking of universities is fraught with some known problems as argued in Pomfret (2007). The ranking is also important to explain the productivity of resources in a typical input–output format: universities acquire resources from public and private sources and it is an important question for providers of these resources to know if resources are spent in an economically significant manner. To put it on a different note: are there slacks in the utilisation of these resources to produce some well-defined output? The ranking acts as some kind of an imperfect measure of productivity of resources.

However, it is widely recognised that it is not satisfactory to examine the productivity of resources at the university level as these rankings are neither transparent nor comparable. As a result, a greater emphasis has been placed on discipline-based rankings since discipline-based rankings are more comparable and also transparent (see Pomfret, 2007). In order to promote research in Australian universities the Federal Government of Australia has instituted a national body to recommend specific research metrics for allocating research funds in Australia. The departmental research performance will hence be an important concern of public policy in Australia in the coming days.

In the two international rankings of universities, in recent years, Australian universities fared reasonably well. In the academic rankings of world universities of the Institute of Higher Education at Shanghai Jiatong University and in the annual ranking of the Times Higher Education Supplement, Australian universities have shown excellent performance (see Pomfret, 2007). Yet, at the discipline-based rankings, economics departments have posted abysmally low index of performance at the international level. In Australia, one may therefore perceive some sort of behavioural problems for economists and economics departments. To put it in different words, one usually notices a disjuncture between rankings of Australian universities and the ranking of (Australian) economics departments. Our study can be seen as a preliminary analysis of the sources of failures of economics departments to keep up with the Joneses in the international context.

2.2.2. Existing Literature on Research Productivity of Australian (Academic) Economists

To the best of our knowledge, there is a single piece of work on the determinants of research productivity of academic economists in Australia. In an enormously interesting work, Fox and Milbourne (1999) examined the individual characteristics of Australian economists, which can explain their productivity in terms of quality-adjusted publications for 150 economists in Australia. Their focus was on three important characteristics, namely human capital, teaching load and research funding of each academic economist as the determinants of their research productivity. A comparison of their work with ours will bring out the differences and advances that our work represents: first, our dataset is a much larger one with 555 academic economists as opposed to 150 academic economists of Fox and Milbourne (1999). Secondly, the human capital variable for an economist in Fox and Milbourne (1999) was represented by the following: (1) a dummy variable for a PhD, (2) grade of the honours degree, (3) a dummy variable for the nature of the PhD. In contrast, we have used a composite index to represent the human capital of an economist by linking the PhD-awarding department to the global ranking of the department. To our understanding, there is no historical precedence to our human capital index, which highlights the skill formation of an academic directly relevant for their research publication. Thirdly, we have used a vector of department-specific factors to characterise the research culture of a department that can seriously impinge on the research productivity of an academic economist. In the work of Fox and Milbourne (1999), it is important to note that the research culture was not examined. Finally, the ethnic fragmentation is taken as an explanatory factor in our model, which was also absent in the work of Fox and Milbourne (1999). Our notable omissions are the teaching hours in the explanatory variables, which seem to be unimportant as academic economists from the same department displayed a wide variability in their research productivity, while their teaching hours are similar both within and between economics departments. We have also excluded the research grant as an explanatory variable from our study, since there are serious disagreements on whether the research grant is an endogenous, or exogenous, variable.

2.2.3. Postulated Models and Specific Variables of Interests

The goal of this study is to understand the determinants of individual research productivity of academic economists in Australia. Let us label the

research productivity of academic i in a discipline of university j as X_{ij}, the precise import of research productivity will be explained in the following section. We postulate that the research productivity X_{ij} will depend on a host of factors: first and foremost, the research productivity of an individual researcher is dependent on the *ability* of researcher i that we represent by the embodied human capital h_i. In our model h_i represents the capacity of a researcher for undertaking research and publishing the research in ranked journals. For the period of analysis in the model, h_i is predetermined. Hence h_i is the *caste* variable that partially determines the research productivity of a researcher. Note h_i is already chosen by a researcher in our model and hence irreversible. Secondly, the research productivity also depends on the *effort* level m_i chosen by researcher i. The implicit production function of research of researcher is given as:

$$X_{ij} = f(m_i, h_i, Y^j) \tag{1a}$$

where $(\delta X_{ij}/\delta m_i) > 0$ and $(\delta X_{ij}/\delta h_i) > 0$. Y^j labels a vector of other factors specific to the discipline in university j that influences the local research productivity. The Y^j vector captures the discipline-specific and university-specific characteristics that promote, or inhibit, research productivity. Y^j is postulated to consist of two sets of exogenous variables: the first set of variables is supposed to act as a proxy for research *culture* in the discipline of university j and we label them as Y^j_1. Thus Y^j_1 represents characteristics of a discipline in university j that offer appropriate incentives to researchers to undertake and publish quality research. The second set of exogenous variables is labeled as Y^j_2 that seek to capture those characteristics of the discipline in university j that inhibit the research aspirations of a discipline.

In our empirical model, we exclude m_i as a determinant of research productivity of researcher i for two sets of reasons: first, it is very difficult to get a measure/proxy for effort level chosen by a researcher. Secondly, m_i and h_i are likely to be correlated, as more able academics will choose a larger effort. Thus the retaining of m_i and h_i in the same regression can seriously mis-specify the model. Hence, in our estimation, we replace (1a) by (1b):

$$X_{ij} = f(h_i, Y^j_1, Y^j_2) \tag{1b}$$

We introduce a dummy variable D_1 to separate the top eight universities of Australia, commonly known as Go8, from the rest. Thus $D_1 = 1$ for each of top eight universities (Go8), otherwise $D_1 = 0$. After having tried several functional forms, we choose the following functional form for the

estimation of individual research productivity:

$$X_{ij} = \alpha_0 + \alpha_1 \log h_i + \alpha_2 Y_1^j + \alpha_3 Y_2^j + + \alpha_4 D_1 \qquad (1c)$$

In this exploratory study, we take the following proxy variables to run the regression. In order to capture the impact of research *culture* prevailing in department on the individual research productivity, we have chosen the average (research) productivity of department as a proxy. The underlying idea is that a typical researcher tries to 'catch up with the Joneses' by conforming to the research *norms*/culture of the relevant reference group. One may rationalise the role of conformity by appealing to several available economic theories: in a series of studies, Akerlof (1976, 1980), Kuran (1989) and Coleman (1987) developed theories of conformity by founding them on the threat of *sanctions upon deviants*. The fear of punishment, or absence of rewards, can motivate researchers that can lock the research policy of a university in place and will thereby stimulate individual research productivity. Alternatively, one possible way of rationalising the effect of research culture on individual research productivity is by appealing to the theory of *conformity preference* as stressed by Becker (1991). According to this strand of thoughts, an individual prefers to do the same things that others are doing. In the regression, Y_1^j represents the average research productivity of the department in university *j*. It is desired that other relevant department-specific factors be included in future studies.

We use a single proxy measure for Y_2^j to capture gamut of factors that inhibit the implementation of research goals of a department in a university. The proxy we use is an ethno-linguistic-fractionalisation (ELF) index. Y_1^j is hence postulated as a scalar and it is very important to extend our study by accounting for other factors that thwart the implementation of the active research policy of a department or university. The ELF measures the likelihood of two randomly chosen members of a department from different ethnic, or language, groups. It is calculated using a simple Herfindalh concentration index, which has been widely used in the cross-country growth regressions for unraveling the impact of ethnic diversity fragmentation on growth (see the pioneering work by Easterly & Levine, 1997).

What is the theoretical justification for introducing ELF as one of the factors that influence the individual research productivity in departments? There are several ways to rationalise the inclusion of ELF as an exogenous variable determining research productivity, the first two are well-received doctrines in the context of economic growth and ethnic diversity: first and foremost, one may argue that ethnic diversity and fragmentation matter

simply through the multiplicity of interests that it brings to the department, which can lead to irreconcilability of their preference and demands on research. Secondly, following the logic of Alesina and Rodrik (1991) and Alesina, Baquir and Easterly (1999), one may argue ethnic fragmentation is taken as a proxy for interest group polarisation, which is claimed to breed rent-seeking behaviour that can thwart the implementation of research policies of a department.

There is a third possibility that ethnic diversity in a research discipline can inhibit research productivity, which has not been examined in the literature on ethnic diversity hitherto. We argue that ethnic diversity makes communication within a department less credible and more costly, which may adequately explain the negative impact of ethnic diversity on individual research productivity. Let us try to explain this new mechanism that can explain the adverse impact of ethnic fragmentation on productivity in our specific context: in the context of research productivity, social copying and observational learning can play an important role (see Bikhchandani, Hirshleifer, & Welch, 1992): the key question is how individual researchers determine which alternative research question/issue and its publication is better. Each individual researcher can devote time to analyse each of the alternatives and then choose the best one. However, in the field of research this is very costly and time-consuming, so a possible alternative is to rely on the information of others. Usually, in the context of research such influence may take the form of direct communication and discussion with others. The discussion forum provides the necessary public good wherefrom the rational processing of information takes place by observing others' actions, which is popularly known as social/observational learning. Social learning leads to an efficient outcome if and only if communication is credible and costless. In the presence of costly communications, an efficient outcome may not get selected. Similar problems will arise if researchers display an aversion to the public good as highlighted by Alesina et al. (1999) in the context of local public goods and ethnic diversity.

2.2.4. Methodology, Measurements and Data

2.2.4.1. Methodology: Incremental/Marginal Contribution of an Explanatory Variable

The fundamental problem in our analysis is a lack of well-defined model that can adequately explain the complex outcome of research productivity of academic economists. In what we proposed, we highlighted the possibility

of a set of factors that can influence individual productivity of a researcher. The model can be further vitiated by possible correlation between regressors (h_i, Y_1^j, Y_2^j) in the sample at hand. In our current study, since there is little existing literature on research productivity of economists whilst this productivity usually depends on so many individual and department-specific factors, it is an important lesson to examine the introduction of explanatory variables that significantly reduces the RSS. We will therefore apply the standard analysis of the variance technique to unravel the marginal, or incremental, contribution of each explanatory variable that we have chosen, namely, h_i, Y_1^j, Y_2^j.

We will choose them sequentially to ascertain the statistical significance of these variables in terms of their marginal contribution to the explained ESS and R^2. We will also determine whether individually some of the regressors have statistically significant impacts on the regressand (X_{ij}) on the basis of separate t-tests. We will also examine the F test collectively whether all the regressors have a statistically significant effect on the regressand.

For measuring the statistical significance of introducing a new explanatory variable, we will recast the relevant F ratio by using the R^2 values only. For an explanatory variable, say Y_1^j, we will measure the statistical significance of introducing Y_1^j as an explanatory variable in explaining individual research productivity X_{ij} by constructing the relevant F as the following:

$$F = \frac{[(R_{\text{new}}^2 - R_{\text{old}}^2)/\text{number of new regressors}]}{(1 - R_{\text{new}}^2)/\text{df}} \qquad (2a)$$

where R_{new}^2 is the new (sample) coefficient of determination that is a measure of goodness of fit and R_{old}^2 the old coefficient (without the new explanatory variable Y_1^j), df the degree of freedom. For the inclusion of a variable, the F value must be highly significant. The equivalent guiding principle is the rule of thumb that we will use in the next section: the inclusion of a new explanatory variable is statistically significant if the t value of the coefficient of the newly introduced explanatory variable is larger than 1 in its absolute value.

2.2.4.2. Measurements of Relevant Variables
2.2.4.2.A. Index of Human Capital of an Academic Economist. Despite the fact that human capital is an important and universally accepted concept, the indexation of which still lacks a common measure. The measures are still evolving and context-specific. In most studies human capital is estimated

with reference to individual characteristics and mainly educational attainments, which are of considerable value for our study. The OECD definition of human capital as 'the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being' raises the possibility that an individual's human capital could be described by comprehensively enumerating that individual's knowledge, skills, competencies and attributes. The obvious problem with this approach is that many characteristics do not have a common unit of measurement and cannot be easily aggregated. We may be able to devise tests that would give measures of people's numerical, verbal, written and social abilities, and of their knowledge base within particular disciplines (sufficiently accurate to approximately rank persons within each category) but this leaves us short of an overall measure.

Human capital of an academic economist should be measured both in terms of quality and quantity of formal education that accords an appropriate training for conducting research and teaching. We measure human capital of an academic in terms of one's past educational investment – both in terms of quantity and quality: following the usual footsteps of the existing literature, we take the quantitative measure of years of training in higher education as a component of human capital of a researcher. We then introduce the quality issue of human capital by incorporating the quality of academic training by accounting for the ranking of the economics department where a researcher receives one's doctoral training. We use a very specific cardinal ranking to offer a proxy for human capital of a researcher that we present in Table 2.1.

A few observations are in order: first, we allocate a baseline point of 30 units to each academic regardless of having a doctoral training or not. Since most academics at least have honours and postgraduate degrees, the baseline point/score tends to capture their minimal educational training. This score reflects the quantitative aspect of human capital embodied in an academic. This notion is in consonance with the usual practice in measuring

Table 2.1.   Index of Human Capital of Researchers.

PhD from top 10 departments	100
PhD from 11 to 25 departments	85
PhD from 26 to 50 departments	75
PhD from top 8 departments in Australia (Go8)	65
PhDs from any other department	50
No PhDs	30

Source: Constructed from survey data.

human capital for an average worker since it is a common practice to link the stock of human capital per worker to some function of the years of schooling. Secondly, we add further 20 points to anyone having a PhD degree that signifies a longer duration of relevant training. By so doing we once again seek to capture the quantitative aspect of human capital: the larger is the stock of human capital the longer is the duration of relevant training.

Thirdly, the qualitative aspects are brought in by scaling up the index of human capital of an academic depending on wherefrom the academic receives the PhD training. We add 15 more percentage points to the human capital of an academic if the degree is received from one of the Go8 (leading) universities of Australia. Further fine-tuning is accorded to leading departments of the globe: further 10 points are added to the human capital of an academic if s/he obtained the PhD from the top 26–50 departments of the globe. For anyone who obtained a PhD from a department ranked among the top 11–25 departments of the world, we add 10 more points. Finally, a score of 100 is given to an academic who obtained a PhD from a department ranked among the top 10 departments of our globe.

The scoring principle mirrors what academics do to rank their student's ability. We have used various scaling formulae to reflect the above principle of ascending order of human capital to take into account the quality and quantity of training of academics and the statistical results are invariant. However, a more rigorous measure is to be devised in future studies.

2.2.4.2.B. Index of Ethnic Fragmentation.   It is postulated that during the 1990s, Australian universities in their bid to promote research appointed researchers from the global market and especially targeted academics from Asia due to the geographic proximity of Australia to Asia. During the 1990s due to ongoing conflict in the Eastern and central European nations, there is a perception that many European students and scholars chose Australian universities as their research bases. There is an entrenched belief in the sector that the bid to internationalise Australian universities led to a gradual movement from a predominantly homogeneous academic community to an increasingly heterogeneous academic community. For our research we consider three broad ethnic-lingual divisions of the academic economists in a university of Australia: the first is the English-speaking Anglo-Saxon-Celtic group, the second is the group of Asian academics and the third is the group of (non-English speaking) European academics. On the basis of this tripartite ethnic division of the academic economists, we apply the standard

measures of fractionalisation to characterise the ethnic divisions in economics departments.

We summarise the ethnic landscape of economics departments of Australian universities by using a single statistic known as the Herfindahl index. The standard formula for the Herfindahl index for measuring ethnic fragmentation is given as:

$$Y_2^j = 1 - \sum (S_i^j)^2 \tag{2a}$$

where S_i^j is the share of ethnic group i in the department j for i ranging from 1 to 3. As noted before, the ethnic divisions are Anglo-Saxon-Celtic group, Asian group and the non-English speaking European group.

2.2.4.2.C. Individual Research Productivity and Average Research Productivity of a Department. In this work we measure the research productivity of an individual academic in terms of stocks during 1990–2002, as opposed to the measurement of research productivity as a flow as undertaken in Neri and Rodgers (2006). We measure research stocks by crediting for all prior publications of an individual to the current affiliation of the researcher regardless of where the research was carried out. Details of the data will be discussed in the next section. The average productivity of department j, Y_1^j, reflecting the research culture is the simple average of individual productivities in department j.

2.2.5. Data

The subjects of this study are the 555 academic economists and their 28 employers, namely departments of economics in Australian universities, during 1990–2002. The study collects data on the publication of each economist for the period of 1990–2002. The scope of this study covers all economists above the rank of an associate lecturer, whose research productivity is believed to be still evolving. As explained before, we measure the research productivity as a stock. Since the study focuses on the emerging research strategy of economics disciplines in 1990s to position themselves in the global market of higher education, we select publications of these academics in the top 88 journals of the profession. Ideally, one should consider the top tier journals in economics (top 30) since the research prestige of an economist comes from one's success in the top tier publications. However, only a handful of Australian economists regularly publish in the top 30 journals of economists, which could not have provided

any significant data for our analysis if we focus only on this top tier. It is also important to note that most of these 88 journals form the core of A* and A categories of journals (tier 1 and tier 2 journals) as recommended by the Australian Business Deans Committee (ABDC) for developing the research quality framework in economics discipline in Australia. Our major source of accessing the publication data of Australian economists in the top 88 journals is the online version of ECONLIT. In order to maintain consistency, we have chosen the 88 journals that Pomfret and Wang (2002) selected for their study. Extreme care has been taken to identify the authors and assigning them to a department with the help of departmental handbooks, annual reports, publicly available curriculum vitae and websites of economics departments. We take the work of Pomfret and Wang (2002) and their dataset as a guidepost and we are grateful to Pomfret and Wang for allowing us access to their dataset. By applying the well-established conversion rules, we measure the research productivity of each economist by taking into account the rank of the journal and the length of an article. Our measures are confirmed by the available dataset of Pomfret and Wang on common individual economists on our and their lists.

The research productivity data of ours is very similar to the dataset we received from Pomfret and Wang dataset. The data on research productivity X_{ij} is therefore beset with the usual strengths and weaknesses of the pioneering study of Pomfret and Wang. From the same dataset we also obtain the explanatory variable Y_1^j to capture the research culture of department j as a simple average of individual research productivities of members of department j. Once again the collected data are confirmed against the benchmark provided in the work of Pomfret and Wang.

In order to obtain a proxy of the embodied human capital of each economist (h_i), we collected data on the PhD training of economists from the ECONLIT, publicly available CVs, websites of economists, departmental websites, annual reports of departments and university handbooks. In some unusual cases, we contacted individual researchers for this information. Once we collected data on the PhDs of academic economists, we allocated the points/scores as per Table 2.1 to arrive at a proxy of human capital of each of 555 academic economists.

In order to home in on a measure of ethnic fractionalisation, we collected data on the ethnic background of an economist from publicly available information on their background from CVs, webpages, annual reports, university handbooks, country of their first degree etc. We roughly used three ethno-lingual classifications to measure ethnic division of a department by constructing the ELF index. The tripartite divisions are simplistic – the

English-speaking division (Anglo-Saxon-Celtic ethnicity), other European division and the Asian division. From the collected data we place each economist into one of the above three ethno-linguist groups. We subsequently applied the measure as outlined in Eq. (2a)to measure an index of ethnic diversity, or fractionalisation (Y_2^j), in economic department j.

2.2.6. Preliminary Findings

In order to unravel the importance of explanatory variables, we adopt the following steps:

Step 1. By following the methodology of the regression as outlined in Section 2.2.4.1, we regress the individual research productivity (X_{ij}) on the ethnic fragmentation (Y_2^j) and the postulated dummy D_1:

$$X_{ij} = \alpha_0 + \alpha_3 Y_2^j + +\alpha_4 D_1 \tag{3a}$$

Note that (3a) is a truncated version of the postulated relationship (1c). The basic regression results are provided in Table 2.2.

Table 2.2. Regression Result of X_{ij} on Y_2^j: Summary Output.

Regression Statistics					
Multiple R					0.325167
R^2e					0.105734
Adjusted R^2					0.102494
Standard error					2.032941
Observations					555

	df	SS	MS	F	Significant F
ANOVA					
Regression	2	269.73	134.8	32.6	4.0314
Residual	552	2281.3	4.1328		
Total	554	2551.0			

	Coefficients	Standard Error	t Statistics	P-Value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.153057	0.4017	2.870	0.004	0.364008	1.942105	0.364008	1.942105
Y_2^j	−1.34934	0.7685	−1.75	0.079	−2.859	0.1603	−2.859	0.1603
D_1	1.398535	0.1767	7.913	1.37	1.051407	1.7456	1.0514	1.7456

Source: Computed from the data.

The most important thing to note that the ethnic fragmentation (Y_2^j) of department j has a strong and negative impact on the individual research productivity and the effect is statistically significant. Both the intercept and dummy variable have expected signs and both are statistically significant. The adjusted regression coefficient is low (0.10), which is expected in a cross-sectional study with a few variables.

Step 2. In this sequence we introduce the explanatory variable Log h_i, as an index of human capital, for researcher i in the regression:

$$X_{ij} = \alpha_0 + \alpha_1 \text{Log } h_i^j + \alpha_3 Y_2^j + +\alpha_4 D_1 \tag{3b}$$

Note that (3b) is a truncated version of (1c) as we have not introduced the cultural factor yet. The results are presented in Table 2.3. The important thing to note is that adjusted R^2 has increased significantly from 0.10 to 0.196 with the introduction of human capital as a determining factor of individual research productivity. This value is quite significant for a cross-sectional analysis. Except the intercept term with a negative sign, every

Table 2.3. Regression of X_{ij} on Log h_i and Y_2^j: Summary Output.

Regression Statistics					
Multiple R					0.448589
R^2					0.201232
Adjusted R^2					0.196883
Standard error					1.869124
Observations					555

	df	SS	MS	F	Significant F
ANOVA					
Regression	3	484.95	161.65	46.270	1.1126
Residual	551	1924.9	3.4936		
Total	554	2409.9			

	Coefficients	Standard Error	t Statistics	P-Value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	−9.5886	1.0782	−8.89	8.49	−11.7065	−7.47	−11.706	−7.470
Y_2^j	−1.80407	0.7073	−2.55	0.011	−3.19348	−0.41	−3.1934	−0.4146
D_1	0.873407	0.17526	4.983	8.397	0.52913	1.217	0.5291	1.2176
Log h_i	4.544436	0.59074	7.692	6.681	3.384056	5.704	3.3840	5.7048

Source: Computed from the data.

other variable on the right-hand side of (3a) is economically and statistically significant and confirms the basic intuition and alternative theories. The research productivity of an economist is strongly and positively associated with the index of human capital that is embodied in a researcher. The research productivity is strongly and negatively associated with the degree of ethnic fractionalisation of the department that employs him or her. The research culture, as partly captured by the dummy, also displays a significant (economically and statistically) influence upon the individual research productivity.

Everything else remaining unchanged, the productivity of an economist is significantly higher when s/he belongs to a Go8 (leading universities) university vis-à-vis a non-Go8 university. There are two plausible explanations: one is the cultural influence on research and the second is the selection bias as better economists are employed by Go8 universities. It is also true that better economists seek to work with Go8 universities for the social prestige that it carries. One may also like to argue that Go8 universities have a strong resource base to offer better research facilities to its members. So the effect of the dummy is what is expected.

Step 3. In this sequence we introduce the cultural variable/factor (Y_2^j) as an explanatory variable. First and foremost, research culture as measured by Y_2^j is statistically significant as the F value is very high. The sign of the regression coefficient is also meaningful. All explanatory variables still have the expected influence on the regressand, however, both the ethnicity and the dummy variables are not statistically significant (Table 2.4).

2.3. A SIMPLE MODEL OF ETHNIC HETEROGENEITY AND IMPLICATIONS FOR INTER-ETHNIC HARMONY AND CONFLICTS

The above empirical section establishes a set of important insights that are of critical importance in understanding ethnic diversity within a 'global firm'. We offer a summary as follows:

• The empirical study shows that a global firm has an incentive to recruit and mix employees with ethnic heterogeneity in order to exploit their human capital.

Table 2.4. Regression of X_{ij} on Log h_i and Y_1^j and Y_2^j: Summary Output.

Regression Statistics							
Multiple R							0.468008
R^2							0.219032
Adjusted R^2							0.213352
Standard error							1.849861
Observations							555

	df	SS	MS	F			Significant F
ANOVA							
Regression	4	527.85	131.9	38.56			1.822
Residual	550	1882.0	3.421				
Total	554	2409.9					

	Coefficients	Standard Error	t Statistics	P-Value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	−9.90543	1.0708	−9.250	4.931	−12.0088	−7.802	−12.008	−7.802
Y_2^j	−1.1166	0.7264	−1.53	0.124	−2.54362	0.310	−2.5436	0.3104
D_1	0.17421	0.2628	0.662	0.507	−0.3421	0.690	−0.3421	0.6905
Log h_i	4.431748	0.5855	7.568	1.613	3.281622	5.581	3.2816	5.5818
Y_1^j	0.441913	0.1248	3.545	0.004	0.196738	0.687	0.1967	0.6870

Source: Computed.

- Within a global firm, the economic productivity bears a positive relation with the human capital of an employee, regardless of their ethnic background. It is hence optimal for a global firm to mix employees.
- Within a global firm, there is some evidence to believe that there is some inter-ethnic tension as the ethnic polarisation/fragmentation reduces overall productivity within a global firm.
- However, the negative impact of ethnic polarisation on the productivity is compensated by the positive effect of human capital on the productivity.
- It is also important to note that the regional cultural variables also play an important role in softening the adverse consequences of ethnic polarisation.

There are hence reasons to believe that ethnic heterogeneity within a global firm is built on the economic incentives of global firms to maximise their economic returns. Yet within a society there are unintended

consequences from the apparently optimising behaviour of global firms. Employees of these global firms work in a multicultural environment and live in societies that bear the burden of ethnic diversity but do not directly benefit from the ethnic diversity. On the social front, the conflict arises as there is apparent fragmentation of the regional society, yet there are no direct and apparent economic or social benefits to the dominant ethnic groups. This is the source of polarisation and serious flash points of conflicts between ethnic groups.

Now let us consider the unintended consequences of a global firm choosing an ethnically diverse team of workers. The intended consequence of this decision is to increase productivity of the firm. The unintended consequence is to bring people of different ethnicities and mix them with the local community. The local community, willy-nilly, confronts an ethnic diversity. Let us model their possible reactions: let us look at a randomly picked agent from the community who derives some benefits from an economic transaction. In order to highlight ethnic intolerance, we hide this transaction from our analysis. We call R^N the *normal return* to this agent from the transaction. In the context of the transaction this agent can also take an *action* of ethnic intolerance T_i. The return from T_i is uncertain: if this ethnic intolerance gets a social approval the reward from the transaction is above R^N. On the contrary, if the act of ethnic intolerance receives social censure, or disapproval, the reward from the transaction is below R^N. In our work this points to the case of multiple possible social interpretations of action T_i.

This intolerance can take a very minor form: suppose this agent is in a shopping center to buy the weekend newspaper and there enters a member of a minority group into the store. The act of intolerance, T_i, can be just a verbal abuse that members of minority groups increasingly face in the globalised society today: '*Go back to your country*'. We argue that the return from this simple act of intolerance depends on how this act is received in the society within the appropriate context. If others in the store simply enjoy the mundane and *just* harassment of this minority member, there is a *social approval* of this intolerance. This social approval of others is typically communicated to the actor as well as to the victim by body languages, snide comments and the post-action treatment of the agent and the victim.

With a social approval the return of the agent increases above R^N. Following this act of intolerance, others in the store may send the message of disapproval/censure by their body languages, snide comments, confrontation and post-action treatment of the agent and the victim. This social disapproval lowers the return below R^N. Thus our agent faces a gamble

when he engages in an act of intolerance. Will this intolerance beget the scorn of social censure? Will this intolerance beget the warmth of social approval? This kind of simple gambles may haunt perpetrators of different levels of intolerance. Imagine a university where a particular member of the minority group is refused tenure for reasons of racial intolerance. The chair of the tenure committee may face a serious opposition from other members, which will cause a serious loss of welfare. On the other hand, the chair of the committee may enjoy the warmth and cooperation of colleagues who, in principle, support the sacking. The act of sacking, depending on how colleagues will react, may bring social scorn or glory to the chair. The uncertainty is similar in spirits to Mark Twain's story of *the Connecticut Yankee* (1917): a practical Yankee sought to bring education, modern technology and high standard of living to King Arthur's kingdom. His action was initially supported by a band of young converts but subsequently drowned by the despotic church and noble beneficiary who opposed his action just due to 'deep-rutted habits'. The Yankee failed because he could not change the outlook of enough of King Arthur's subjects – ultimately his action met up with overwhelming social disapproval.

At a larger scale of intolerance, one may imagine the case of human rights abuse of Iraqi prisoners by the US army personnel: if voters approve of this abuse as necessary to fight terrorism, this social perception will not only enhance the resolve to fight terrorism but also shore up the electoral success of the present US government. A public rebuff, or social censure, can – not only – undermine this resolve but can also threaten the political survival of the current government in the next election. This notion bears some remarkable similarities with the fable of Lisbon catastrophe immortalised by Voltaire (see Newman, 1957): following the massive earthquake of 1775 Marques de Pombal hurled a flurry of activities at salvaging and rebuilding the city of Lisbon. Meanwhile the clergy convinced the people that the earthquake was divinely inspired upon a wicked city. The public opinion turned overwhelmingly against Marques de Pombal and he, wisely, beat a hasty retreat.

Thus an act of intolerance is akin to a gamble that we formalise as the following.

Assumption 1. Agent i expects two possible returns from his act of intolerance T_i. He expects a high return $R^N + \Delta (> R^N)$ where Δ is the excess return due to a social approval of intolerance T_i. On the other hand, agent i expects the rate to be $R^N - \Delta (< R^N)$ if there is a social censure/disapproval of T_i. Agent i further expects that the social approval

will materialise with a probability $(1-\lambda)$, and the social disapproval to materialise with a probability λ. Agent i thus confronts the following gamble: either he receives $R^n + \Delta$ with a probability $(1-\lambda)$, or receives $R^n - \Delta$ with a probability λ.

Observation 1. The expected value of the gamble is $E(\cdot)$:

$$E(\cdot) = R^n + \Delta(1 - \lambda) \tag{1a}$$

Proof. $E(\cdot)$ by definition is the following:

$$E(\cdot) = (1 - \lambda)(R^n + \Delta) + \lambda(R^n - \Delta) \tag{1b}$$

Simplification of (1b) yields (1a) (Q.E.D.).

Assumption 2. Agent i assumes that the probability of social disapproval (λ) is positively related to the benefits from intolerance Δ:

$$\lambda = \eta\Delta \text{ where } \eta > 0 \tag{1c}$$

Claim 1. The expected value of the gamble is reduced to the following:

$$E(\cdot) = R^n + \Delta - \eta\Delta^2 \tag{1d}$$

Proof. Substituting (1c) in (1b) yields (1d) (Q.E.D.).

Assumption 3. The benefit (cost) of social approval (disapproval) is an increasing function of the act of intolerance:

$$\Delta = \frac{T_i^2}{2} \tag{1e}$$

Assumption 4. If there are N agents in the society (excluding the minority), the average resource (pecuniary) cost of intolerance for each agent is C that is given as:

$$C = C_0 - C_1\left(\sum T_i\right) \tag{2a}$$

For a two-agent society, C reduces to the following:

$$C = C_0 - C_1(T_1 + T_2) \tag{2a'}$$

Claim 2. The return from intolerance to agent i in a two-agent (group) society is reduced to the following:

$$R_i = R^n + \frac{T_i^2}{2} - \eta \frac{T_i^4}{4} - C_0 T_i + C_i T_i^2 + C_i T_i T_j \qquad (2b)$$

Claim 3. The society consists of two agents who can hurl intolerance to minorities (not modelled in this work). Even in this two-member society the reaction function of each agent is S-shaped, which creates the possibility of multiple equilibria. The following diagram shows four possible non-zero tolerance equilibria E_1, E_2 E_3, E_4 that are Pareto ranked. E_1 is the best whilst E_4 is the worst: the equilibrium level of intolerance is quite low at E_1; the equilibrium level of intolerance is extremely high at E_4.

Proof. See Diagram 2.1.

Observation 2. By construction there are three possible rest points, or equilibria, that are intrinsically stable as well. The first one is

$$T_1 = T_2 = 0 \qquad (3a)$$
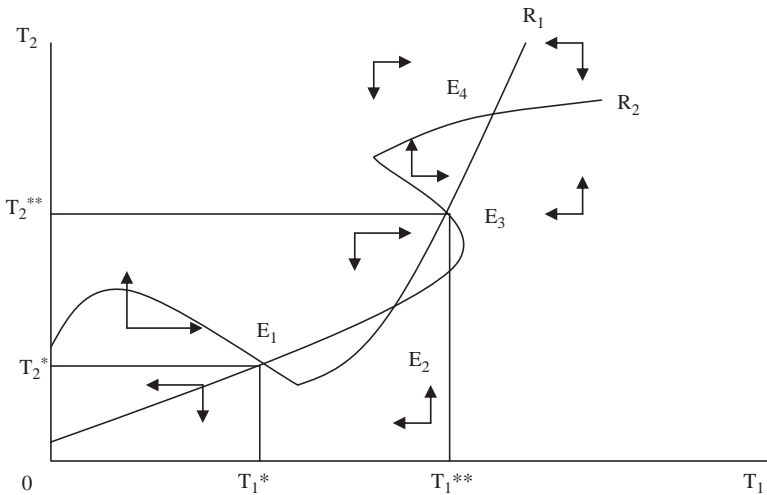
Diagram 2.1. Intolerance and Multiple Equilibria. By construction: E_1 is unstable, E_2 is stable, E_3 is unstable, E_4 is stable.

This is the zero-intolerance equilibrium. This rest point is achieved if $T_1 < T_1^*$ and $T_2 < T_2^*$. If the historical profile of intolerance, or people's expectations, are contained within the rectangle $OT_1^* E_1 T_2^*$, the system gradually converges from low-intolerance states to zero intolerance states, which is an ideal world.

Observation 3. If the history, or expectations, of intolerance have initial values of T_is in the region $OT_1^{**} E_3 T_2^*$, then the system gravitates towards an intermediate-intolerance equilibrium E_4.

Observation 4. If the history, expectations, of intolerance goes beyond the box $OT_1^{**} E_3 T_2^{**}$ – even momentarily – then the equilibrium intolerance rises to E_4, which is a high level of intolerance that can easily beget violence and conflict.

2.4. EXOGENOUS SOCIAL INTERACTIONS AND THE SOCIAL DYNAMICS

Social interactions take place whenever an agent's return is a function not only of his own action but also depends on the actions of other agents in the setting (Townsend, 1988). There is an extensive literature on the relevance of social interactions for economic behaviour in a wide range of contexts. Benabou (1993) considers social interactions in neighbourhoods with regards to education and crime. Diamond (1982) introduces social interactions in thick market externalities in trading. The literature has shown that social interactions can have a wide range of effects on the properties of the economic equilibrium: social interactions can lead either to conformity of behaviour or to polarised actions (Bernheim, 1994). They can cause multiplicity of equilibrium in which equilibrium would otherwise be unique (Cooper & John, 1988). Cooper and Haltiwanger (1996) argue how social interactions may influence the dynamics of a system. In this section we show, for the first time to our knowledge, social interactions can generate chaotic dynamical behaviour that can have a far-reaching influence on the economics of intolerance and conflicts. Let us look at the nuts and bolts of the model.

We assume that agent i receives a utility U_i from the act of intolerance T_i:

$$U_i = \frac{1}{2} A T_i^2 - pB(T_i - \alpha T^*)T_i \qquad (4a)$$

where: $B = 1$ for $(T_i - T^*) > 0$, $B = 0$ for $(T_i - T^*) < 0$, $p =$ probability that $(T_i - T^*) > 0$, $T^* =$ average (social) opinion about the *tolerable* level of intolerance, $\alpha =$ degree of lenience to intolerance.

Thus social interactions in our model are a part of the objective function of the agent as his utility/return depends on T^*. In this sense social interactions are exogenous. Banerjee (1992) offers a case of endogenous social interactions in a sequential decision-making framework wherefrom a special form of social interactions, namely herd behaviour, arises endogenously. As opposed to herd behaviour, our model highlights only exogenous social interactions. In some broader sense, our model of social interactions entails some kind of *anti-social capital*: social capital typically embodies the 'influence which the characteristics and behaviours of one's reference groups has on one's assessments of alternative courses of behaviour' (Durlauf, 1999, p. 2). Bowles (1999) spells out the attributes (such as trust, commitment, adherence to social norms and retributions to violators) that constitute the social capital that is in consonance with Putnam's initial idea (Putnam, 1993). These attributes dictate interrelationships among people wherefrom a course of actions gets chosen. In our model of anti-social capital, an agent displays a lack of trust and commitment; sheer hostility and even economic harm to a minority as long as his reference groups allow, tolerate and possibly reward his efforts. We call these attributes anti-social capital since they typically open up chinks in a social order and create insider–outsider kind of conflicts.

The first-order condition of utility maximisation yields:

$$T_i = \left[\frac{\alpha(pB)}{(2pB - A)} \right] T^* \tag{4b}$$

The second-order condition requires

$$2pB - A > 0 \tag{4c}$$

Agent i believes that his act of intolerance does not alter the average opinion nor it changes the degree of lenience. In this sense social interactions are exogenous and T_i is chosen to maximise U_i and not to influence T^* and α. However, agent i holds the opinion that 'others as a group' can shape both T^* and α. We posit the following belief functions:

Postulate 1. Agent i believes that the society shows increasing intolerance to intolerance by others as a group. For agent i this is modelled as T^* as a

decreasing function of T_j where j denotes the rest of the society. We postulate a simple functional relationship

$$T^* = T^{\text{Max}} - kT_j \quad \text{for } k > 0 \tag{4d'}$$

where T^{Max} represents the maximum level of intolerance beyond which the society displays zero tolerance to intolerance. Any intolerance beyond T^{Max} by anyone attracts serious and costly penalty to the perpetrator. This is where the social contract bites once the seriousness of the offence becomes very high. We now date the relationship as the following. Agent i believes that the average opinion T^* at date $t+1$ depends on the act of intolerance by others at date t:

$$T^*(t+1) = T^{\text{Max}} - kT_j(t) \tag{4d}$$

Postulate 2. Agent i believes that his own choice of intolerance does not impact on the social lenience to intolerance. However, the social lenience conditions on the acts of intolerance by others. Thus, the time path of α is

$$a_{t+1} = mT_j(t) \text{ where} m > 0 \tag{4e}$$

In a similar fashion one can describe the dynamics of $T_j(t+1)$.

Theorem 1. Assuming that there are two (or, two groups of) agents, the dynamics of T_i and T_j can be laid down as the following:

$$T_i(t+1) = \left[\frac{mpB}{2pB - A}\right] T^{\text{Max}} T_j(t) \left[\frac{1 - kT_j(t)}{T^{\text{Max}}}\right] \tag{5a}$$

$$T_j(t+1) = \left[\frac{mpB}{2pB - A}\right] T^{\text{Max}} T_i(t) \left[\frac{1 - kT_i(t)}{T^{\text{Max}}}\right] \tag{5b}$$

With a suitable change of variables

$$X = \frac{T_i k}{T^{\text{Max}}} \tag{5c}$$

$$Y = \frac{T_j k}{T^{\text{Max}}} \tag{5d}$$

The dynamics laid down in (5a) and (5b) can be restated as

$$X(t+1) = \left[\frac{mpB}{2pB - A}\right] Y(t)(1 - Y(t)) = \chi Y(t)(1 - Y(t)) \tag{6a}$$

$$Y(t+1) = \left[\frac{mpB}{2pB-A}\right]X(t)(1-X(t)) = \chi X(t)(1-X(t)) \qquad (6b)$$

$$\chi = \left[\frac{mpB}{2pB-A}\right] \qquad (6c)$$

Proof. The proof, being simple, is omitted (Q.E.D.).

The above dynamics are well recognised in physical sciences and economic sciences as being the dynamics of the quadratic map (see May, 1976; Feigenbaum, 1978; Benhabib & Day, 1982, 1980; Day, 1994, 1983). In this model of double logistic maps one can expect interesting local bifurcations and global bifurcation phenomena. Based on this line of research we offer the following theorem that characterises the behaviour of the dynamic system laid down by (6a) and (6b).

Theorem 2. The dynamical system (6a) and (6b) and the first and second iterates of these difference equations have four fixed points: $E^1 = (0,0), E^2 = ((\chi-1)/\chi, (\chi-1)/\chi), E^3 = (X^*, Y^*), E^4 = (Y^*, X^*)$ where

$$X^* = \left(\chi + 1 - \sqrt{\left\{\frac{(\chi+1)(\chi-3)}{(2\chi)}\right\}}\right) \qquad (7a)$$

$$Y^* = \left(\chi + 1 + \sqrt{\left\{\frac{(\chi+1)(\chi-3)}{(2\chi)}\right\}}\right) \qquad (7b)$$

The stability properties of these fixed points are given as the following:

E^1 is a stable node if $0<\chi<1$ and is the unique Nash equilibrium. For $\chi>1$, E^1 loses its stability and for $\chi=1$ we have a transcritical bifurcation and E^2 becomes stable for $1<\chi<3$.

For $\chi>3$ a stable two-period cycle is generated.

For $3<\chi<(1+\sqrt{6})$, both E^3 and E^4 are stable. Which one gets established depends on the initial condition.

For $\chi>(1+\sqrt{6})$, the levels of intolerance evolve through a cycle of infinite period. The levels of intolerance are within the relevant bounds but never repeat. For a higher order these levels of intolerance may look like a random process but they are fully deterministic.

Proof. The fixed points are derived from the quadratic maps and their first iterates. We then differentiate (6a) and (6b) with respect to X and Y wherefrom we form the Jacobian. The stability properties are arrived at by evaluating the Jacobian at these fixed points (Q.E.D.).

2.5. THE REPLICATOR DYNAMICS AND DYNAMIC STABILITY

In this section we introduce the possibility that social behaviours can be copied, or replicated, by agents over time in an evolutionary manner. Agents have an incentive to update their strategies if current strategies fail to yield an average return. This leads to the possibility of self-selection of an equilibrium. Following Taylor and Jonker (1978) we presume that agents are programmed to pure strategies. At any point in time, we interpret the mixed strategy h as a population state each component h_i representing the population share of agents who are programmed to play strategy i. In what follows we represent the replicator dynamics as an ordinary differential equation and examine the stability properties of this differential equation. It is well known in the literature that those stationary states that are dynamically unstable do not correspond to the overall Nash equilibrium behaviour.

We assume each agent has a utility/return function from intolerance as given by (4a). We define h_1 as the proportion of population programmed to choose intolerance levels greater than T^* that is the average intolerance level in the society. We define h_2 ($= 1 - h_1$) as the proportion of population programmed to choose intolerance levels less than the average intolerance T^*. Table 2.5 summarises the static game: two agents meet up with each other at random at a spot where there is a minority. Each agent can choose either strategy S_1 or strategy S_2. For each agent i $S_1 = T_i$ such that $T_i = T^* + d > T^*$, $S_2 = T_i = T^* - d \leq T^*$, where $d > 0$.

Table 2.5. Description of the Static Game.

Agent I	Agent II	
	S_1	S_2
S_1	A_1, A_1	H, B_1
S_2	B_1, H	A_2, A_2

Where $H = AT_i^2/2 - (T_i - T^*)T_i/2, A_1 = A(T^* + d)^2/2, B_1 = A(T^* - d)^2/2, A_2 = AT^*2/2$. It is easy to note that $A_1 > A_2 > B_1 > H_1$. The expected return from strategy S_1 is given as EU(S_1, S):

$$EU(S_1, S) = h_1 B_1 + (1 - h_1)H \tag{7c}$$

Similarly, the expected return from strategy S_2 is given by EU(S_2, S)

$$EU(S_2, S) = h_1 B_1 + (1 - h_1)A_2 \tag{7d}$$

The population average payoff/utility is EU(S, S)

$$EU(S, S) = (1 - h_1)B_1 + (1 - h_1)^2 A_2 \tag{7e}$$

Eq. (7e) gives the utility/payoff to an agent drawn at random from the population. Note that this is the payoff of the mixed strategy h earns when played against itself.

The replicator dynamics is given as

$$\frac{dh_1}{dt} = h_1[EU(S_1, S) - EU(S, S)] \tag{8a}$$

$$= [h_2^2 A_1 - (1 - h_1)h_1 H - h_1(1 - h_1)B_1 - (1 - h_1)^2 A_2 \tag{8b}$$

The above states that the growth rate of the population share using strategy i is equal to the difference between the strategy's current payoff (in biology reproductive fitness) and the current average payoff (fitness). Eq. (8b) is described in Diagram 2.2. By differentiating the EU(S, S) function we get the separatrix h_1^*:

$$h_1^* = \frac{(A_2 - B_1) + (A_2 - H)}{[2\{(A_1 - H) + (A_2 - B_1)\}]} \tag{8c}$$

For $h_1 < h_1^*$, the replicator dynamics converges to $h_1 = 0$.
For $h_1 > h_1^*$, the replicator dynamics converges to $h_1 = 1$.

2.6. CONCLUDING COMMENTS

The empirical section shows that a global firm has an incentive to recruit and mix employees with ethnic heterogeneity in order to exploit their human
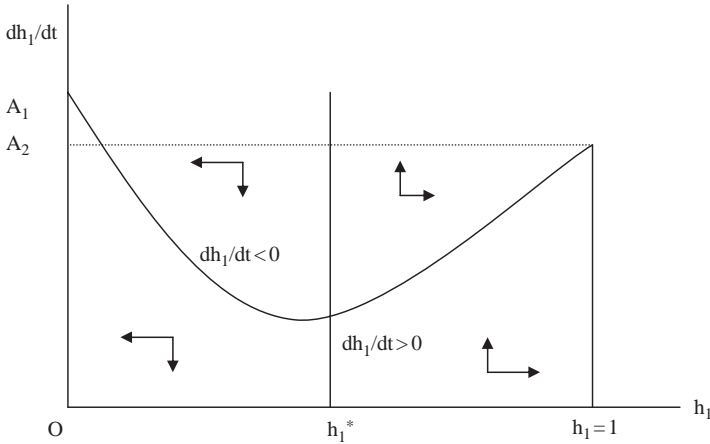
Diagram 2.2.   The Replicator Dynamics.

capital. Within a global firm, the economic productivity bears a positive relation with the human capital of an employee, regardless of their ethnic background. It is hence optimal for a global firm to mix employees. Within a global firm, there is some evidence to believe that there is some inter-ethnic tension as the ethnic polarisation/fragmentation reduces overall productivity within a global firm. However, the negative impact of ethnic polarisation on the productivity is compensated by the positive effect of human capital on the productivity. It is also important to note that the regional cultural variables within a global firm also play an important role in softening the adverse consequences of ethnic polarisation on the productivity. However, the unintended consequences of the spread of the global firms across countries are the increasing ethnic fragmentation of modern societies and their consequent problems. It is important to learn that the economic foundation of mixing ethnicities within a firm is based on the usual rational foundation for the employers. However, the cost of ethnicity falls on the society while the benefits are at best spread, which in our view can give rise to inter-ethnic hostility.

We then rivet our attention on the economics of ethnic intolerances in modern societies dominated by global firms. It is well documented in economics that fully rational and well-informed agents may display ethnic intolerances and engage in ensuing conflict only because they prefer conflicts to peace provided the potential penalties are not too high at the margin. It is well recognised that intolerances and conflicts can also arise from the desire

to build reputation and also because of imperfect information (Bowles & Gintis, 1988; Crampton, 1984; Crawford, 1982). It is also well known that multiple equilibria can be a source of conflicts (Hollis, 1987).

In this work we stress the role of an uncertainty that can accompany intolerances and conflicts. An act of intolerance by an agent may beget social censure or social approval. Approval brings a high return while censure/disapproval causes a welfare loss and hence a low return. In a static model, by imposing reasonable restrictions on these costs and benefits, we establish the multiplicity of equilibrium intolerance. We show five Pareto-ranked equilibria ranging from zero-intolerance equilibrium to severe-intolerance equilibrium. History and/or expectations play a decisive role in selecting one of them whilst momentary departure beyond a threshold can engender serious social problems. The dynamic setting highlights exogenous social interactions such that the payoff of an agent depends not only on his own decisions, but also on the decisions of other agents. Here we introduce a new concept that we call *anti-social capital* – a collection of attributes (vices) such as a lack of trust and commitment to members of a minority group, non-adherence to social norms and non-retributions to violators of social norms – that typically endanger social cohesion and create chinks within a social system. It is a specific type of social interaction. From these social interactions we derive the social dynamics that are well recognised in physical and economic sciences as being the dynamics of the quadratic map. In this model of double logistic maps one can expect interesting local bifurcations and global bifurcation phenomena. We show the possibility that the level of intolerance remains bounded but never repeats exhibiting chaotic dynamical behaviour. Time profiles of intolerances and conflicts, which start very close together, will separate exponentially. The strength of Nash equilibria gets terribly emasculated since predicting predictions of others become impossible, in the context of anti-social capital. An application of standard results of chaotic behaviour can be an important step forward to the understanding of the dynamics of intolerances and conflicts.

We then introduce the replicator dynamics, which examines the possibility that social behaviours can be copied, or replicated, by agents. At any point in time, we interpret the mixed strategy h as a population state in which each component h_i representing the population share of agents who are programmed to play strategy i. Agents, thus programmed to play a particular strategy, now have an incentive to update their strategies if current strategies fail to yield an average return. This leads to the possibility of self-selection of an equilibrium. From the proposed replicator dynamics

we find whether a low-intolerance, or high-intolerance, equilibrium gets established depends on the initial proportion of agents (population share) programmed to choose a low-intolerance strategy. We find a critical value of h_1, h_1^*. For $h_1 < h_1^*$, the replicator dynamics converges to the low-intolerance equilibrium. For $h_1 > h_1^*$, the replicator dynamics converges to the high-intolerance equilibrium.

CHAPTER 3

CYCLES OF VIOLENT CONFLICTS AND PEACE IN A DYNAMIC MODEL OF THE GLOBAL SYSTEM

3.1. INTRODUCTION

Violent conflicts and peace are the flip sides of the same coin of our societies. In many societies, sometimes conflicts of violent nature paralyse our collective senses, which result in an appalling destruction of economic and social assets and abysmal loss of human lives. In similar societies, a peaceful resolution of serious conflicts takes place. Even many societies seem to traverse from conflicts to peace and to costly conflicts again. The goal of this chapter is to examine the foundation of cyclical fluctuations in the level of conflicts. One can ponder that a low level of conflict is a peaceful composure, while a high-level conflict represents a lack of peace. However, admittedly, it is impossible to pin down a level of conflict as a threshold between peace and violent conflicts. There is no science that we are to apply to define this threshold, or boundary, and we will rather depend on the common sense. Our simple definition of peace is somewhat tautological: peace is an absence of an unacceptable level of violent conflicts. What is an acceptable level of conflict in a society? It is important to note that it is virtually impossible to banish violence and conflicts from a society – especially at its current stage. We will thus externally impose a cut-off point for conflicts below which a society is taken as peaceful and beyond which the society descends into a conflictual crisis. Our intention is to explore whether the system has its own internal dynamics to fluctuate between peace and violent conflicts.

The question of peace vis-à-vis conflict is neither well understood nor fully addressed by social scientists. Though intolerances are universal, serious and costly conflicts occur disproportionately in low-income countries and push these nations further down the poverty trap. An important consensus today is that serious conflict has a substantial economic dimension; hence, we

expect economists to proffer a positive contribution to our collective bid to analyse conflicts. Central to the economic modelling of conflicts is the trade-off between production and appropriation as initiated in the literature by Haavelmo (1954). Thus, the key to conflicts rests upon a *rational* choice between production and appropriation. Hirshleifer (1995a) defined a system *anarchic* in which rivals seize and defend economic resources without an effective regulation from above. In the classic work, Hirshleifer demonstrated that anarchy arises as an economic equilibrium of spontaneous order and is not *chaotic* by any means. It is further argued that anarchy is a *fragile* equilibrium that can easily descend into formless 'amorphy' or chaos. Anarchy has also the tendency to become a more organised system such as hierarchy. In an anarchic system, decision-makers have to divide current resources into two competing uses: (1) exploiting the currently held assets in a productive manner and (2) seizing and defending a resource base. Thus, there are two technologies for each contender, or rival claimant: one is a technology of production and the other is a technology of appropriation, conflict and struggle (Hirshleifer, 1991, 1995a).

The existing literature also places an overt emphasis on conflict as a contest between rational agents (see Grossman, 1991, 1994). The economic theory of anarchy and contest explains conflict by modelling optimal behaviours of participants and offering an equilibrium conflict. The equilibrium conflict is a product of optimal group decisions to produce economic output and to fight such that no individual has an incentive to unilaterally move away from this equilibrium. Thus, one can view, following Hirshleifer (1991, 1995a), that the anarchy and conflict are a spontaneous order of a Nash equilibrium, which derives from the optimal choice of contesting agents. A serious problem emerges when economic agents do not harbour the *common* knowledge that every agent is fully and clinically rational. It is well known as Binmore (1988) articulated that the fact that some people are not smart enough to get their sums right does not mean that one should re-write the rules of arithmetic. Yet as aptly highlighted by Sugden (1988), what should be the optimal act of an agent if s/he confronts an irrational agent? The bounded rationality is a serious challenge to the application of the deductive equilibrium method to the study of conflict.

The major motivation for conducting research in the bounded rationality derives from the collective 'dissatisfaction' of our profession with the dominant paradigm of *rational agency* (Rubinstein, 1988, 1991). The paradigm of rational agency models an economic decision-maker as 'perfect rational man' who has the uncanny ability to optimise: given his well-defined preferences, he can *correctly* choose the best outcome from the feasible set

of alternatives. Even in the mainstream economics, the dissatisfaction with this paradigm arose due to escalating evidence that there is a serious hiatus between what the paradigm assumes and the actual human behaviour, mainly in laboratory-based observations (see Allais, 1953; Kahneman & Tversky, 1979). Herbert Simon, in a series of papers written in 1950s, established alternative models of decision-making that constitute a serious departure from the paradigm of rational agency (see Simon, 1955, 1956). Despite the fact that these works of Maurice Allais and Herbert Simon received wide popularity and serious recognition, the profession did not make further progress on developing alternative models of economic decision-making until the experimental economics bursts to the scene (see Rubinstein, 1988).

Major research in experimental economics was led by Vernon Smith and Daniel Kahneman to examine human behaviour in laboratories. Results are, at best, mixed. In some experiments, subjects of experiments – though fraught with bounded rationality and other distortions in their mental models – do home in on the best outcome as predicted by the paradigm of rational agency (Kahneman & Tversky, 1979; Tversky & Kahneman, 1986). In the context of market allocations, Vernon Smith came to term these experimental models as *smart markets* (Smith, 1991). Experimental economics, with the aid of structured experiments, established circumstances in which the paradigm of rational agency did not hold (Hargreaves Heap & Varoufakis, 2002).

It is only recently that the paradigm of bounded rationality has been applied to the context of conflict (see Moyersoen, 2006). Following Moyersoen (2006), in this work, we examine impacts of irrationality on conflict by posing the following question: To what extent ensuing conflict is a product of misperception and irrationality of agents?

In order to address this important issue of irrationality and conflict, we make several departures from the dominant economic models of conflicts: first, we adapt a simple model of duopoly that allows us to depart from the dominant model of *rational* choice between production and appropriation as highlighted in the existing literature. Secondly, our model also departs from the current focus on equilibrium conflict as a contest in which the game has a unique and globally stable Nash equilibrium. Finally, the main problem with the existing line of research has been its sole reliance on the equilibrium analysis as a tool of investigation. We, on the contrary, argue that conflict embraces a very dynamic field that is, in turn, influenced by bubbles of expectations, desires for domination and a constant quest for survival. It thus seems that the equilibrium approach to modelling conflict ignores various dynamics and psychological facets of conflict. One may argue this as a general weakness of the economic approach to conflict analysis.

Economists typically focus their attention on economic models with regions of local stability on the assumption that regions of instability are of little importance and more of a pathological case (see Gangopadhyay, 2004, 2005, 2002, 2000). The main justification for using the equilibrium analysis in this context is that the research does not find exploding time paths of any significant variable. This justification is incorrect once we introduce the possibility chaotic dynamics. The development of chaotic behaviour significantly undermines this dismissal of regions of instability that can actually generate complex, yet deterministic, dynamics within bounds. This is where we pitch our work to highlight the importance of chaotic behaviour in the context of conflict as highlighted in earlier work of Furth (1986), Kopel (1996) and Puu (1998). The major innovation of our work is three-fold: first, we consider the race for market domination between rivals who seek long-run survival and growth – instead of short-run profits. Secondly, we develop a simple model to capture the dynamics and fluidity associated with non-equilibrium conflict in which agents may depart from the paradigm of rational behaviour. Finally, we strain the theory of chaos to shed lights on the time profile of conflict in our simplified model.

The recent economic literature on conflict led by Hirshleifer-type models has reignited interests of researchers in conflicts over economic resources. A major weakness of Hirshleifer-type models is that they are static. In an interesting paper, Reuveny and Maxwell (2001) examine conflict dynamics over renewable resources which thereby lend a dynamic flavour to the traditional Hirshleifer-type models. Their model demonstrates how a complex nonlinear dynamics can characterise the time profile of conflicts over renewable resources. However, Reuveny and Maxwell (2001) retain the critical assumption of Hirshleifer models that relevant actors are fully rational. Conflict is therefore modelled as a rational activity. On the contrary, our model examines conflict dynamics when actors are known to deviate from the clinical paradigm of rationality. Our model demonstrates how chaotic regimes can emerge when actors are known to be imperfectly rational.

3.2. A BRIEF SURVEY OF THE EXISTING LITERATURE ON VIOLENT CONFLICTS

At the outset, it is important to note that each conflict is different in its own way: international conflicts, rebellions, civil wars, secessionist civil wars, wars against colonial rules, domestic terrorism, international terrorism,

state failures and genocide are different forms of conflicts that represent departures from peace. However, their precise causes, levels of belligerence, internal dynamics and resilience are simply heterogenous. As a result, any attempt to put them in a common model can be dangerous. Yet most of the attempts in economics have precisely done that.

The economics literature offered a narrow theoretical model as highlighted before. The main model of conflicts examines civil conflict. In Grossman (1991), a government and rebel group maximise their expected utility from states of war and peace. The government has access to revenues and royalties, but is challenged by the excluded rebel group, which may violently overthrow it. As a corollary, the government can use the fiscal system to transfer resources to rebels to 'buy' peace, and an external third party may contribute resources and set incentives for the local parties to commit to peace. Thus, in such models, peace arises as a complete absence of violent conflicts between a government and a rebel group. Conflicts, or peace, are thus a product of the economic greed to extract resources or rents.

As to be articulated in Chapters 4 and 6 of the book, political scientists highlight the role of grievance behind conflicts, which is usually driven by inequality, injustice and economic ill-fare. However, the dichotomy between greed (appropriation of rents, see Collier & Hoeffler, 1998, 2002a, 2002b) and grievance (deep-rooted injustices, as expounded by Gurr 1970 and later by Stewart 2000) in this standard model to explain the origin of conflict should shift into a balance in which both coexist. But it has not yet been analytically explored an endogenous relation between greed and grievance. In Chapters 3 and 4, we argue that either or both greed and grievance can explain violent conflict or its duration. However, most violent conflicts arise due to the absence of a mechanism that can peacefully resolve differences between groups (the social contract).

Economic impacts of conflicts are usually measured in terms of the effect of wars on economic growth and absolute poverty. Empirical studies have estimated the effects of wars on economic growth and poverty (Alesina, Özler, Roubini, & Swagel, 1996; Collier & Hoeffler, 2002a, 2002b; Miguel, Satyanath, & Sergenti, 2004; Doppelhofer, Miller, & Sala-I-Martin, 2004; Elbadawi & Sambanis, 2002). There are interesting studies that examined the impacts of wars on other social and economic variables like education, health, nutrition, migration or household survival strategies. A comprehensive survey of the literature is found in Justino (2006). Available evidence is usually inconclusive with respect to a dominant cause of conflicts and war.

Some important studies deny the merits of the grievance hypothesis (Collier & Hoeffler, 1998, 2002a, 2002b), others find an overwhelming support for it (Stewart, 2000; Østby, 2008). As our findings in Chapters 4 and 6 show that grievance may coexist with greed, it is almost impossible to disentangle them. More eclectically, Kaldor (2001) suggests that globalisation leads to new internal wars that blend political and criminal motives. Our Chapter 2 provides a comprehensive foundation to it.

Given serious data gaps and restrictions to disentangle causality, recent research has offered significant insights into the microeconomic theoretical underpinnings of conflict origin and resolution. Models created an important framework in which greed and grievance are driving forces in triggering, driving and fuelling conflict among local groups, with a recent incorporation of external players, commitment mechanisms and imperfect information (Rothchild, 2005; Azam, 2005; Walter, 2002). Our Chapter 6 provides a complete foundation to the economics of conflicts dictated by a partnership formation between local, or regional groups, and external/international players. Azam and Mesnard (2001) characterises civil war as a situation in which the state breaks its implicit promise to make a fiscal transfer to all of the society's members. The absence of the promised largesse creates a grievance in the excluded group, which rebels and fights against the government to redress its grievance. Azam and Mesnard (2001) argue inter-ethnic conflict in Africa as the result of the state's failure to make a fair provision of resources among ethnic groups, thus encouraging individuals to rely more on ethnic capital. In this setting, meaningful peace will fail to be restored and sustained if grievances about the distribution of rents, resources or public spending (and taxes) are not redressed. The heart of this theoretical approach is the perception of conflict as breach of an agreement between groups, a deviation from a contract that results in some sort of state of anarchy (Hirshleifer, 1995b), following Hobbes' Leviathan in 1651, whereby in an original state of nature – akin to a jungle – humans were at perfect liberty to prey upon each other with impunity. Factors such as inequality, poverty, polarisation, exclusion, ethnic tensions, natural resource appropriation all contribute to the risk of conflict, yet some societies having such conditions do not descend into conflict.

For greed, grievance or both to take the form of large-scale violence, there must be problems with the ground rules that lead to inequality, injustice and grievances as highlighted in Chapter 4. As a result, the 'social contract' does not get enforced as shown in Chapter 2. By social contract, we signify a framework of widely agreed rules, both formal and informal, that govern the allocation of resources, including resource rents, and the peaceful

settlement of grievances. If enforceable, the contract can be sufficient to restrain, if not eliminate, opportunistic behaviour such as large-scale theft of resource rents and the violent expression of grievance.

Kant's (1795) essay on the 'Perpetual Peace' is an important reading for social scientists. How can one define a social contract with an agreeable set of desirable properties: first, contracts must be self-enforcing, hence the term perpetual, so that there are no incentives to deviate from it. What we argue in Chapter 2 is that the modern era of globalisation has created serious problems for the self-enforcement of the social contract – especially the informal elements. Second, a good government (translated to more modern terminology, good governance) must hold the social contract together. Our Chapter 1 shows how and why the good governance can fail in our current international milieu due to clientalisation. Third, it must emanate from a sovereign and legitimate power – with the continual integration of the globe, it is becoming almost impossible to have a source of legitimate sovereignty. In this context, Humphreys (2005) argues that sparse economic interaction makes wars between competing groups more likely as their opportunity cost from a destructive war is smaller. It is now increasingly realised that conflicts are inversely related to state capacity to collect taxes (fiscal capacity), enforce contracts and promote markets (legal), recently discussed in Besley and Persson (2007). The authors argue that external wars can promote the development of state capacity on behalf of a common interest externally threatened. On the other hand, prospects of internal conflict can de-incentivise a government from investing in state capacity. In the case of resource-rich societies, in particular, conflict prospects may specifically increase resource extraction, which may be used to either finance the military, increase elite's gains or diversify the economy and deliver public goods to buy peace. The preferred outcome will both depend on what optimises the survival function of the elite groups in power (Caselli & Cunningham, 2007) and the set of rebels' opportunity and incentives to appropriate such gains. There are many examples of conflicts due to fiscal disputes. Côte d'Ivoire, as an example, became unstable with the collapse of the social contract implemented by the late President Houphouët-Boigny, in which he allocated public spending across the regions to buy the loyalty of the country's ethnic groups. Disputes over the apportionment of revenues from natural resources are especially common and, as in Indonesia and Nigeria, these take on ethnic and regional dimensions.

Fiscal arrangements need not break down to cause the collapse of a social contract and the onset of crises and conflicts. The redistribution that takes place in existing arrangements may not be perceived as a 'fair' distribution

of gains from economic growth among groups. Conflict theorists (see Bates, 2001; LaFree & Tseloni, 2006) – as opposed to the Lipset (1960)'s modernisation theory – highlight that the transformation towards capitalist market, modern economies has more often than not resulted in increasing inequality, unemployment and poverty.

High or higher average incomes may well hide a widening gap among groups, leading to sentiments of greed, selfishness and historical resentment leading to violent conflicts. Least developed nations have histories of weak governance and incomplete implementation social contracts or disintegration of a prior strong social contract. This specific weakness is in many instances a legacy of colonialism that institutionalised mechanisms favouring settlers over native peoples and thereby divide and rule by favouring one ethnic group over another.

In all the above, we notice a complete absence of human psychology and partial irrational behaviour that can trigger and drive conflicts in a society. The goal of the following section is to offer a formal model to explain how the dynamics of interactions between rival groups can endogenously fluctuate from conflicts to peace and to conflicts again.

3.3. A MODIFIED COURNOT MODEL: PREDATORY ACTIVITIES AND RIVALRY TO CAPTURE BUYERS

A simple allegory to explain the proposed model is as follows: two predators simultaneously enter a grazing ground wherefrom they simultaneously capture their preys by choosing levels of their predatory activities. Once they bag their prey, they receive some return from their captured preys. Their decision variable is the choice of predatory activity given the anticipated predatory activities of their rivals. The economic model that we propose is thus a modified Cournot model: we consider a market that has duopolists (hereafter sellers) selling a good to a large number of consumers. We assume consumers' disposable income is constant and given as Y. We assume that a fraction h_i of Y is spent on the good sold by seller i. The rivalry and potential conflict between these two sellers are introduced by this coefficient h_i. Note that the sellers are the predators and buyers are the prey. In our model, we assume that each seller can control h_i that is equivalent to capturing buyers. This means each seller enjoys a direct power over their captured buyers.

It is imperative that we provide some concrete examples to rationalise how sellers can exercise a direct power, or leverage, on their buyers. The

above power, or leverage, will arise in modern industrial markets when buyers have serious *switching costs* as extensively modelled and examined by Klemperer (1987a, 1987b) and Bulow et al., (1985). These switching costs of buyers will cause *market fragmentation* and sellers will enjoy local monopoly power in their respective market segments or fragments (see Basu & Bell, 1991). One interesting example can be drawn from the experience of rural credit markets in developing nations: from time immemorial down through various phases of history, in rural credit markets, the landed aristocracy, or large farmers, have considerable influence on small farmers. Small farmers rely on the aristocracy for both consumption and production loans, which leads to some kind of market fragmentation. Small farmers can obtain loans only from specific large farmers and thus become *captive* to the landed aristocracy (see Braverman & Stiglitz, 1982). We also know that the credit market leverage spills easily into product markets where the aristocracy takes on various exploitative roles in order to extort extra rents, both in kind and cash, to force reservation utilities upon small farmers (Braverman & Stiglitz, 1982; Basu, 1983). It is now well known that the leverage of the landed aristocracy will influence upon the equilibrium prices and volumes of trade in credit and product markets, which is a form of interlinkages between credit and product markets (see earlier papers of Bhaduri, 1973; Bardhan, 1984; Rudra, 1982). Rural credit and product markets in developing nations often display interlinkages and fragmentation, and some of these interlinkages cause significant market distortions. It is, however, a moot point if these distortions are always harmful for captive agents (Braverman & Stiglitz, 1982; Basu, 1983). In other words, the underlying features of rural credit markets of developing nations often cause market fragmentation that, in turn, leads to the captivity of borrowers (small farmers) to lenders (large farmers). Lenders, as a result, have a strong leverage over their captive, or captured, borrowers. In terms of the allegory, our model will explain the formation of the captive market for each large farmer.

We assume that there is a predatory activity called 'capture and seizure' activity, labelled as Π_i, for each seller i. In terms of the above example, the predatory activity amounts to creating a captive market of borrowers. The act of capture and seizure by seller i gives a market share to seller i that offers economic return, R_i, to seller i and we now turn to it. Let Y be the potential captive market. In terms of our previous example, Y denotes the total borrowing of all small farmers. We postulate that, ceteris paribus, the larger the size of captured buyers by seller i, the higher is the value of h_i and $h_i < 1$. Thus, h_i represents the market share of seller i. Each seller

therefore has an incentive to outcompete one's rival in Πs to enhance one's market shares for survival. We represent these ideas in the following notations:

Output sold by seller is Q_i:

$$Q_i = Yh_i \quad \text{where} \quad i \forall 1, 2 \tag{1a}$$

We assume a simple linear relationship between h_i and Π_i and Π_j:

$$h_i = h_0 + h_1(\Pi_i - \Pi_j) \tag{1b}$$

Eq. (1b) states that the sales of seller are positively related to the relative level of predatory activity advantage of seller i. We assume the unit cost of production (C_i) of seller i to be linear in the predatory activity Π_i:

$$C_i = \beta_0 + \beta_1\Pi_i \tag{1c}$$

We assume a simple mark-up pricing rule so that the price of good sold by seller i (P_i) is given by

$$P_i = M_i(\beta_0 + \beta_1\Pi_i) \quad \text{where} \quad M_i > 1 \tag{1d}$$

This is a simple version of Kaleckian full-cost pricing as Kalecki (1971) has shown how pricing in the manufacturing sector depends on 'the degree of monopoly of the firm's position'. The degree of monopoly depends on a set of environmental and institutional factors (see Reynolds, 1987, pp. 55–56). The profits of seller i is R_i that is given as the residual between total revenues and costs:

$$R_i = P_iQ_i - C_i \tag{1e}$$

Substituting (1a) through (1d) into (1e) yields (2a):

$$R_i = Y(M_i - 1)[(h_1\beta_0 + \beta_1h_0)\Pi_i + h_1\beta_1\Pi_i^2 - (\beta_0 + \beta_1\Pi_i)\Pi_j + \beta_0h_0] \tag{2a}$$

A typical model of *rational* decision-making now performs maximisation of (2a) with respect to Π_i that will give rise to the following best response rule of seller i in terms of his predatory activity Π_i:

$$\Pi i = \frac{A_1 + E(\Pi_j)}{2} \tag{2b}$$

$$A_1 = -\left(\frac{h_1\beta_0 + \beta_1h_0}{2h_1\beta_1}\right) \tag{2c}$$

where $E(\Pi_j)$ is the expectation of seller i of the predatory activity chosen simultaneously by seller j. The deductive equilibrium approach imposes a condition here regarding the expectation of seller i as typified in the Cournot–Nash equilibrium (Gangopadhyay, 2000), or in rational expectations models (Gangopadhyay, 1999): the assumption is known as *zero conjectural variation* that posits that seller i assumes rival j will keep the strategic variable constant/pegged as he varies his own strategic variable (in our case predatory activities). Then a mutual consistency assumption is introduced to home in on the Cournot–Nash, or rational expectations, equilibrium (Gangopadhyay, 2005).

In our proposed model, under the assumption of symmetry, the pure-strategy Nash equilibrium (level of predatory activity) does not exist, since the profits of each seller are not concave in his own predatory activity. One can demonstrate the existence of a mixed strategy Nash equilibrium. In order to introduce non-equilibrium dynamics and characterise the conflict dynamics, we introduce the following key assumptions:

Assumption 1. Each seller refrains from maximising short-run profits and, instead, focuses on its survival and growth by the choice of predatory activity in an incremental fashion. At date $t+1$, seller adjusts predatory activity $\Pi_i(t+1)$ by the following rule:

$$\Pi_i(t+1) = \Pi_i(t) + a\left[\frac{\partial R_i(t)}{\partial \Pi_i(t)}\right] \tag{2b'}$$

where $[\partial R_i(t)/\partial \prod_i(t)]$ is the partial derivative of the profit function with respect to own predatory activity, 'a' the adjustment coefficient. Eq. (2b) states that if an adjustment in predatory activity raises (lowers) profits at date t by one dollar, then the seller augments (lowers) the predatory activity by this coefficient 'a'. Substituting the relevant equations yields

$$\Pi_i(t+1) = ah_1\beta_0 + a\beta_1 h_0 + (1 + 2ah_1\beta_1)\Pi_i(t) - a\beta_1 E(\Pi_j(t+1)) \tag{2c'}$$

where $E(\Pi_j(t+1))$ is seller i's expectation of the predatory activity to be chosen by seller j at date $(t+1)$. For simplification, we assume $h_1 = 1$, which gives without a loss of an analytical bite:

$$\Pi_i(t+1) = a\beta_0 + a\beta_1 h_0 + (1 + 2a\beta_1)\Pi_i(t) - a\beta_1 E(\Pi_j(t+1)) \tag{2d}$$

Assumption 2. We assume $E(\Pi_j(t+1))$ be given by the following:

$$E[\Pi_j(t+1)] = F(\Pi_i(t)) = N_1\Pi_i(t) - N_2[\Pi_i(t)]^2 + N_3 \tag{3a}$$

We assume the same for seller j.

First, it is important to note that the assumption (3a) is a breach of the deductive equilibrium approach – since we have not introduced the syntactic concept of equilibrium here (see Gangopadhyay, 2004, 2005). Secondly, the assumption of (3a) posits a shared mental process: each seller thinks that as he chooses a higher level of predatory activity to dominate the market (as seen by market shares), his rival will oppose this tactic by choosing a higher predatory activity till a point $(N_1/2N_2)$. Beyond this threshold, each seller thinks that the rival will acquiesce to his dominance by scaling down the predatory activity. This assumption is equivalent to some kind of anticipated conflicts as reflected in the increases in the predatory activity by each seller when both sellers attempt to dominate the market. As the conflict reaches the threshold, each expects the other to roll over. As opposed to this assumption, the deductive equilibrium approach assumes that each seller thinks that the rival will not change its predatory activity (strategic variable) if he changes his predatory activity to dominate the market. What it boils down to is an implicit assumption made by the deductive equilibrium approach that each seller assumes there will be no market conflict as the rival is always going to capitulate by not responding to his tactics to dominate the market. This assumption may be realistic in some cases, but it seems completely naïve to believe that this assumption carries much weight when agents aggressively compete against each to enhance their market shares for survival and growth. From the above, we offer the following results.

Result 1. The dynamics governing the predatory activity of seller i is reduced to the following:

$$\Pi_i(t+1) = \gamma_3 + \gamma_2 \Pi_i(t)^2 + \gamma_1 \Pi_i(t) \qquad (4a)$$

where $\gamma_3 = a\beta_0 + a\beta_1 h_0 - a\beta_1 N_3$, $\gamma_2 = aN_2\beta_1$, $\gamma_1 = 1 + 2a\beta_1 - a\beta_1 N_1$.

Proof. Substituting (3a) into (2b′) yields (4a) (Q.E.D.).

Assumption 3. We make a simplifying assumption to consider a symmetric equilibrium that makes the analysis tractable.

$$\Pi_i(t) = \Pi_j(t) = \Pi(t) \qquad (4b)$$

From Feigenbaum (1978) and May (1976), we know that the second iterates cause more fixed points and the stability of the system has to be considered in the light of Eqs. (4a) and (4b).

Result 2. The dynamics of predatory activities as described in Eqs. (4a) and (4b) has two fixed points or steady states:

$$\Pi^* = \frac{1 - \gamma_1}{2\gamma_2} - \frac{\sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}}}{2\gamma_2} \tag{5a}$$

$$\Pi^{**} = \frac{1 - \gamma_1}{2\gamma_2} + \frac{\sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}}}{2\gamma_2} \tag{5b}$$

The stability of fixed points requires

$$\Pi < \frac{1 - \gamma_1}{2\gamma_2} \tag{5c}$$

Thus, Π^* is a stable fixed point under a restriction while Π^{**} is an unstable fixed point (Q.E.D.).

Result 3. The above fixed point Π^* loses stability if

$$\sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}} = 2 \tag{5d}$$

The first fixed point Π^* is stable if

$$\sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}} < 2 \tag{6a}$$

Proof. Simple substitutions yield the results (Q.E.D.).

Now it is possible to derive two limits on Π within which the predatory activity is to be bounded. We call them Π^{MIN} and Π^{MAX} and note

$$\Pi^{MIN} = \Pi^{**} - \left(\frac{\gamma_1}{\gamma_2}\right) \tag{6b}$$

$$\Pi^{MAX} = \Pi^{**} \tag{6c}$$

Note that the dynamics of predatory activities is bounded if

$$\Pi(t) < \Pi^{MAX} = \Pi^{**} \quad \text{for } t = 0, 1, 2 \ldots \tag{7a}$$

$$\Pi(t) > \Pi^{MIN} = \Pi^{**} - \left(\frac{\gamma_1}{\gamma_2}\right) \quad \text{for } t = 0, 1, 2 \ldots \tag{7b}$$

$$\sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}} < 3 \tag{7c}$$

It is possible to make suitable changes in variables to arrive at the following dynamics:

$$X_{t+1} = AX_t(1 - X_t) \tag{7d}$$

$$A = \sqrt{\{(1 - \gamma_1)^2 - 4\gamma_2\gamma_3\}} + 1 \tag{7e}$$

$$X_t = \gamma_3 \frac{[\Pi^{**} - \Pi(t)]}{A} \tag{7f}$$

Observation 1. The dynamics of predatory activities converges to the stable fixed point Π^*if $1 < A < 3$. However, the fixed point Π^* becomes unstable if $A > 3$ and a two-period cycle of predatory activities appears. If $A > 3.57$, the cycle evolves through a cycle of infinite period. The level of predatory activities is bounded within the aforementioned limits (7a) and (7b), yet the level never repeats itself (May, 1976).

3.4. A BRIEF DISCUSSION

It is now possible to characterise the dynamics: for $1 < A < 3$, the dynamics of rivalry, or predatory activities, will converge to the stable steady state. This is the region of stability that plays an important role in the deductive equilibrium analysis as discussed in Gangopadhyay (2005) and Gangopadhyay (1997). If the value of A is increased above 3, Π^* becomes unstable and predatory activities converges to a stable two-period cycle. As the value of A is increased further, the stable period cycles of n bifurcates into cycles of period $2n$. From Feigenbaum (1978), we know that the range of values of A for which the nth cycle is stable shrinks at a geometric rate. For $A > 3.57$, the profile of predatory activities evolves through a cycle of infinite period. The choices of predatory activities are within the relevant bounds but never repeat. For a higher order, these choices may look like a random process but are fully deterministic. In other to demonstrate the importance of the results, we have chosen three sets of values of relevant parameters, namely Sets I, II and III. These hypothetical values of the eight parameters are given in Table 3.1, and the resultant value of A is calculated for each set of parameters.

Table 3.1. Characterisation of the Dynamics.

	a	β_0	β_1	N_1	N_2	N_3	h_0	h_1	A
I	0.5	1	5	3	0.5	1	0	1	5.03
II	0.5	1	5	3	0.5	0.2	0.001	1	3.509
III	0.5	1	5	2	0.5	0.8	0.5	1	2.118

Source: Computed from the hypothetical values of the parameters.

Note that for Set I, the value of A is 5.03, which is greater than the critical value of 3.57. As a result, the profile of predatory activities will exhibit chaotic dynamics for the assumed values of parameters in Set I.

For Set II, the value of A is calculated to be 3.509 and hence, the postulated dynamics will be characterised by a stable two-period cycle as the equilibrium loses its stability. For Set III, the value of A is 2.118 and the postulated dynamics of rivalry will converge to the stable equilibrium.

Let us now have a clear comparison of our findings with the traditional equilibrium analysis: the Smithian perspective on mutually beneficial exchanges highlights a congruence of interests of market participants – say, a buyer wants some milk and is ready to give some money to the milkmaid for it, and the milkmaid wants money and is, therefore, ready to give a carton of milk in exchange. This exchange allows each to achieve one's goal and they, thereby, help each other. In a complex market mechanism, however, economic problems are often embedded in a conflicting situation. It is recognised that the market mechanism can easily handle congruent interests but may fail to resolve conflicts in a harmonious or fair fashion (see Sen, 1984). To redress such conflicts, the visible hand of government has usually been invoked (Ostrom, 1987). In this work, we highlight conflicts in the traditional way: we introduce conflicts at the market level in the usual fashion as market rivalry – two prototype firms compete against each other for market shares. By applying the simple game-theoretic reasoning and the postulated Cournot behaviour, one may have obtained the equilibrium market outcome (mixed strategy equilibrium). However, the core of the problem remains that the emerging market outcome, conduct of firms, market shares and take-home profits of these rivals critically depend on the anticipated reaction of one's rival to one's predatory behaviour. If agents are imperfectly rational and anticipate some kind of opposition from one's rival to one's predatory activity, the system can engender chaotic behaviour in terms of predatory activities.

3.5. CONCLUSION

The finding has important bearings: it is typically assumed in the deductive equilibrium approach to modern economic theory that the Nash equilibrium dispels all systematic prediction errors and the economic system settles in an equilibrium characterised by self-confirming and mutual-best responses. This approach has its strong influence upon economic theory of conflict, as the traditional literature on production and appropriation demonstrates the existence of an (Nash) equilibrium conflicts from which no agents have any incentive to unilaterally deviate. However, little attention has been given to the regions of instability. We establish that the postulated dynamics of predatory activities can exhibit chaotic behaviour. Agents now fail to see systematic errors. Agents also fail to make long-run predictions with certainty even thought they act in a deterministic world. Time profiles, which start very close together, will separate exponentially. The strength of Nash equilibria gets terribly emasculated. We conclude that an application of standard results of chaotic behaviour in the context of conflict issues can be a very important step forward to understand the dynamics of conflicts.

CHAPTER 4

POLITICS OF DEFENCE SPENDING AND ENDOGENOUS INEQUALITY

4.1. INTRODUCTION

In recent years, economics has turned its serious attention to the explaining of conflicts and a peaceful resolution of conflicts. Some interesting and powerful microeconomic models have been developed, yet it seems there are gaps that motivate the current research. As our discussion shows below, the existing models are robust in explaining an equilibrium defence spending of a nation in a general equilibrium setting. Yet, there is little that we know about the regional distribution of defence spending that is likely to give rise to serious rent-seeking activities, politicking and consequent economic consequences in terms of regional disparity and inequality. In this work, we posit that defence spending is like a local public good that impacts on a regional, or local, economy. To be more specific, our model suggests that defence spending offers public infrastructure to a regional economy that, in turn, impinges on the costs of production of local firms, which thereby influence the competitive positioning of the regional economy in the national, or global, market. The goal of the work is to explore how the politics of allocation of defence spending can create an equilibrium regional inequality within a nation, which may in turn drive internal conflicts. Since an allocation of defence spending impacts on regional inequality, regional inequality becomes endogenous in our model. We establish an equilibrium inequality in our model that depends on the optimal allocation of defence spending across regions, which is driven by the electoral motive of an incumbent government.

Conflict models are usually cast as general equilibrium models with presumed perfectly competitive markets that involve a trade-off between economic and productive activity, vis-à-vis unproductive activity entailing conflicts. This is the much-famed trade-off involving 'guns and butter' of economics. Hirshleifer (1988, 1989, 1995a, 2000) put forward several models

to explain conflicts in terms of three economic variables: (1) preferences, (2) opportunities within constraints and (3) prevailing perceptions. Hirshleifer in his work introduced a contest to explain conflicts as a means to make economic gains. One of his many contributions to the field is to introduce a Tullock-type contest success function that came to be called 'conflict technology' in the relevant literature. In the light of the conflict technology and an economic prize to be won from conflicts, akin to that of a contest, Hirshleifer offered an equilibrium conflict as a Nash equilibrium of the proposed contest such that efforts (guns) are chosen as the mutual-best responses of the micro agents. The Hirshleifer model thereby explains feasible equilibrium defence expenditures/spending of a group of competing nations. The prototype model was further finessed to explain various interesting results related to the incentives of nations to arm themselves and explore the well-known paradox of power.

Several important papers developed along the line of Hirshleifer-style model, which focussed upon the optimal choice of a nation on defence spending in the context of a general equilibrium setting. The important work of Grossman (1991, 1998, 2004) also shares the similar notion of conflict, however, in a richer setting. Grossman reduces a society into three groups: first, there is a group of peasants who decide to choose between two activities – to fight or to produce an agricultural product. The second group represents a government agency who taxes the peasants and thereby collects a booty and raises an army to protect the booty. The third group is a rebel group who recruits and raises a rebel army from the peasants to fight the government for the booty. The rebel group funds their activities by raising an army and looting peasants. It is the treatment of rebellion as business that is one of the most distinguishing features of conflicts – insurgents are similar to bandits, or pirates, who engage in rebellion and conflicts to make profits. Thus, the new model of Grossman is more intricate than the models of Hirshman; however, the fundamental notion is that conflicts are akin to a contest for acquiring resources, as opposed to a peaceful participation in a market exchange that involves a mutually beneficial trade. Conflicts are a zero-sum game – there is only one winner in the contest who takes the whole prize or stake. Conflicts are a product of rebellion that is akin to an industry that creates profit-making opportunities from an act of piracy or looting. The rebel group has an increasing marginal cost of recruiting soldiers/fighters from the peasantry and also a declining marginal benefit in terms of the increased probability of winning a contest and the prize with increasing size of the armed force under the control of the rebel group. The economic equilibrium is struck where the marginal cost of

employing one more soldier is balanced by the marginal benefit of so doing by the rebel group.

Skaperdas (1992) introduced the possibility of cooperation, as opposed to conflict, in a game that repeats over time. In the proposed model, Skaperdas confirmed the existence of multiple Nash equilibria: the first Nash equilibrium involves a full cooperation equilibrium in which contesting parties share the available prize without arming themselves, under a set of restrictive assumptions. Thus, one may call the first equilibrium as a complete peaceful equilibrium in which nations invest zero dollar in defence spending as a Nash equilibrium. In the second equilibrium, only one nation invests in defence spending and the equilibrium has come to be termed as a partially cooperative equilibrium. Finally, he established the existence of a conflict equilibrium in which each nation spends adequate resources to create an effective conflict technology. Garfinkel (1994) extended the analysis to the international arena by introducing domestic politics as a determinant of defence spending of a nation. His famous result in a two-period model shows that electoral uncertainty in democracies can reduce the severity of international conflicts by inducing competing nations to reduce their defence spending as an equilibrium phenomenon. The negative impact of democracies on defence spending derives from the probability that the incumbent government will not be re-elected, which induces the incumbent governments to commit less on military spending.

Against the backdrop of this strand of economic theory, political scientists traditionally argue that conflicts and rebellions are actuated by political protests that are driven by deep-rooted *grievances* of people. The grievances are precipitated by a host of social banes like inequality, racial, ethnic or religious intolerances and oppression of one group by another. The exploitation of one group by another has also received a serious attention from Hirshleifer (2000) who calls this proclivity of human beings to form a gang upon others as the Machiavelli's theorem that can shape preferences and stir up grievances and exaggerate opportunities from conflicts. The political science literature has highlighted two elements in exacerbating conflicts: first, the type of political regime has been isolated as a determinant of conflicts (see Hegre et al., 2001). There is some evidence to believe that more democratic countries have a lower risk of war (see Collier & Hoeffler, 1998, 2002b). Secondly, economic inequality is believed to be an important determinant of conflicts, though recent economic studies have not found any systematic relationship between inequality and conflicts (see Collier & Hoeffler, 2002b). In their study, Collier and Hoeffler noted that low per capita income and low growth rates are contributing factors to conflicts.

Our principal goal is to develop a simple model to show how democracies can endogenously drive inequality that may play an important role in determining equilibrium levels of conflict in a society.

There is no doubt that we have excellent models that can explain an equilibrium defence spending in a competitive framework involving a group of rival nations. However, there is no further examination of the impact of defence spending on the economy and its constituent parts, since the only assumed role of defence spending is to extend the conflict technology of a nation as per the Hirshleifer-type model. Our model starts where the Hirshleifer-type models end in explaining an optimal defence allocation: we explore the spatial component of the defence spending, which has not been examined in the literature prior to our modelling. In order to model the spatial aspects of defence spending, the simplified story of our model subsumes the following: we examine government policy that concerns with an allocation of defence spending between two different regions or locations. We postulate that defence spending brings a host of local public goods to the regional economy like roads, electricity, water supply and security to life and property, etc. It is argued that the location of defence spending will therefore determine the short-run cost functions of firms in these locations where defence spending gets concentrated. These costs of production will, in turn, determine the nature of competition in the product market. As a result, government policy will endogenously determine the degree, or nature, of competition in the product market, which will determine the profitability of firms located in different regions. As a result, an allocation of defence spending also enables us to analyse the political cost: promotion of an industrial location/regions is an implicit taxation of firms in the other location/region. As the government increases defence spending in a location, voters from this constituency increase their political support for the incumbent government whilst this government loses votes from the other location. An allocation of defence spending thus influences voters' evaluation of the government and this evaluation constrains government policy on allocation of defence spending that, in turn, impinges on voters' evaluation.

In the proposed equilibrium of the game, the government chooses the optimal allocation that influences the voters' evaluation that, in turn, maximises the probability of re-election of the incumbent government. The optimal allocation will thus determine the nature of competition in the product market that will determine the take-home profits of regional firms and thereby regional inequality.

4.2. ECONOMIC IMPACTS OF DEFENCE SPENDING AND ITS SPATIAL CONSEQUENCES

The interrelationships between defence spending and economic growth of a nation have been extensively studied in the literature starting with the pioneering work of Benoit (1973) and others (see Benoit, 1978; Dunne & Smith, 1990; Dunne et al., 2005)[1]. The apparent inconclusiveness of the literature on growth and defence spending motivated economists to examine the spatial distribution of defence spending and its impact on the spatial, or regional, distribution of economic activities in a nation (see Atkinson, 1993). In the context of the United States, it is well recognised that the defence buildup of the 1970s and 1980s had a distinct spatial pattern benefiting some areas of the country while hurting others (Atkinson, 1993, p. 7). Economists have isolated three components of defence spending, which have serious regional implications. The first component of defence spending is the personnel expenditure that significantly impinges on the spatial distribution of (un)employment in the national economy, the second one is the operational spending (expenditure on defence bases and contracts, and investment and infrastructure expenditure) that drives the distribution of economic activities and the third one is the defence spending on research and development (R&D hereafter). The second and third components are shown to influence the regional distribution of public infrastructure and drive the mobility of private capital, which together unleashes the much-celebrated agglomeration process to build the production network of a regional economy[2]. We now look at the specific experiences of some nations in terms of the spatial consequences of their defence spending.

In the United States, the military's presence in the Tenth Federal Reserve District (Reserve District, hereafter)[3] has been an important part of the American history. The most unique defence institutions in the Reserve District are part of the US Department of Energy that includes the Los Alamos and Sandia National Laboratories in northern New Mexico, which ensure the safety and reliability of the US nuclear weapons stockpile and undertake research on national security issues. It is important to note that Department of Defence contracts are relatively less important in the Reserve District than in the nation. However, the mammoth presence of a number of private defence contractors like the Boeing Company is believed to have more than compensated the lack of defence contracts in the region. The Reserve District is home to a disproportionately large number of national guardsmen and reservists, individuals who have played an increasingly important role in

national defence in recent years. In the Reserve District, it has been firmly established that certain types of defence spending do boost the regional economy: investment type of spending like R&D and equipment procurement are a consistent source of regional economic growth (Mehay & Solnick, 1990), while spending on personnel and service contracts (operations-type spending) have positive impacts on regional employment[4].

The Reserve District is known to have significant concentration of defence spending: in 2006, defence spending accounted for an estimated 6% of overall GDP in the Reserve District – about 25% larger than the US average. The district state with the largest defence presence is New Mexico, where an estimated 11% of economic output is accounted for defence-related activities. The region also has a sizable presence in 'other defence expenditures', which are largely personnel or base related. The Reserve District is home to a sizable number of military installations, some of which are among the largest in the country. The overall picture is that the concentration of defence investment spending and private defence contractors have aided the Reserve District to maintain its strong economic growth, while the spatial concentration of operations-type defence spending has given stability to regional labour markets. The strong regional growth and buoyant labour markets are a source of regional disparity in favour of the Reserve District in the United States.

The Swiss experience of spatial consequences of defence spending has been examined by Bernauer et al., (2009). The results are instructive: for instance, the canton of Uri attracts 3% of the total ArmaSuisse defence spending in Switzerland. In per capita terms, this translates into a share of 640% above the average cantonal allocation. The canton of Bern, to take another example, receives 35% of ArmaSuisse spending, whereas its share relative to the national average is 276%. The distribution of defence spending across cantons has significantly impacted on the regional labour markets by stabilizing unemployment at lower rates. Since the economic growth depends on a host of factors, other than defence spending, the distribution of defence spending has not contributed to the dispersion of cantonal growth rates; however, the authors recommend a further and more careful study.

Some European case studies have also highlighted the role of defence spending in boosting regional economies with strong spatial consequences. For example, Bishop (1992) studied the spatial, or regional, economic impact of a major dockyard and naval base in the counties of Devon and Cornwall in the United Kingdom. He observed that out of the 29,900 jobs that were supported directly or indirectly by the dockyard complex, 6,900 jobs directly depended on local expenditure by base and dockyard facility

employees. The Devonport complex was estimated to generate about 5% of annual total income in the sub-region. If the dockyard were closed, it was estimated that the sub-region would lose 3.7% of its income and 22,600 jobs. The regional unemployment rate will increase to 20% in that case.

Battistelli (1991) considered defence-dependent occupational groups in the Rome region in Italy in 1987. He identified 52 defence companies in the region, employing about 12,000 workers with a further 2,000 jobs in sub-contracting. He estimated that these defence-dependent jobs amounted to around 8% of all industrial employment in the Rome region. Huck (1991) studied the impact of defence spending on employment in the region of Munich (Germany) in 1986. He found that 8% of manufacturing employment and 11% of metalworking employment were directly dependent on defence spending.

4.3. STRATEGIC TRADE AND INVESTMENT MODELS: A DISCUSSION

Our model bears a close resemblance to the models of strategic trade and investment, which have known deficiencies. Our model can be applied to address these deficiencies. The strategic trade and investment models attracted serious criticisms on two well-known grounds: first, their conclusions are extremely sensitive to the assumptions about the mode/nature of competition (Krugman, 1992, p. 363). Secondly, it is also highlighted that the optimal rent-seeking policy loses much of its gloss once we consider political costs associated with the policy (Dixit & Grossman, 1986, p. 234). An important step towards a better understanding of this issue requires one to endogenise the mode of competition and also to introduce explicitly government policy-making in this context. In some sense, our model makes both the nature of competition and the government policy-making endogenous and, thereby, provides a framework in which public policy like defence spending, conduct of firms and political decisions are endogenously determined.

Our concern is to address two critical issues of public policy and government involvement in the context of strategic investment models: first, the nature of competition plays an important role in determining whether government policy has the intended and desirable effects. It is also important to model the nature of competition endogenously in this context, since government policy can significantly influence the nature of competition through its effect on defence spending (Dixon, 1986). Secondly, the promotion

of one region with one set of firms represents a 'taxation' of others. Government policy thus entails a political cost that is an important ingredient for formulating government policy. The existing literature has a gap, since it does not make both government policy and nature of competition endogenous. This is a major difficulty with the rent-extraction argument, since political costs constrain government's behaviour whilst the benefits from strategic government policy largely depend on the endogenous degree of competition. An optimal government policy will thus be misconstrued unless we determine these elements endogenously.

We combine two distinct ideas – namely, the probabilistic voting model and the conjectural variations model – to endogenise the nature of competition and the government policy. First of all, the probabilistic voting model is a recent development in political theory to counter the time-honoured predictions of the traditional political theory (Wittman, 1989): for centuries, social thinkers argued that democratic governments are plagued by the absence of a stable electoral equilibrium and the risk of expropriation of minorities by majorities. The probabilistic voting model, by assuming a universally concave votes-to-offers curve, establishes the existence of a stable voting equilibrium and also that the expropriation argument is 'an optical illusion'. The probabilistic voting model will allow us to endogenise the relevant government policy. Secondly, the conduct of firms has been made endogenous in a very important contribution of Bresnahan (1982) that is popularly known as the conjectural variations model. Laitner (1980), Bresnahan (1982), Kamien and Schwartz (1983) and Perry (1982) questioned the robustness of the Cournot model as an equilibrium concept by using the model of consistent conjectured reactions. A conjectural variation is a conjecture by one firm about how the other firm will adjust its decision variable in response to potential adjustments by the first firm. The consistent conjectural equilibrium is believed to be a rational expectations equilibrium that collectively confirms individual expectations about changes in the decision variables. It is argued that the Cournot equilibrium is not generally a consistent conjectural equilibrium. However, there are problems with this approach: the consistent conjectural equilibrium is not equilibrium since each firm can unilaterally change its output to make more profits (Bresnahan, 1982, p. 937). Experimental evidence indicates that agents do not converge on the consistent conjectural equilibrium (Holt, 1982). It is also recognised that the conjectural variations parameter is not observable in principle. It has also been noted that these models lack a game-theoretic foundation (Shapiro, 1989). Yet it is widely held that conjectural variation models are still very important in examining scenarios underpinned by complex dynamic processes.

The simplified story of our model is the following: we examine government policy that concerns with an allocation of defence spending between two different regions/locations. It is argued that defence spending at a region will determine the short-run cost functions of firms in that region/location. These costs of production will, in turn, determine the nature of competition in the product market[5]. As a result, government policy will endogenously determine the degree/nature of competition in the market. On the other hand, this allocation of defence spending also enables us to analyse the political cost: promotion of an industrial location is an implicit taxation of firms in the other location. As the government increases defence spending in a location, voters from this constituency increase their political support for the incumbent government, whilst this government loses votes from the other location. An allocation of defence spending thus influences voters' evaluation of the government, and this evaluation constrains government policy on defence spending that, in turn, impinges on voters' evaluation. In the proposed equilibrium of the game, the government chooses the optimal allocation that influences the voters' evaluation that, in turn, maximises the probability of re-election of the incumbent government. The optimal allocation will determine the nature of competition in the product market.

The game unfolds over two stages: in Stage I, the government allocates defence spending in order to maximise its probability of re-election given the voters' preferences and characteristics. Thus, at Stage I, an electoral platform is formed. In Stage II, two firms compete for a unified market whilst their production bases are different. At the perfect Nash equilibrium of this sequential game, the government achieves an electoral equilibrium that maximises votes cast in favour of the government. This optimum allocation of defence spending provides a winning electoral platform to the incumbent government from which the costs of production for firms and the nature of competition in the product market will emerge.

4.4. THE MODEL

The primary idea here is to break up an economy into different sectors characterised by regional features and allow them to produce locally and compete globally. On the basis of this disaggregation, we will search for sectoral inequality and imbalances driven by the allocation of defence spending. In what follows we develop a model in terms of two sectors, which can easily be extended to a multi-sector economy.

We consider a market that has duopolists who have two distinct production locations. We assume that these locational choices have already been made and, hence, the location of a firm is part of the history. It is also assumed that the national economy consists of these locations. The government has a given amount of tax revenue for defence spending that is to be distributed between these locations. The impact of defence spending is to reduce costs of production. Thus, the larger the defence spending in location i, vis-à-vis j, the lower is the cost of production of the firm at location i. We further assume that buyers are located in such a fashion that the cost of transport is zero and, hence, there is a single price that prevails in the market. The market is thus characterised by the following sequential game: at Stage I, the electoral equilibrium is achieved that, in turn, determines the distribution of defence spending. The distribution of defence spending determines the costs of production of the oligopolists in Stage II of the game who engage in competition in the product market to capture the largest possible market shares (Fig. 4.1).

The solution to the game is proposed in a recursive fashion. We first determine the market outcome at Stage II and then trace back to Stage I that is popularly known as the logic of backward induction. Rationality and complete information dictate that both these firms and the government will form their expectations by looking ahead and foreseeing the product market equilibrium of Stage II. If agents behave in this fashion, they are said to have rational expectations. In Stage I, all these agents adopt their optimal actions based on the rational expectations. The resultant outcome is the perfect Nash equilibrium of the proposed game.
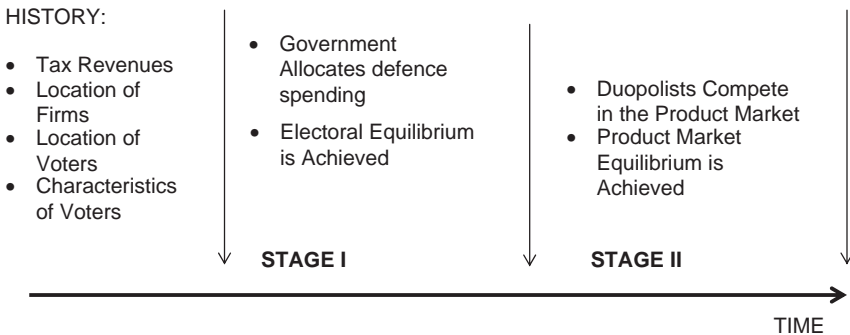
Fig. 4.1. Time Structure of Decisions.

4.5. STAGE II: NATURE OF COMPETITION IN THE PRODUCT MARKET

We introduce the following assumptions to characterise the product market.

Assumption 1. The industry demand function (inverse) is linear:

$$p = a - bX \tag{1}$$

where p and X are price and output, respectively, and a, $b > 0$.

Assumption 2. There are two regions/locations for defence spending. We assume that firm i is based at location i, for $i = 1, 2$.

Assumption 3. The cost of production of firm i is as follows:

$$c_i = c_i(X_i, G_i) = \frac{mX_i^2}{G_i} \tag{2a}$$

where X_i is the output of firm i ($i = 1, 2$); G_i the allocation of defence spending to location i where firm i is located.

The marginal cost is hence given as MC_i:

$$MC_i = \frac{2mX_i}{G_i} \tag{2b}$$

Thus, MC_i is increasing in X_i given G_i and decreasing in G_i given X_i:

$$\frac{\partial MC_i}{\partial X_i} = \frac{2m}{G_i} > 0 \tag{2c}$$

$$\frac{\partial MC_i}{\partial G_i} = \frac{-2mX_i}{G_i^2} < 0 \tag{2d}$$

The profit function of firm i is as follows:

$$\Pi_i = X_i(a - bX) - \frac{mX_i^2}{G_i} \tag{3a}$$

It is assumed that the firms have non-zero conjectural variation and, hence, we get the following for firm 1:

$$\frac{d\Pi_1}{dX_1} = a - 2bX_1 - bX_2 - bX_1\left(\frac{dX_2}{dX_1}\right) - \frac{2mX_1}{G_1} \tag{3b}$$

We define the conjectural variations as the following:

$$\phi_1 = \left(\frac{\mathrm{d}X_2}{\mathrm{d}X_1}\right), \quad \phi_2 = \left(\frac{\mathrm{d}X_1}{\mathrm{d}X_2}\right) \tag{3c}$$

Hence, the reaction functions in quantity decision of the duopolists are the following:

$$X_1 = \frac{(a - bX_2)}{2b + \phi_1 b + 2m/G_1} \tag{3d}$$

$$X_2 = \frac{a - bX_1}{2b + \phi_2 b + 2m/G_2} \tag{3e}$$

The consistency condition is that the change of X_1 with respect to X_2 along Eq. (3d) must be self-confirming. That is, the slopes of the reaction functions must be equal to the appropriate conjectural variations. Hence

$$\phi_2 = \left[\frac{-b}{(2b + b\phi_1 + 2m/G_1)}\right] \tag{4a}$$

$$\phi_1 = \left[\frac{-b}{(2b + b\phi_2 + 2m/G_2)}\right] \tag{4b}$$

The consistency conditions (4a) and (4b) give the following:

$$2b\phi_2 + \phi_1\phi_2 b + \frac{2m\phi_2}{G_1} + b = 0 \tag{5a}$$

$$2b\phi_1 + \phi_1\phi_2 b + \frac{2m\phi_1}{G_2} + b = 0 \tag{5b}$$

Subtracting Eq. (5b) from Eq. (5a) will yield

$$\frac{\phi_2}{\phi_1} = \frac{b + (m/G_2)}{b + (m/G_1)} \tag{5c}$$

The more negative ϕ_1, firm 1 believes that firm 2 is more accommodating. Thus, at the consistent conjectural equilibrium, all expectations are ex post confirmed and, hence, ϕ_2/ϕ_1 is a measure of relative competitiveness of firm 1.

Definition 1. We define ϕ_2/ϕ_1 as the degree of competitiveness of firm 1 vis-à-vis firm 2.

The larger ϕ_2/ϕ_1 is, the more accommodating firm 1 is and vice versa. It is instructive to note that the degree of competition depends on the allocation of defence spending G_1 and G_2. We now turn to the explanation of G_1 and G_2 that will in turn determine the degree of competition.

4.6. STAGE I: ELECTORAL EQUILIBRIUM

Citizen voters have two entitlements: first, as an economic agent, each voter has entitlement to returns from the firm of his location. We assume that the higher the profit of a firm, the larger is the economic return of the citizen residing in the location in which the firm operates. Secondly, as a voter he has an entitlement to influence the rules of the game, that is the allocation of defence spending. This allocation, in turn, affects his economic returns. It is assumed that each citizen exercises the voting rights in one's interests. The rational government chooses the allocation of defence spending (rules of the game) that will give rise to nominal returns to voters that will, in turn, maximise its votes. The electoral equilibrium is the optimal allocation of defence spending that maximises the votes cast in favour of the incumbent government.

In order to determine the allocation of defence spending G_1 and G_2, we now look at the electoral equilibrium of Stage I. We apply the probabilistic voting theorem to explain the electoral equilibrium (see Wittman, 1989). It is assumed that voters are located in two locations of defence spending. Within a location, voters have identical preference for the defence spending. Thus, there are two groups of voters and their preferences are represented by their utility functions $U_1 (G_1-G^a)$ and $U_2 (G_2-G^b)$, and S_1 and S_2 are the sensitivity parameters of these groups of voters. G^a and G^b are, respectively, the 'ideal points' of voter groups 1 and 2 given their tax burdens. For instance, S_1 represents the extent to which voters from group 1 based at location 1 decrease their support/vote for the political party in response to a divergence between G_2 and these voters' preferred allocation of defence spending G^a. We specify the votes-to-defence-spending function as the following:

$$V_1 = 50 + n_1 S_1 (U_1(G_1 - G^a)) \tag{6a}$$

$$V_2 = 50 + n_2 S_2 (U_2(G_2 - G^b)) \tag{6b}$$

Suppose G^* is the total tax revenue to be distributed and group i of voters is located at location i. Each group splits votes equally between two parties when both the parties offer the same defence spending[6]. Otherwise, a party loses votes as its defence-spending offer deviates from the 'ideal point' of a group. From Wittman (1989), we know that vote-maximising electoral equilibrium is ensured when the following first-order condition is satisfied[7]:

$$n_1 S_1 \left(\frac{\partial U_1}{\partial G_1} \right) = n_2 S_2 \left(\frac{\partial U_2}{\partial G_2} \right) \tag{6c}$$

Assumption 4. We specify the utility functions of the two groups of voters as the following:

$$U_1(G_1 - G^a) = -(G_1 - G^a)^2 \tag{6d}$$

$$U_2(G_2 - G^b) = -(G_2 - G^b)^2 \tag{6e}$$

The above formulation of the utility function suggests that voters dislike both shortfalls and over-allocation of defence spending to their respective localities. The latter needs an explanation: voters may dislike an over-allocation simply to escape from congestion and pollution that an over-allocation brings with it[8].

Proposition 1. Eqs. (6d) and (6e) capture voters' preferences, and Eqs. (6a) and (6b) are the votes-to-defence-spending offer functions, then the optimal allocations G_1 and G_2 of the defence spending that maximise the votes of the incumbent government are given by:

$$G_1 = w_1(G^* - G^b) + G^a(1 - w_1) \tag{7a}$$

where

$$w_1 = \frac{n_2 S_2}{n_1 S_1 + n_2 S_2} \tag{7b}$$

Similarly,

$$G_2 = w_2(G^* - G^a) + G^b(1 - w_2) \tag{7c}$$

where

$$w_2 = \frac{n_1 S_1}{n_1 S_1 + n_2 S_2} \tag{7d}$$

Proof. See the appendix.

Eqs. (7a)–(7d) establish that the political elements such as n_i, S_1 and S_2 are the critical ingredients in determining G_1 and G_2 given G^*. If the incumbent government wants office and voters want defence spending, then the vote-maximising government allocates defence spending in an optimal fashion to create an electoral equilibrium platform that is sensitive to voters' characteristics. The vote-maximising allocation of defence spending influences the nature of competition due to its effect on costs of production of duopolists. The higher the allocation that a particular location gets, the lower is the cost of production of the firm based there. This firm, due to its lower cost, will be able to extract larger profits from the output market.

4.7. ELECTORAL EQUILIBRIUM AND NATURE OF COMPETITION

From Eqs. (7c) and (7d), it is evident that the allocation of defence spending depends on w_1 and w_2 given the exogenously determined budget and the 'ideal points' G^a and G^b. It is instructive to note that w_1 and w_2 depend on the sizes of these voter groups – n_1 and n_2 – and their political sensitivities, S_1 and S_1, to the non-fulfilment of their demand for defence spending. From Eq. (5c), we know that the nature of competition in the product market depends on the ratio of G_1 and G_2 given the values of a and b. Hence, combining Eqs. (5c) and (7a) through (7d), we argue that the political elements such as the size of the voter groups (n_i) and political sensitivities of these voters, S_1 and S_1, are the main determinants of the degree of competition, ϕ_2/ϕ_1 in the product market. In order to highlight this finding, let us consider two special cases.

Assumption 5. Suppose each group of voters wants all available funds G^* to be ploughed back into their respective localities. Hence,

$$G^* = G^a = G^b \tag{8a}$$

Proposition 2. In the perfect Nash equilibrium of the proposed sequential game, the degree of competition (ϕ_2^*/ϕ_1^*) lies between the Cournot and Bertrand values and is sensitive to the political landscape of the simplified society.

Proof. In the perfect Nash equilibrium, all agents hold rational expectations about the market outcome at Stage II which are given by Eqs. (3d) and (3e). The rational expectations outcome in turn depends on the allocation of defence spending G_1 and G_2 at Stage I. Given the rational expectations outcome, the incumbent government chooses G_1 and G_2 at Stage I to maximise votes. Suppose voters' ideal points are given by Assumption 5, then we know

$$G_1 = \left[\frac{(n_1 S_1)}{(n_1 S_1 + n_2 S_2)}\right] G^* \tag{8b}$$

and

$$G_2 = \left[\frac{(n_2 S_2)}{(n_1 S_1 + n_2 S_2)}\right] G^* \tag{8c}$$

Substituting Eqs. (8b) and (8c) we get

$$\frac{\phi_2^*}{\phi_1^*} = \frac{bG^* + m(n_1 S_1 + n_2 S_2)/(n_2 S_2)}{bG^* + m(n_1 S_1 + n_2 S_2)/(n_1 S_1)} \tag{9a}$$

(Q.E.D.).

Eq. (9a) establishes that the equilibrium degree of competition (ϕ_2^*/ϕ_1^*) is determined by the political factors $(n_i S_i)$ of the society – given the cost and demand conditions. It is also evident that the equilibrium values lies between the Cournot and Bertrand values. Now we turn to the comparative-static results.

4.8. COMPARATIVE STATICS (UNDER ASSUMPTION 5)

The starting point of this section is that each group of voters would want the whole of defence spending G^* (assumption 5). In this scenario, we have the following comparative-static results that characterise the proposed perfect Nash equilibrium.

Proposition 3. As the size of a group of voters increases, ceteris paribus, the degree of competition shifts against the interest of the other group.

Proof. Differentiating Eq. (9a) with respect to n_2, we get

$$\frac{\partial(\phi_2^*/\phi_1^*)}{\partial n_2} < 0 \tag{9a$'$}$$

Thus, as n_2 increases given the size of group 1, the competitiveness of firm 1 based at location 1 goes down, since the political power of its opponent increases. As a result, the equilibrium inequality moves against region, or location 1, as n_2 rises ceteris paribus. Similarly, we can show

$$\frac{\partial(\phi_2^*/\phi_1^*)}{\partial n_1} > 0 \tag{9b}$$

(Q.E.D.).

Proposition 4. In the perfect Nash equilibrium, the competitiveness of firm i is an increasing function of S_i and a decreasing function of S_j. Thus, the voter sensitivity is an important determinant of the degree of competitiveness in the proposed equilibrium.

Proof. Differentiation of Eq. (9a) yields the result. We find

$$\frac{\partial(\phi_2^*/\phi_1^*)}{\partial S_2} < 0 \tag{9c}$$

In an analogous fashion, we find

$$\frac{\partial(\phi_2^*/\phi_1^*)}{\partial S_1} > 0 \tag{9d}$$

(Q.E.D.).

The regional inequality is predicated on voters' sensitivities. The upshot is that a location/region gains a larger (smaller) chunk of the defence spending if voters residing in this location are more (less) sensitive about the deviation of the actual defence spending from their desired allocation. Thus, if voters of a region are highly committed to the incumbent government, the region will receive a lower share of defence spending that will, in turn, impoverish the region and the voters of the region.

4.9. COMPARATIVE STATICS (UNDER ALTERNATIVE ASSUMPTION)

It is presumed that voters want a fixed share of the defence spending and any deviation from this share lowers the welfare of the voters. One may rationalise this by assuming a congestion, or pollution, cost. We represent this idea under the following assumption:

Assumption 6. Suppose each group of voters has the ideal point as the following:

$$G^a = G^b = \lambda G^* \qquad (10a)$$

where $0 < \lambda < 1$.

Lemma 1. Let Eq. (10a) be the preferences of the voters. The vote-maximising allocation of defence spending G_1 and G_2 are given by

$$G_1 = G^*(w_1 + \lambda + 2w_1\lambda) \qquad (11a)$$

$$G_2 = G^*(w_2 + \lambda + 2w_2\lambda) \qquad (11b)$$

As a result, the degree of competition in equilibrium is as follows:

$$\frac{\phi_2^*}{\phi_1^*} = \frac{bG^* + [bm/(w_2(1 + 2\lambda) + \lambda)]}{bG^* + [bm/(w_1(1 + 2\lambda) + \lambda)]} \qquad (11c)$$

Proof. Substituting Eq. (11a) into Eq. (7a) yields

$$G_1 = G^*(w_1 + \lambda + 2w_1\lambda) \qquad (12a)$$

Similarly,

$$G_2 = G^*(w_2 + \lambda + 2w_2\lambda) \qquad (12b)$$

Substituting Eqs. (11a) and (10a) into (5c) yields the degree of competition in equilibrium which is given by Eq. (11c) (Q.E.D.).

Lemma 2. The competitiveness of firm 1 in equilibrium is an increasing function in w_1 and decreasing function in w_2. Thus, the regional inequality is predicated on w_i.

Proof. Straightforward differentiation of Eq. (11c) with respect to w_1 and w_2 yields the above equations. Details are available upon request to authors.

Lemma 3. The weight w_i is an increasing function of S_i and a decreasing function of S_j.

Proof. Straightforward differentiation yields the result.

Proposition 5. From Lemma 2 and Lemma 3, we find that the competitiveness of firm i in equilibrium, or inequality in favour of region i, is an increasing function of the political sensitivity of voters of group i.

Proof. Combining Lemma 2 and Lemma 3, we get

$$\frac{\mathrm{d}\phi_2^*/\phi_1^*}{\mathrm{d}S_1} = \frac{\partial\phi_2^*/\phi_1^*}{\partial w_2}\frac{\partial w_2}{\partial S_1} + \frac{\partial\phi_2^*/\phi_1^*}{\partial w_1}\frac{\partial w_1}{\partial S_1} > 0 \qquad (13a)$$

Similarly,

$$\frac{\mathrm{d}(\phi_2^*/\phi_1^*)}{\mathrm{d}n_1} > 0, \quad \left(\frac{\mathrm{d}\phi_2^*}{\phi_1^*}\right)\mathrm{d}n_2 < 0, \quad \frac{\mathrm{d}(\phi_2^*/\phi_1^*)}{\mathrm{d}S_2} < 0$$

Note that the degree of competitiveness of firm i is equivalent to regional inequality in favour of location/region i, by construction. The comparative-static results show the precise nature of sensitivity of the degree of competition to changes in political factors. As examples, the degree of competition or competitiveness of firm 1 goes up (down) as the number of voters in its location, (n_1), goes up (down) ceteris paribus. The competitiveness of firm 1 goes up (down) as voters in its production location become more (less) sensitive to the non-fulfilment of their demand for defence spending. That is, the competitiveness of firm 1 goes up (down) as S_1 goes up (down). In an analogous fashion, the competitiveness of firm 1 goes up (down) as n_2 goes down (up) and S_2 goes down (up).

4.10. DISCUSSION AND CONCLUSION

The Smithian perspective on competition highlights a congruence of interests of market participants: say, a buyer wants some milk and is ready to give

some money to the milkmaid for it, and the milkmaid wants money and is, therefore, ready to give a carton of milk in exchange. This exchange allows each to achieve one's goal and they, thereby, help each other. In a complex market mechanism, however, economic problems are often embedded in a conflicting situation. It is recognised that the market mechanism can easily handle congruent interests but may fail to resolve conflicts in a harmonious or fair fashion (see Sen, 1984). To redress such conflicts, the visible hand of government has usually been invoked (Ostrom, 1987).

In this work, we highlight two types of conflicts – namely, market conflicts and political conflicts – and, thereby, attempt to weave them together to illuminate an important intersection between the economy and the polity. We introduce conflicts at the market level in the usual fashion as market rivalry – two prototype firms compete against each other for market shares. By applying the simple game-theoretic reasoning, we obtained the equilibrium market outcome. However, the core of the problem remains that the emerging market outcome, conduct of firms, market shares and take-home profits of these rivals and regional inequality critically depend on the choice of their strategic variable and, hence, on the nature of competition[9]. Dixon (1986) introduced consistent conjectural variations to make the degree of competition endogenous. He established that the degree of competition is driven by investment decision of firms since capital stocks impinge on costs of production.

We exploit this intuition of Dixon by focussing on an impact of defence spending, as opposed to private capital, on costs of production. The degree of competition in the product market is therefore driven by an allocation of defence spending. The introduction of defence spending in our model allows us to link the second type of conflict, namely the political conflict with the first type. Since, the availability of funds for defence spending is fixed, it is modelled that there is no congruence of interests of agents coming from two distinct locations, as Hirsch (1977) noted, 'what winners win, losers lose'. An allocation of defence spending will naturally entail political costs and benefits that a self-seeking government – driven by electoral motive – would try to exploit. An incumbent government will naturally choose an allocation to maximise the probability of its re-election. Our model on probabilistic voting has antecedents in the literature: Lindbeck and Weibull (1987) and Dixit and Londregan (1994) adapted the probabilistic model to examine public policies that redistribute income to narrow groups of voters. They assume that the various groups differ in their preferences for the political parties and, thereby, identify political characteristics of a group that makes it as an ideal candidate for receiving political largesse. The upshot is that these authors mainly study the major determinants of the political success of a special interest group.

On the contrary, we start off with the political characteristics of voters and then apply the probabilistic voting theorem to determine the electoral equilibrium that is driven by political largesse in the form of defence spending. This is how our model resolves political conflicts. What is important for us is that the resolution of political conflict also determines the equilibrium allocation of defence spending that in turn determines the equilibrium regional inequality. The equilibrium regional inequality maximises the probability of re-election of an incumbent government.

The resolution of political conflict can have a serious ramification for the product market due to its impact on the allocation of defence spending and thereby on regional inequality. This is indeed a serious point to consider: the traditional political theory highlights the failure of the majority-rule voting caused by the absence of a stable electoral equilibrium. As a result, political instability can create significant instability in product markets. This is where we apply the probabilistic voting theorem to highlight the existence of a stable voting equilibrium to establish that democratic political markets are well organised to promote the vote-maximising allocation of defence spending that will, in turn, lend stability to the product markets: the model predicts that the vote-maximising government adopts an optimal allocation of defence spending that induces an electoral equilibrium that, in turn, maximises its chances of re-election. However, the achievement of product market stability is accompanied with a regional inequality that can seriously destabilise a political system. In this perspective, the nature of competition, structure of industry and conduct of firms in an oligopolistic market and regional inequality critically depend on this electoral equilibrium and, hence, on voters' preferences and characteristics. The degree of competition is thus identified with the equilibrium allocation of defence spending and becomes a continuous variable, rather than a binary variable. It captures intermediate situations between the pure Bertrand and Cournot cases. We also find important comparative-static results that show that the structure, conduct of firms and nature of competition in oligopolistic markets and equilibrium regional inequality will be sensitive to political characteristics.

Future extensions of the work are desired on two fronts: voters' preferences should be made dependent on the final good's price and thus on the nature of competition. This extension can enhance our understanding of the nature of equilibrium by providing circular interdependence between government policy on defence spending and market outcomes. Secondly, important extension is possible by allowing voters 'voting with their feet'. This extension will once again introduce the circular interdependence between government policy on defence spending and market outcomes.

NOTES

1. The empirical findings are inconclusive partly reflecting the econometric difficulties involved in the estimation of the postulated relationship between economic growth and defence spending. Most of these empirical findings have problems as their authors rely on time series for individual countries, which can create spurious time effects in the estimation. Other papers use averages for different countries, and the robustness of their econometric findings is compromised due to strong cross-country variation in country characteristics.

2. From the complex mix of defence spending, mobility of private investment and skilled migration and the onslaught of the regional agglomeration, economists explain the spatial consequences of defence spending (see Braddon, 1995). The scaling down of defence spending in the United States during 1990s has been argued to have strong spatial consequences.

3. The Tenth Federal Reserve District includes Colorado, Kansas, Nebraska, Oklahoma and Wyoming, the northern half of New Mexico and the western third of Missouri. Given the region's lack of a coastline, these bases are primarily either Air Force or Army. The Air Force accounts for 43% of defence personnel in the region, compared with just 23% nationally. The region is home to 3 of the country's 12 largest army bases, and together, these three large bases house nearly 50,000 defence personnel. In addition to traditional military bases, the district is also a home of a number of unique defence institutions like the US Air Force Academy and the US Strategic Command that is instrumental in controlling space defence and nuclear weapons assets.

4. Extensive research further established that changes in defence investment spending have strong impacts on regional economic growth in the United States (see Bhattacharya, 2003; Hooker & Knetter, 1997). Both political considerations and 'military value' of a region play important roles in determining defence investment spending in the United States wherefrom regional growth spurts have been generated.

5. Arrow and Kurz (1970) and Barro (1990) have stressed the importance of public infrastructure being a substitute for private capital in the production function. Thus, an increase in public infrastructure in an industrial location, ceteris paribus, reduces cost of production of all firms of that location. Alternatively, one may assume that public infrastructure reduces cost due to the 'iceberg' effect of Samuelson (1954): if public infrastructure is inadequate then a large portion of the goods produced will be wasted and will fail to reach the consumers. An increase in public infrastructure therefore reduces cost by facilitating trade. Public infrastructure has assumed significance in Europe as EC-funded infrastructure projects aim to create strategic advantages for the member nations (Martin & Rogers, 1995). As examples, the Channel Tunnel, high speed rail network and new telecommunication networks have been undertaken in the recent years to boost industrial development and convergence in Europe.

6. Why should voters care for infrastructure? One plausible explanation is that voters are the stakeholders of the firms both as shareholders and employees.

7. It can be checked that the second-order condition is automatically satisfied.

8. It is important to note that a simple concave utility function, where voters are happier the more infrastructure investment they get but decreasingly so, will provide similar results.

9. From an early work of Marshak and Nelson (1962), we know that if the production structure is inflexible, then the Cournot outcome is a natural conclusion. On other hand, if production is completely inflexible, then the Bertrand outcome is

the likely candidate. It is argued that production is more flexible – the steeper the MC functions. The nature of competition is introduced as an external assumption in Brander and Spencer (1983, 1985), Dixon (1985), Dixit (1984), Eaton and Grossman (1986), Yarrow (1985).

APPENDIX

Proof of Proposition 4.

With the specified utility functions, the first-order condition (6c) is reduced to

$$\frac{G_1 - G^a}{G_2 - G^b} = \frac{n_2 S_2}{n_1 S_1} \tag{A.1'}$$

Since the amount of resources for investing in defence spending is given at G^*, the optimal allocation of G^* is given by

$$G_1 = \frac{G^* n_2 S_2 - n_2 S_2 G^b + n_1 S_1 G^a}{n_1 S_1 + n_2 S_2} \tag{A.2'}$$

$$G_2 = \frac{G^* n_1 S_1 + n_2 S_2 G^b - n_1 S_1 G^a}{n_1 S_1 + n_2 S_2} \tag{A.3'}$$

We can simplify the above equation as

$$G_1 = \frac{n_2 S_2}{n_1 S_1 + n_2 S_2}(G^* - G^b) + \frac{n_1 S_1}{n_1 S_1 + n_2 S_2} G^a \tag{A.4'}$$

Hence

$$G_1 = w_1(G^* - G^b) + G^a(1 - w_1) \tag{A.1}$$

where

$$w_1 = \frac{n_2 S_2}{n_1 S_1 + n_2 S_2} \tag{A.2}$$

Similarly,

$$G_2 = w_2(G^* - G^a) + G^b(1 - w_2) \tag{A.3}$$

where

$$w_2 = \frac{n_1 S_1}{n_1 S_1 + n_2 S_2} \tag{A.4}$$

(Q.E.D.).

CHAPTER 5

REGIONAL INTEGRATION, DEVELOPMENT AND PEACE PROCESS

5.1. INTRODUCTION

John Maynard Keynes effectively raised the following important points for initiating a peace process regardless of time and geography:

- During wars and economic crisis political decisions modify the course of history.
- Scientific knowledge of the economy can help modify our collective history.
- Peace is ultimately a pre-condition for economic development.
- Lasting peace is feasible if and only if peace treaties are fair.
- Otherwise, peace will be replaced by renewed and armed conflicts.

To create the peace dividend by improving the economic situation, Keynes recommended a reduced military spending along with arms limitations (see Keynes, 1921). Keynes dichotomised time into the short run and the long run. In the short run, military spending will create its usual multiplier dynamics to give a boost to the economy and thus a great economic asset. The same asset turns into a disaster in the long run since the military spending imposes a burden on the society as the spending is treated by Keynes as unproductive. Armament has a huge opportunity cost in the long run. Keynes believed security is delicately predicated on economic strengths for two sets of reasons that drove the research agenda of Chapter 6 of this book:

- A lack of economic strengths and consequent crises can lead to the downfall of democracies.

- Poor economic conditions invite the threat of outsiders to rule, in the Keynesian thoughts economic crisis can only invite communism to capitalist systems.

Thus, one of the major deterrence for peace and disarmament is economic sluggishness of various nations and regions within a nation. The Keynesian recipe for lasting peace and disarmament calls forth an international economic forum and solidarity and harmonisation of national and international economic interests. Our findings in this chapter are very significant for re-establishing the initial intuitions, ideas and ideologies of Keynes: the issue of international security must be multilateral and ought to be shared. How to pave the way for disarmament and peace? The Keynesian proposal is highly valuable for the modern world and akin to our theoretical model:

- In 1929 Keynes called for extensive financial support to establish a Society of Nations.
- Membership in this Society should be limited to peaceful states.
- The Society should be granted relevant powers to institute a penalty mechanism for non-peaceful states.
- In 1937 he recommended economic sanctions against Italy and Japan.
- In 1938, he asked for a European defence and conflict prevention pact, in essence a bloc of countries forming a military coalition or alliance as in our theoretical model.

The most powerful observation of Keynes is the potential role of prisoners' dilemma setting the forces for an over-arming by individual nations since each individual decision is correctly based on individual rationality, which unfortunately brings the collective disaster of an excessively armed world. The over-arming only hurts us by reducing our economic well-being, which clears the way for a violent conflict. How do we get out of this collective mess? Keynes suggested the role of negotiation, arbitration and coalition formation and application of moral ethics and penalty mechanism to break the tyranny of the prisoners' dilemma – a strategic concept unknown to Keynes.

In the following section the research will examine the theoretical issues concerning foreign direct investment (FDI) and how to achieve Pareto-improving economic integration (or what we choose to call 'win–win economic integration') with entry of foreign firms into a regional economy. Here our focus will be on engineering economic integration by a national, or regional, authority by initiating privatisation of state enterprises. By the

construction of the problem, the bidding firm is a foreign firm and we thereby highlight the roles that foreign firms play in creating linkages in regional economies, which gradually unleash the forces of economic integration in a region. This process of economic integration is closely associated with the globalisation of the world economy, which has significantly affected the regional economies in the Arab world.

5.2. PRIVATISATION, SPATIAL MODELS AND SUSTAINABLE FDI: FOUNDATION TO WIN–WIN ECONOMIC INTEGRATION IN THE GLOBALISED WORLD ECONOMY

5.2.1. Introduction to the Complex Issues of Globalisation and Regional Integration

Globalisation represents a gradual spread of market forces across the globe. In transition economies and developing nations, one of the principal means to spread modern markets is via privatisation. In most privatised industries, both domestic and foreign firms play an important role in shaping competition. The major problem with privatisation is the entry of powerful firms (say, a multinational corporation) that can thwart competition and exploit local resources, and especially workers. The critical question is whether it is feasible to have sustainable FDI by multinationals that can create a win–win situation for all parties. This chapter offers a glimpse of this important issue. By sustainable FDI we mean entry of Multinational Corporation in a privatised sector of a developing/transition economy that entails some forms of Pareto improvement in welfare.

5.2.2. Regional Integration and Spatial Economies: The Relevance of New Economic Geography

It is observed that globalisation has several aspects such as economic and political. In terms of economics for instance, globalisation causes expansion of markets and intensity of economic interdependency beyond state borders. As a result of globalisation, a political challenge arises to effectively integrate interdependent economies into a harmonious unity through the formation of new super-state institutions. After World War I and II, world

economy has successfully restructured itself. Global competition on economic markets and resources, as dictated by previous forces of colonisation, accelerated the pace of globalisation in the 1960s–1980s. The new stage of globalisation since the 1990s is a peaceful stage driven by the steady decline in transport cost required in the international flows of many factors, such as goods, services, capital, information, knowledge and technology. This reduction of transport costs has been triggered by the continuing improvement in technologies of transport; this has been enhanced by the revolution in information technology. The improvements of both transport and information technologies coincided with the intensification of efforts to eliminate the obstacles to trade flows, which was reflected by new international measures and the creation of very important institutions, such as the General Agreement on Tariffs and Trade (GATT) as well as World Trade Organization (WTO).

The continual reduction of transport costs has supported the growth and the improvement of international trade and investment. This gave rise to a new stage of globalisation comprising most of the countries of the world. It could be safely said that the tendency towards the sub-global regionalisation has also been increased during the past five decades. The reduction in transport cost has been encouraging simultaneously the globalisation of the world economy and also the regional integration causing the formation of sub-regional groups. The main three examples of the regional integration in the world are NAFTA, EU and East Asia. The NAFTA (North-American Free Trade Agreement), includes the United States, Southern part of Canada and Northern part of Mexico, while the EU (European Union) comprises of most important economic powerhouses of Europe and the East Asia consists of Japan, Indonesia and the East China Sea and South China Sea. Over the last 30 years, the East Asia registered a rapid economic growth. Consequently, the East Asia yielded 23% of the world GDP, the EU registered 25% and the NAFTA contributed 35%. One can safely assert that 83% of the world GDP during the last three decades was mainly concentrated in these three regions.

The remarkable point is that the rapid growth of GDP does not necessarily always reflect the economic integration. This point poses the important question whether the economic interdependency among nations has been intensified as a result of their growth. One will need to look at the intra-regional trade against the backdrop of inter-regional trade. The intra-regional trade share is an appropriate measure to examine such question. The intra-regional trade of the EU countries is the highest, in which it registered about 60% during 1980–2003. In fact, this is not unexpected for a

number of rich neighbouring countries with small size of lands since these 15 European countries have also been cooperating in various fields over the past half-century. In contrast, in 1980 the East Asia region had lower shares of intra-regional trade than the benchmark of the EU at 60%: the East Asia region registered about 35%, whereas the NAFTA registered 33.2%. However, since the 1980 intra-trade shares of the East Asia region and the NAFTA regions have been increasing in tandem. Thus the forces of regionalisation are doing a splendid job for these three regional groupings.

Since the 1990s, theoretical and empirical models on economic geography have been revitalised. Paul Krugman (1991a, 1991b) initiated the core–periphery model, which opened the door and activated the interesting contributions to economic geography.[1] Venables and Krugman have further advanced the model when they developed new models of international trade and industrial agglomeration/specialisation, whilst Krugman and Fujita extended the analysis to cities and urban systems. Subsequently, a growing number of economists joined their efforts in improving what can be called a new approach to the study of economic geography. The new economic geography has quickly become one of the important areas of contemporary economics, which is expected to play a vital role in the economic analysis of the increasingly borderless global economy.

The explanation of the formation of a large variety of economic agglomeration can be considered the focal point of the new economic geography. The clustering of economic activities can take place at different geographic levels. For example, one type of agglomeration arises when small factories and shops cluster in a neighbourhood. In addition, spatial agglomeration in a greater geographical scale can be seen where significant regional disparities exist within a country.

To explain the distribution of economic activities based on factor price differences is a helpful framework as articulated by the traditional theory of international trade and regional economics. Nonetheless, the agglomeration of economic activities in a borderless economy cannot be explained by the factor price movement alone. It can be said that the feature of new economic geography has offered a combined approach to the modelling of a spatial economy characterised by diversity in degrees of economic agglomeration. Models emphasise the three-way interaction among increasing returns, transport cost and the movement of factors of production. In these models, the general equilibrium framework is unified with nonlinear dynamics and an evolutionary approach for the equilibrium selection. The basic framework of new economic geography is described in Fig. 5.1.
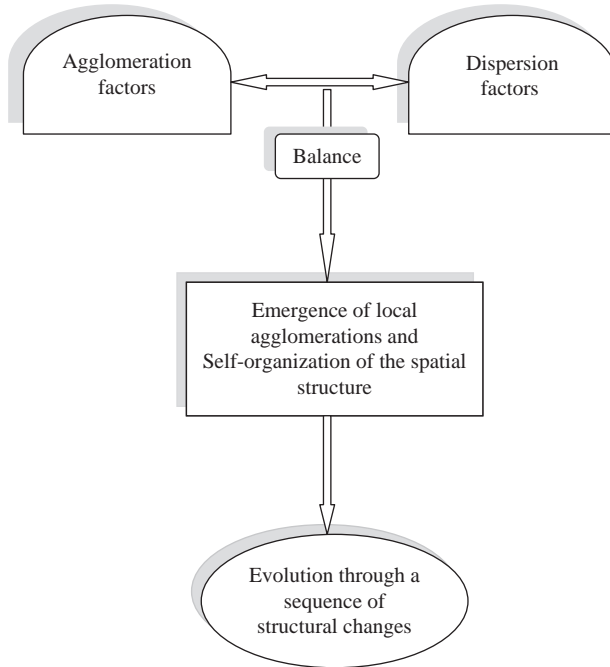
Fig. 5.1. Framework of New Economic Geography.

It is observed that there are spatial activities that characterise a certain economic region as the composition of economic activities is considered as a product mainly of a process that entails two opposing forces, namely (i) agglomeration forces (centripetal forces) and (ii) dispersion forces (centrifugal forces). In fact, these two differing forces are created by and create a complicated balance. Consequently, local agglomeration of economic activities differs from regions to regions. In addition, the spatial construction of the regional economy is self-organised. Moreover, with the steady changes in both technological and socioeconomic circumstances, a series of structural changes is usually experienced by the spatial system involving several regional economies, and the complex system dynamically evolves. The main concern of new economic geography is how to elucidate the agglomeration forces that cause the formation of a large diversity of spatial agglomeration such as cities and industrial districts. Fig. 5.2 describes the general principle of the economic mechanism conducive to creation of agglomeration forces. The figure demonstrates the notion that in the context
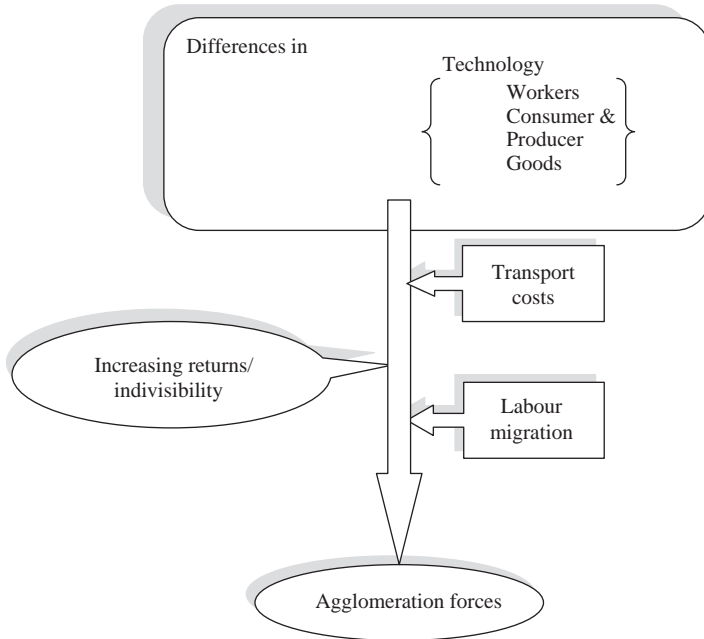
Fig. 5.2. Generation of Agglomeration Forces.

of sufficient heterogeneity in goods and services or workers, the three-way interaction among increasing returns at the individual firm level, transport costs and workers migration can generate a circular causation, which can trigger the agglomeration process as described below. So, the first element is the heterogeneity in goods – goods are differentiated from each other. Therefore, the producers of these goods can locate next to each other in the geographical space without an all-out trade war – including service rivalry, price competition while consumers can benefit from the complementarity of such heterogeneous goods when consumers locate close to producers. The increasing returns at the firm level along with the indivisibility of human capital are the second critical element of regional economic development. The concentration of production of each good at the same location is not required when scale economies at the firm level are not present. Scale economies and concentration of production in a geographic location provide a boost to the regional development. The third element is transport cost. In case of an absence of transport costs, once again the location of production does not really matter. Decisions of producers to locate close to

a large market are driven by transport costs. Finally, the last element in the agglomeration process is the migration of workers, which combines with the agglomeration of production to shape up economic development of a region.

The new phase of globalisation is mainly driven by the steady reduction of transport cost. The simultaneity of globalisation and regional integration can be elucidated by examining the general effect of declining transport cost on economic activities in terms of spatial distribution. To do this, the transport cost is meant to indicate the cost required in the movement of goods, services, labour, capital, information and knowledge, and technology. It is also important to distinguish between some type of costs: there are costs for movement of goods and workers, which are under the category of usual costs. There are costs associated with transfer of information with various modes of communication. Moreover, there are other costs like tariffs and non-tariff barriers costs, costs associated with exchange-rate variations and costs associated with R&D. There are significant costs that also emerge from language and culture differences. With the incessant improvements in transport and development in the information technologies, most of these transaction and trading costs have been gradually declining over the past five decades. This has been ably assisted by concerted efforts to reduce institutional barriers in international trade, investment and finance.

5.3. MULTINATIONALS AND LABOUR ISSUES

One can safely state today that multinational enterprises play an important role in shaping global competition. We know that the largest 500 multinational firms control more than 50% of global trade flows that constitutes one-fifth of global GDP. The multinational production–location decision is explained by a trade-off between maximising proximity to consumers and concentrating production to reduce cost of production. In imperfectly competitive models, this trade-off arises since a multinational enterprise has proprietary advantages that are internally exploited by spreading production across nations due to asymmetric information, technology diffusion and quality control. The primary purpose of internationalisation of production base is to achieve cost efficiency given the distribution of global customers. The cost structure of multinational enterprises, their production–location decision and internationalisation will, therefore, depend critically on the outcome of local labour market outcomes

and government tax policies. This is so since the cost structure is seriously influenced by wages, local infrastructure, taxes and subsidies.

Recent years have witnessed the emergence of a literature that addresses an important area of interface between internationalisation and multilateral tax reforms. The current interest is partly fuelled by the emergence of the EU that has accorded high priority to multilateral tax reforms in member nations. With an increased pace of internationalisation in the 1990s, the explicit trade barriers in the global markets have been steadily on the wane. As a corollary policy advisers have recommended multilateral tax reforms to reduce potential and actual trade distortions and to increase internationalisation. These tax reforms have taken two major forms: first, a uniform contraction of all taxes and tariffs and, secondly, the harmonisation of commodity taxes. The major concern of the existing literature is to assess whether a common or harmonised tax is better, in welfare-theoretic terms, than distinct and distorting tax systems in different nations.

An important implication of multilateral tax reforms is its influence on the production–location, or investment, decisions of multinational corporations (MNCs hereafter) that in turn propel the forces of internationalisation. National governments traditionally offer tax concessions to the MNCs to attract foreign investment. In this context the institutional structure of labour markets has surfaced as an important element in determining 'international competitiveness' of firms involved in the global markets. It is generally recognised that unionisation and labour market asymmetries have strong influence on the investment decisions of MNCs that, in turn, impact on the process of internationalisation. The conventional wisdom is that a strong labour union in a nation will increase the wage rate above their opportunity cost and, thereby, lower the profits of both domestic and foreign firms. This will indeed damage the competitive position of these firms located in highly unionised nations. Therefore, strong unionisation of labour market is commonly regarded as an entry deterrence for MNCs. Both tax reforms and institutional structure of labour market have strong influences on the production–location decisions of MNCs.

5.4. PRIVATISATION: MAJOR ISSUES

Privatisation of public enterprises involves an increased trust in the efficiency of the market principle in comparison with the efficacy of the government. This ideological backdrop has engendered a series of debates in the 1980s and 1990s. The ostensible purpose of this chapter is to examine a

very important aspect of privatisation that has been neglected in the literature: we examine the impact of sales of public assets on the relevant industrial structure and wherefrom we derive sustainable FDI. Why is it important to analyse the post-privatisation industrial structure? The answer to this question is intertwined with the rationale behind nationalisation of an industry. During the golden age of capitalism, an industry was inevitably nationalised when it was beset with some kind of market imperfections. To put it differently, nationalisation of an industry was justified on twin grounds: first, nationalisation was justified when an industry had displayed a natural monopoly. Secondly, if the market was beset with a high sunk cost and consequent concentration of market power. There is, hence, a reason to believe that such an industry – once privatised – will have a tendency to bounce back to its original industrial structure characterised by market imperfections. As a result, one can argue, privatisation of an industry may engender an imperfectly competitive market that can thwart the very goals of privatisation.

The focus of this chapter is to study the ramification of privatisation that creates imperfectly competitive markets. In order to lend tractability, we offer a simple Cournot–Nash type of privatisation game involving an incumbent, a foreign firm (MNC) and a government. The storyline subsumes the following: the foreign firm brings a new technology that leads to a decline in the cost of production in the industry, but this foreign entry sheds employment in the concerned industry. Government investment in infrastructure reduces cost of production and also increases employment. The concern of this model is to examine the possibility of a Pareto-improving privatisation in this context such that privatisation leads to net welfare gain for each party. We call this scenario sustainable FDI. We consider a government implementing a Pareto-improving privatisation with the mixed objectives of creating a consumer surplus through price reduction and an increase in employment. For the government to achieve this objective, it enters into a game with the privatised domestic firm (incumbent) and the new foreign entrant (MNC) who forms a simple duopoly. To partially offset the displacement of public employment from the domestic firm, the government invests in infrastructure to create employment in the infrastructure sector and together with employment creation from the foreign entrant firm. The Pareto-improving privatisation entails post-privatisation market equilibrium with lower price and higher employment vis-à-vis the pre-privatisation outcome.

The proposed model establishes that an unstable equilibrium exists that separates two stable equilibria of the privatisation game involving the

government and these duopolists. Investing below this critical point of unstable equilibrium will lead to a stable equilibrium where the Pareto-improving privatisation objectives are not met and, therefore, the system is not Pareto improved. As a result, the FDI is not sustainable. In order to achieve Pareto-improving privatisation the government will hence need to invest beyond this critical level of investment for the other stable equilibrium to be reached. The system is Pareto improved when the second stable equilibrium is reached. It is also important to note that the proposed game may not have equilibrium in some cases. Simulation analysis is conducted to determine the parameter ranges where equilibrium will occur and what level of government investment is required for the system to be Pareto improved.

5.5. RATIONALES FOR PRIVATISATION: A GLOBAL PICTURE

During the 1980s and 1990s privatisation of public enterprises has been a common economic event that has rocked Africa, Asia, Australia, South America and Eastern and Western Europe (Kikeri et al., 1992). Western European nations provide a nice cameo of privatisation: Great Britain and France propelled the major forces of privatisation in Western Europe. In Great Britain large and important industries such as telecommunications, gas and electricity were privatised. In France large industrial and financial conglomerates cropped up from public enterprises. On the other hand, West Germany, Italy and Netherlands had cavalier approach to sell public shares in industrial companies and banks (see Knauss, 1988). In these countries no measures were taken to privatise major public utilities such as telecommunications and postal services. It was widely recognised that the major public utilities were inefficient, yet privatisation was pushed to the background. However, national governments attempted to reduce inefficiency by initiating changes in the internal organisation of these public utilities. In Austria, Belgium and Scandinavian nations, the forces of privatisation have been in low gear. In many Eastern European countries, privatisation bids are a step towards a capitalistic economic system. Similar privatisation measures have been taken in many Asian, African and South American nations mainly to embrace the capitalistic economic system. These nations of Asia, Africa and Eastern Europe are typically characterised by absence of stock markets, experienced managerial team, and beset with inadequate industrial organisation, lack of comprehensive legal framework and appropriate market institutions.

Thus, the bids of privatisation in the South are significantly different from the bids in the industrial nations with well-developed capitalistic economic systems. In non-industrial nations, privatisation aims to lay down the structures of market economies whilst in the Western economies the aims of privatisation are mainly to improve the efficacy of the capitalistic economic system. The conventional wisdom in this context is that public enterprises are heavily laden with inefficiency. There are three types of inefficiency that have surfaced in the literature: first, the cost of production in public enterprises is argued to be significantly higher than the cost of private enterprises providing similar services. Public provision of municipal services is shown to be very costly in comparison with their private provision in the United States (see Donahue, 1998). Secondly, public enterprises have lower profitability relative to private firms in similar businesses (see Lopez de Silanes, 1993). Thirdly, public firms are more inefficient in the utilisation of resources vis-à-vis private firms (see Mueller, 1989; Vining & Boardman, 1993). The conventional wisdom has been further supported by the recent findings of the World Bank that highlight that efficiency improves after privatisation (see Boycko, Shleifer, & Vishny, 1996). It naturally leads to the question about the rationale behind the inefficiency of public enterprises. The explanation of the inefficiency is that public enterprises, instead of maximising efficiency, address the needs of the vote-maximising politicians (Boycko et al., 1996).

The main secret behind improvement in efficiency is the change in management behaviour that is caused by three factors (Bös, 1994): first, privatisation entails less government intervention that allows flexibility in management. Secondly, the management of a privatised firm is more responsive to market forces due to the bankruptcy threat and the capital market discipline (see Kay & Thompson, 1986). Thirdly, the management of a privatised firm has less power in influencing the government policy and favours since the close political ties between them are snapped by privatisation. Thus, privatisation not only endows more decision-making and strategising power to the management but also makes them more reliant on the market mechanism. As a result, the management – in order to survive and prosper – must enhance the market value of the firm given the available resources. The natural corollary is that the management will enhance efficiency in their bid to increase the market value of the firm. However, privatisation is controversial in all societies – partly because of its political and ideological leanings and partly because of its adversarial relation with labour unions. It is indeed true that privatisation alters the distribution of power within a society: economic decisions are transferred from the hands

of policy-makers and bureaucrats to the managers of private firms whilst the management becomes directly responsible to their shareholders. As is argued, socialistic modes of ownership are replaced by the capitalistic ones. Privatisation also impinges on the institutional aspects of labour markets. Privatisation is normally accompanied by a reduction in trade union's power and its political influence. As an example, privatisation of the electricity industry in Great Britain was a means to weaken the stranglehold of miners' union (see Bös, 1994, p. 3).

Similar motives of privatisation have been reported from West Germany. The wheels of privatisation have been clogged by the German trade unions, which exert a strong influence on German political parties. Does privatisation necessarily augment efficiency? The intended effect of privatisation on efficiency critically depends on the entry of private firms to enhance competition in order to reduce the monopoly power of the privatised firm. Foreign firms, in particular, play an important role in promoting competition and bringing technology to lower cost of production. Foreign entry also creates problems of expatriation of profits. Foreign investors naturally compound the problems since an excess of foreign investment will influence the strategies of the privatised firms that may be antithetical to the national goals. In Great Britain and France national governments obviated this problem by retaining a 'golden share' of the privatised firm that lends the national governments a veto power against takeovers and undesirable changes in the policy of privatised firms. It is important to note that privatisation directly affects the budget deficits of the government. Governments, on the one hand, lose their future dividends from the privatised firm but governments also raise revenues from selling their assets. It is generally recognised that the former outweighs the latter (see Yarrow, 1986).

Privatisation may thus have an adverse effect on the government budget and, thereby, on government expenditure on infrastructure. The decline in government expenditure on infrastructure has dual effects: first, it has a recessionary impact as it lowers effective demand in the Keynesian sense. Secondly, a decline in the availability of infrastructure increases cost of production and, thereby, acts on the competitiveness of the entire economy. Hence, privatisation is a mixed baggage whose immediate effects may be counter-productive. In the least, privatisation has political implications that may completely overshadow the economic rationale. To bypass this problem, the concern of this model is to explore privatisation that has beneficial effects to government, unions and owners of firms and consumers who gain from privatising public enterprises. We call this Pareto-improving

privatisation, which is a win–win reform that is considered equivalent to sustainable FDI.

5.6. A SIMPLE MODEL OF PRIVATISATION GAME WITH MULTINATIONALISATION

Consider the privatisation of a domestic industry that has a single firm before privatisation. We assume that a foreign firm (MNC) enters the relevant industry as the industry is privatised. Thus, the post-privatisation structure of the market takes the form of a simple duopoly. The details of the game are summarised in Fig. 5.3.

1. As the government decides to privatise the industry and invest in infrastructure, there is an important question of how to meet the necessary expense. One may expect a mix of tax increase, increased budget deficit and foreign borrowing to finance the formation of infrastructure. We neither explain the source of this finance, nor consider
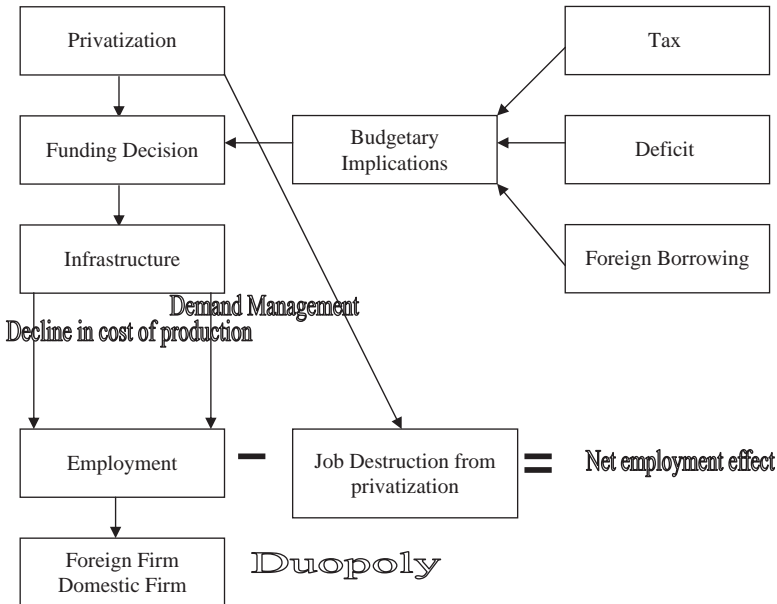
Fig. 5.3. The Game Flow Chart.

its effect on the capital market. This is a weakness of our analysis. Instead, we highlight the impact of privatisation on the labour market and the effects of public infrastructure on the aggregate demand and on the cost of production in the duopoly. The decline in the cost of production – driven by an increase in public funded infrastructure and the new technology of the foreign firm – and the increase aggregate demand associated with public expenses on infrastructure pave the way for the Pareto-improving privatisation.

We assume the following economic relationships.
Net unemployment (u) in the duopoly is given as:

$$u = E_0 - E \tag{1a}$$

E_0: public employment before privatisation in the relevant sector; E: new jobs created in the duopoly.

Demand function characterising the duopoly is assumed to be:

$$p = a - bX + b_1 I_G \tag{1b}$$

I_G: government investment in infrastructure and a, b, $b_1 > 0$.

The demand function includes a positive effect of government investment on the demand for the product.

Total firm output X_P

$$X_P = X_1 + X_2 \tag{1c}$$

X_1: output of domestic firm; X_2: output of the foreign firm.

The marginal cost of production is C_P:

$$C_P = C(I_G, K_2) \tag{1d}$$

Postulate 1. Government investment in infrastructure I_G and foreign investment K_2 both affect the marginal cost of production. That is

$$\frac{\delta C}{\delta I_G} < 0, \quad \frac{\delta C}{\delta K_2} < 0$$

Total employment (E) in the duopoly is defined as:

$$E = E_1 + E_2 = e_1 X_1 + e_2 X_2 \tag{1e}$$

e_i: employment output ratio of firm i.

Output-Competition (Cournot type):
Domestic firm's profit function is expressed as:

$$\pi_1 = PX_1 - CX_1 = (P - C)X_1$$
$$= aX_1 - bX_1^2 - bX_1X_2 - C(I_G, K_2)X_1 + b_1I_GX_1 \quad (2a)$$

Foreign firm's profit function is expressed as:

$$\pi_2 = PX_2 - CX_2 = (P - C)X_2$$
$$= aX_2 - bX_2^2 - bX_1X_2 - C(I_G, K_2)X_2 + b_1I_GX_2 - \gamma K_2 \quad (2b)$$

γ: cost of capital by the foreign firm.

Assuming the government investment I_G and foreign investment K_2 as given, we write the first-order conditions as:

$$\frac{\delta\pi_1}{\delta X_1} = 0, \quad \frac{\delta\pi_2}{\delta X_2} = 0 \quad (2b')$$

Domestic firm's reaction function is

$$X_1 = \frac{(a - bX_2 - C(I_G, K_2) + b_1I_G)}{2b} \quad (2c)$$

Foreign firm's reaction function is

$$X_2 = \frac{(a - bX_1 - C(I_G, K_2) + b_1I_G)}{2b} \quad (2d)$$

From Eqs. (2c) and (2d), we derive the syntactic Cournot–Nash equilibrium of the proposed game. Defining $a_1 = (a - C(I_G, K_2) + b_1I_G)$ and $a_2 = (a - C(I_G, K_2) + b_1I_G)$ we get the following
Optimal domestic firm output:

$$X_1^* = \frac{(2a_1 - a_2)}{3b} \quad (2e)$$

Optimal foreign firm output:

$$X_2^* = \frac{(2a_2 - a_1)}{3b} \quad (2f)$$

Optimal total firm output:

$$X_P{}^* = \frac{(a_1 + a_2)}{3b} \tag{2g}$$

The Cournot–Nash price:

$$p^* = \frac{3(a + b_1 I_G) - (a_1 + a_2)}{3} \tag{2h}$$

Equilibrium employment of domestic firm:

$$E_1{}^* = e_1 X_1{}^* = \frac{e_1(2a_1 - a_2)}{3b} \tag{2i}$$

Equilibrium employment of foreign firm:

$$E_2{}^* = e_2 X_2{}^* = \frac{e_2(2a_2 - a_1)}{3b} \tag{2j}$$

Assumption 1. For simplification it is postulated that $e_1 = e_2 = e^*$. Total employment in the Cournot–Nash equilibrium, E^*, is hence

$$E^* = E_1{}^* + E_2{}^* = \frac{e^*(a_1 + a_2)}{3b} \tag{2k}$$

Pareto-improving Privatisation: Government's objective
The government is assumed to have a mixed objective function W:

$$W = \theta_1 S(p^* - p_0) + (1 - \theta_1)[E^* - E_0 + E_G] \tag{3a}$$

$S(p)$: consumer surplus where p_0 is initial pre-privatisation price, E^*: employment creation in the duopoly equilibrium, E_0: initial employment in the concerned industry before privatisation (job destruction), θ_1: respective weights of consumer surplus and employment in the objective function of the government, E_G: employment created in the public infrastructure.

We know that the consumer surplus satisfies the following:

$$\frac{\delta S}{\delta p} = -X^*(p) \tag{3b}$$

Public employment creation is given by:

$$E_G = e_G I_G \tag{3c}$$

We make the following assumptions about the pre-privatisation status of the industry:

Assumption 2. Initial levels of employment and capital stock are given as E_0 and K_0 respectively. We define the production function as:

$$Y_0 = f(E_0, K_0) \tag{4a}$$

We now look at the demand side before privatisation, from (1a) demand function, we get the pre-privatisation price p_0 as:

$$p_0 = a - b Y_0 \tag{4b}$$

The government seeks to maximise W by choosing investment, the first-order condition for this is:

$$\frac{\delta W}{\delta I_G} = \theta_1 \left(\frac{\delta S}{\delta p}\right) \times \frac{\delta(p^* - p_0)}{\delta I_G + \theta_2(\delta E^*/\delta I_G) + \theta_2 e_G} = 0 \tag{4c}$$

The resulting optimality condition is derived as:

$$\theta_2 \left(\frac{\delta E^*}{\delta I_G + e_G}\right) = \theta_1 X^*(p) \times \frac{\delta(p^* - p_0)}{\delta I_G} \tag{4d}$$

Substituting and solving yields:

$$\frac{\delta E^*}{\delta I_G} = \left(\frac{2e^*}{3b}\right)\left[\frac{-\delta c}{\delta I_G + b_1}\right] \tag{4e}$$

Assumption 3. We assume a nonlinear marginal cost function from (1d) of $C = C(I_G, K_2)$. Foreign investment is technologically superior to domestic investment, which results in a reduction in marginal cost as captured by the

C_1 coefficient in Eq. (4f). The marginal cost decreases by $(1/2) \times C_3$, which reflects the government investment in infrastructure. Similarly, a reduction is caused by C_4 when combining government investment and foreign investment captures the cost reduction caused by combining the synergistic effects of technology superiority with supportive infrastructure placement.

We write the marginal cost function as:

$$C_P = C(I_G, K_2)$$
$$= C_0 - C_1 K_2 + C_2 K_2^2 - \left(\frac{1}{2}\right) C_3 I_G^2 - C_4 I_G K_2 \tag{4f}$$

where C_1, C_2, C_3 and $C_4 > 0$.

Then, the impacts of public and private capital on the marginal cost are as follows:

$$\frac{\delta C}{\delta I_G} = -C_3 I_G - C_4 K_2 \tag{4g}$$

$$\frac{\delta C}{\delta K_2} = -C_1 + 2C_2 K_2 - C_4 I_G \tag{4h}$$

Hence, (4e) can be rewritten as

$$\frac{\delta E^*}{\delta I_G} = \left(\frac{2e^*}{3b}\right)[I_G C_3 + b_1 + C_4 K_2] \tag{4i}$$

After relevant substitution and simplification, the first-order condition yields the reaction function of the government:

$$\theta_2 \left[\left(\frac{2e^*}{3b}\right)(I_G C_3 + b_1 + C_4 K_2) + e_G\right] - \theta_1 X_P{}^*(p)$$
$$\left[\left(\frac{1}{3}\right)(b_1 - 2(C_3 I_G + C_4 K_2))\right] = 0 \tag{4j}$$

Further substitutions reduce Eq. (4j) to Eq. (4k) as the reaction function of the government that gives the optimal public investment in infrastructure as a function of the foreign capital ploughed in by the foreign firm:

$$\begin{aligned} I : &B_0 + B_1 I_G + B_2 I_G^2 + B_3 I_G^3 + B_4 I_G K_2 + B_5 I_G K_2^2 + B_6 I_G^2 K_2 \\ &+ B_7 K_2 + B_8 K_2^2 + B_9 K_2^3 = 0 \end{aligned} \tag{4k}$$

5.7. POST-PRIVATISATION OUTCOME WITH FOREIGN FIRM ENTRY

Similar substitution and simplification yield the reaction function (5a) for the foreign firm that links the optimal capital stock of the foreign firm as a function of the public investment in infrastructure:

$$\text{II}: A_0 + A_1 I_G + A_2 I_G^2 + A_3 I_G^3 + A_4 I_G K_2 + A_5 I_G K_2^2 + A_6 I_G^2 K_2 \\ + A_7 K_2 + A_8 K_2^2 + A_9 K_2^3 = 0 \tag{5a}$$

Simplifying further, by combining (4k) and (5a) yields the equilibrium condition of Eq. (5b):

$$Z_0 + Z_1 I_G + Z_2 I_G^2 + Z_3 I_G^3 + Z_4 I_G K_2 + Z_5 I_G K_2^2 + Z_6 I_G^2 K_2 \\ + Z_7 K_2 + Z_8 K_2^2 + Z_9 K_2^3 = 0 \tag{5b}$$

This gives three roots at equilibrium where:
$I_G^* < I_G^{**} < I_G^{***}$ and corresponding $K_2^* < K_2^{**} < K_2^{***}$.

This shows a cubic function with an unstable equilibrium and two stable equilibriums as shown in Fig. 5.4 below. E_1 and E_3 are stable equilibria whereas E_2 is an unstable equilibrium. If the government invests in infrastructure at a point lower than G^* then the rational behaviour for the foreign firm will be to make a small investment since the foreign firm will not gain considerably from lowered costs of production due to improved infrastructure. If the government invests at least G^* in infrastructure then the rational behaviour for the foreign firm will be to make a significant investment since the foreign firm gains considerably from the lowered costs of production due to improved infrastructure. Moreover, the foreign firm will continue to invest even more to realise the increasingly available benefits of the decline in cost production up to the point where the marginal benefits from further investment are reduced to zero. Thus, the foreign firm will invest towards the stable equilibrium at E_3 as marginal benefits continue to exceed marginal costs. This system is Pareto improved because there is an increased net employment effect, and consumer surplus is increased together with maximisation of wealth by both the domestic and foreign firms in duopoly.
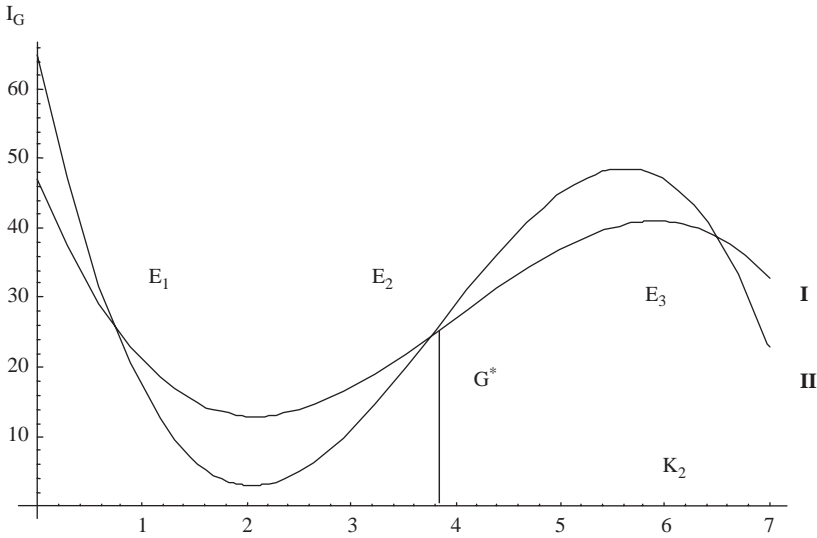
Fig. 5.4. Post-Privatisation Equilibria.

5.8. SIMULATION ANALYSIS

Simulation analysis reveals very interesting relationships in the variables in our game by examining the sensitivity of key variables. With initial standard parameters, we can see more clearly the relationship of government investment, I_G with foreign investment, K_2. From Fig. 5 we can see the cubic functions of government and foreign investment and how they interact with each other in respect to the first-order condition of the government mixed objective function W.

Using initial parameters to test the sensitivities and relationships of significant parameters with system outcomes, it is clear some changes result in Pareto improvement while others create Pareto deficiency. These effects are consistently applied to all sets of initial equilibrium parameters and system outcomes, except in the cases where changes in parameters took the system into disequilibrium. In these cases, the system cannot be Pareto improved because there is no satisfying equilibrium condition, which maximises the objectives of all three players, the domestic firm, foreign firm and the government. Therefore, in order to further Pareto improve this system from our initial simulated parameters, or any others tested,
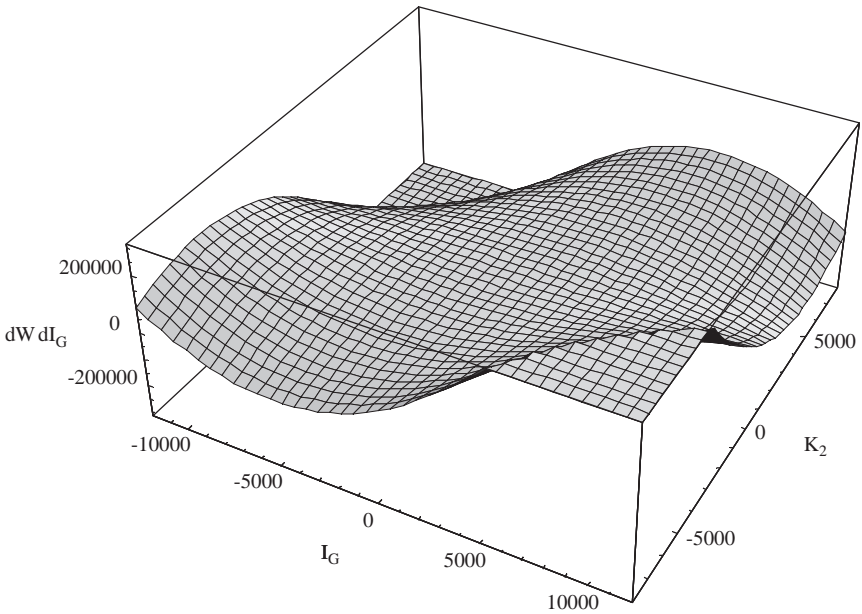
Fig. 5.5. The First-Order Condition of the Government's Mixed Objective.

we would, in order of sensitivity and importance approach it in this manner:

- decrease the variable output–demand parameter (b);
- decrease the variable government investment–demand parameter (b_1);
- increase the variable cost parameter (C_2);
- increase the fixed duopoly market demand (a); and
- decrease the variable cost parameter (C_1).

The fundamental conclusion is that each of the above parameters is outside the direct control of all three players in this two-tier game as they pertain to market demand parameters (b, b_1 and a) and technology parameters – C_2 and C_1.

5.9. DISCUSSION

The model concludes that multiple equilibria can characterise the proposed privatisation game peopled with three types of agent – foreign firm, local

firm and government. We establish two stable equilibria being separated by an unstable one. We also demonstrate that only one of the stable equilibria entails Pareto-improving privatisation. This implies that FDI, which takes the post-privatisation outcome to this low level of equilibrium, is not sustainable. Investing below this unstable equilibrium will lead to a stable equilibrium where the Pareto-improving privatisation objectives are not met and therefore the system is not Pareto-improved and some agents lose out who will subsequently clog the wheel of market forces. Therefore, in order to achieve Pareto-improving privatisation the government needs to invest beyond this investment point for a stable and high-level equilibrium to be reached. If the post-privatisation outcomes homes in on this high-level equilibrium, FDI is sustainable since everyone gains from this entry by MNC/foreign firm into a privatised industry. It is very important to note that equilibrium will not occur in all cases. Simulation analysis determined the parameter ranges where equilibrium will occur and what level of government investment is required for the system to be Pareto improved. The corollary of this is if there is disequilibrium in the system then no level of government investment will be adequate to enable Pareto-improved privatisation. This of course is a case that argues against privatisation because it will not lead to higher levels of income, efficiency and equity-sustainable FDI. The simulation analysis concluded that even if the system is Pareto improved through the two-tier game played by the domestic and foreign firm/MNC, and the foreign firm with the government, the system can easily become Pareto deficient with unfavourable movements in highly sensitive market and technology parameters. That is, even the government as a highly influential player in this game is unable to prevent Pareto deficiency in a system highly dependent on favourable market-driven input–output parameters.

NOTE

1. Concept Spatial economics may be found instead of economic geography in some literature, for more explanation see Fujita and Krugman (2004). See also Fujita (2005) and Fujita and Mori (2005).

CHAPTER 6

SNARES AND QUICKSAND ON THE PATHWAY TO PEACE: ROLE OF INTERNATIONAL TENSION IN LOCAL CONFLICTS

6.1. INTRODUCTION TO INTERNATIONAL TENSION: GLOBAL ROOTS OF LOCAL CONFLICTS

The fundamental idea that we seek to establish in this chapter is that the establishment of regional or local, peace calls forth global peace. In other words, our argument is that local and regional conflicts are partly driven by global factors, especially what is commonly known as international tension. In order to achieve meaningful and sustained peace, there is a reason to believe that it is mandatory to manage and contain international tensions. The main thesis of this chapter is to explain or posit, conflicts as a product of continuing international chasms, splits and differences of political and social ideologies in our modern world. Thus, we argue that conflicts are, to some extent, driven by international tension or global, ideological and geo-political factors. Notwithstanding the global influence, local factors – such as income inequality, income growth or lack of it, political institutions – can and do exacerbate conflicts and a peaceful resolution of conflicts becomes a difficult phenomenon.

In order to drive the point home, we will start our discussion with a detailed glimpse at the great global conflicts. Our main argument is that our current conflicts still have some roots of global origin, which is a product of what is known as international tension. In this chapter, we will offer comprehensive models to capture the feedback between local factors and international tension, which can explain various subtle and intertemporal dynamics involving conflicts, violence and terrorist activities.

The idea of ideological chasms and international/global tension is not new: Rattinger (1975) introduced an idea of international tension into the basic Richardson-type model. International tension was quantified in terms of verbal statements made by the nations embroiled in a conflictual situation. In an interesting work on Iraq–Iran conflict, Abolfathi (1978) introduced the United States–Soviet Union world rivalry as an explanatory variable. In a differential game international tension, as measured by the sum of military expenditure, has also been modelled by Zinnes, Gillespie, Schrodt, Tahim, and Rubinson (1978) to explain arms race. Our model differs significantly from these models as we focus on actual conflicts and not just arms race. It is also important to note that we will derive an endogenous measure/index of international tension-driven conflict, instead of an exogenous measure of international tension. As a result, our model, its empirical questions and findings are significantly different from the early attempts.

The plan of the chapter is as follows: in Section 6.1, we provide a detailed outline of the evolution of global rivalry and conflicts since the First World War. In Section 6.2, we provide a basic theoretical analysis of a new index, what we call beta index, of conflicts driven by international tension. The beta index is argued to capture the global roots of local conflicts. We then offer an empirical foundation to the beta index by calculating the beta values for 92 nations in Section 6.3. In Section 6.4, we examine the intertemporal movement of the beta index of these 92 nations to explore how international tension traversed over time from one region to another. In order to do that we introduce a new concept of beta mobility that is akin to the measures of income mobility in the context of income distribution. In Section 6.5, we provide various details of the data that we will use. In this section, we will also offer an empirical foundation to the sensitivity of the beta index of a country to its economic inequality, GDP growth, military expenditure, internationalisation index, political index and index of openness. The model is based on three main time periods: first period between 1970 and 1982, second period between 1983 and 1991, third period between 1992 and 2004. In this section, we will use the panel data that will allow us to control for unobservable time-invariant country-specific effects on the beta index of conflicts of a country. In Section 6.6, we develop a major theoretical model to explain how local conflicts can be created by international tension. In this section, we examine conflicts mainly in the context of violence perpetrated by terrorist groups. Ours will be a first model in understanding the economics of terrorist group formation in the context of a competitive model. This model depends on the endogenous partnership formation between terrorist agencies/organisations across borders. The findings of the

model explain how local and global issues of conflict can mix to give rise to an equilibrium conflict, which therefore has a tendency to self-perpetuate. The model also explains the incentive structures of terrorist organisations and their sizes.

In Section 6.7, we turn to a very important empirical regularity that has characterised conflicts, especially terror attacks: terror attacks do not move in a linear fashion, they rather display temporal path of cycles. We develop a theoretical model to explain why terrorist activities can display a cyclical path. In Section 6.8, we finally turn to the question of whether terrorist activities and conflicts can be endogenously driven, as opposed to the current emphasis of the literature on the comparative-static analysis in explaining the time path of conflicts and terrorist activities. We will develop a simple model of terror assets, which can explain the possibility of endogenous-driven cyclical paths for conflicts and terrorist activities. We will conclude in Section 6.9.

6.1.1. The Influence of the World War I on Global Chasms and Ongoing Tensions: Historical Diary of Relevant Events

The first great and truly global conflict started as World War I (hereafter WWI) on 28 July 1914, which involved most of the world's main powers. On a statistical front, some 65 million soldiers were mobilised and of whom 12% people were perished and more than 21 millions were wounded. In a bird's eye view account, the foundation stone of the WWI was laid by the German Chancellor Otto von Bismarck in early 1870s. In order to maintain German supremacy in Central Europe and contain French influence, Bismarck actively sought to create a European power axis with Russia and Austria–Hungary in 1871. It is noteworthy that France had still been suffering from the debacle in the Franco-Prussian war. In 1882 Bismarck formed a somewhat tenuous regional power enclave with memberships of Germany, Russia, Italy and Austria–Hungary, which is popular as the 'Triple Alliance'. This led to the finalisation of the German diplomatic supremacy on the European soil by the early 1890s. This enclave had been somewhat unstable as any collusive arrangement is usually, which we will examine in greater theoretical detail subsequently.

At the same time, outside the enclave, France felt vulnerable and actively sought to break up the rival enclave in self-defence. Eventually, in 1894 France and Russia formed the 'Dual Alliance' due to two-fold reasons: first and foremost, there appeared a clear cleavage between Russia and

Germany. Secondly, Russia was in need of French capital for its economic progress at that point in time. The formation of the 'Dual Alliance' acted as a counterbalancing force against the 'Triple Alliance'. This duopoly of power sharing provided some kind of stability and an uneasy lull before the storm in continental Europe.

During the last five years of 1890s Europe witnessed some fundamental changes that gradually attracted British attention to the split of continental Europe into two rival enclaves/camps. First and foremost, the German nationalism had steadily been rising. Secondly, the so-called German imperialism in Africa caused serious concerns for British colonial interests. Great Britain disdained the emergence of Germany as a significant competitor of British industrial goods in regional markets. Finally, the large-scale German naval buildup alarmed senior British politicians. In a series of quick and deft manoeuvring, Great Britain and France buried their differences that led to the formation of 'Entente Cordiale' in 1904. The difficult task of roping Russia was completed in 1907 when Great Britain, France and Russia formed the counter conclave of 'Triple Entente'. Thus by 1907, the split of Europe into two rival armed gangs/camps was complete. This chasm in Europe formed the fundamental source of open conflicts in Europe, which we argue still continues in some form. A series of trigger factors, besides the above fundamentals, burst into the scene by the 1910:

- 1905–1910 witnessed a significant industrial growth in Europe that triggered the need to protect and expand the bases of raw materials in colonies.
- The main sources of raw materials were the African and Asian colonies, which became prime targets of these European nations for capture, seize and exploit.
- At the same time, the industrial growth in Europe caused a worldwide struggle for markets.
- The emergence of surplus capital in Europe needed a safe and secure haven for re-investment.
- At that crucial juncture, it was Germany that posed a serious challenge to Great Britain as a global leader of industry and commerce.
- German imperialist dreams (or so anticipated) became a constant theme in the nightmares of other imperialist powers of Europe.
- The scene was further vitiated by the emergence of heightened nationalism in Germany, France, Italy, Russia, Czech, Polish and the Balkans – the list continues.

- The Balkan war of 1912–1913 added to the explosiveness of continental Europe.
- In a series of crises, Germany and its allies received bitter opposition and hostility from the rival camp.
- Italy's plans in North Africa received an active support from Great Britain and France, which dealt the final blow to the 'Triple Alliance' and Germany wrote off Italy as an ally by 1914.
- In this international anarchy, there was a continuing fear and recrimination between rival groups. The Hague Peace Conferences in 1899 and 1907 produced little resistance to the rising war machineries of the rival camps.

The above complexities in Europe gradually descended into a chaos of WWI as purely European military struggles, which the Wilson government of the United States wanted to stay away from. The US proclamation of neutrality was seriously challenged within the United States by factions who championed the Allied causes and rival factions who championed the German causes. The American public opinion was also utterly confused at the early stage of the WWI. Bearing a striking similarity to Europe, the United States was split and polarised: some Americans openly supported the Allied cause while there was a plenty of support for the Germans. There was a strong wave of sympathy initially for Great Britain and France, which came to be counterbalanced by an equally strong hostility towards Great Britain by Irish-Americans and German-Americans. Americans of Italian origin displayed pro-Italian sentiments. During 1914–1917, it seemed that American entrance to WWI was a remote possibility due to this open cleavage in the American society. However, during the course of the war the American opinion started changing gradually and the US government increasingly leaned towards the Allied cause and by early 1917 the United States was caught by the war fever and a strong disdain for the German cause. Several factors are important for this tilt of the American foreign policy towards the Allied cause:

- First and foremost, the British and the Allied relentlessly pursued to establish a special interpretation of the Great War: according to this interpretation, the war was a product of the ruthless German aggression whilst the main motive behind this aggression was successfully portrayed as a German vision to conquer the world. This vision of Germany gradually embittered Americans against Germany.
- The German submarines played havoc in the Atlantic Ocean and tore into pieces the Allied supply lines. This created a fear in the US politicians that

the control of the Atlantic Ocean will be ceded to the Germans unless a necessary step was to be taken.

- The dividend of WWI to the US economy was enormous due to the Allied Forces ammunition orders. Thus, the US business interests had came to have the knot with the Allied interests.
- In such a grave situation, the American people and politicians were appalled by the Zimmerman Note: on 1 March 1917 the German Foreign Minister Arthur Zimmerman had made official offers to Mexico, the US states of New Mexico, Arizona, Texas if Mexico would join Germany in the war. This acted as a direct threat to dismember the United States.
- Within a few days, the news of the Russian revolution spread to the world like a wild fire. The overthrow of the Tsarist regime and the establishment of Bolsheviks in Russia further created a sense of insecurity in the US mindset. The public came to view that the democracy is at stake.
- By early April of 1917, the anti-German sentiments reached a peak in the United States that was never ever seen on that continent before. On this tide of anti-German feelings, the US Congress voted on the April 6 to enter the war. The mass support for the war came from the belief that the American troops are going to war 'to end the war and protect democracy'.

By December 1917, Russia under the control of the Bolsheviks and withdrew from the war and signed a truce with the Central Powers and concluded a peace agreement. Russia abandoned all claims to Poland, Lithuania, Estonia, Ukraine, Latvia etc. and vast economic concessions were made to the Central Powers. Thus, after winning the war in the eastern front, the German hopes were flying high for a final strike in the west as well. On 15 July, the Germans summoned all their strengths to break through at Chateau-Thierry. The Allied counterattacks started on the 18 July and the United States successfully conveyed the following messages to Germany: President Wilson summoned the advancement of the US army to create *just* peace: 'piece without victory'. That rang with the psyche of the German people and soldiers alike. At the same time, the presence of the US army conveyed to the people of Germany that the Allied Forces are fighting 'the military masters of the German people and not the mass of the German people'. The advancement of the US troops acted as a miracle on the vast majority of the population under the Central Powers. President Wilson's 14 points, as enumerated in the Congress earlier on 8 January 1918, soon caught with the imagination of the people of the Central Europe as the basis for an 'honourable peace'.

One important element of 19th century war is what one may call mutually assured economic destruction (hereafter MAED). The scale of operation became inconceivably large in the trench warfare and occasional charges towards enemies. The constant barrage of machinegun fires and artillery bombardments during the WWI caused the economic cost of war incredibly high. The conservative pecuniary cost of war is conservatively put at $1,000,000 an hour by the British only. The other cost is the direct and indirect involvement of civilian in the war in the supply-chain: some 65-million people were mobilised and 8 millions fell to death and 21 millions were wounded. There appeared a great 'war weariness or fatigue' among all people by the 1916. The cost of war became too burdensome for humans. The prospect of peace was the only source of hope to the hapless masses.

The above dynamics led to what is popularly known as the quiet German revolution. On 29 October 1918 the Kaiser quietly slipped out of Berlin for the General Headquarters, as he felt insecure without a bastion of army protecting him from the angry masses. The navy mutinies led to the independence of Kiel from the control of the Kaiser. Very soon Bremin and Hamburg also followed soon. The new rebel forces wanted to put an end to the war and sent emissaries to the Allied Forces to initiate an armistice on the basis of a 'Fourteenth Points' charter. It became an important moment for the world peace as the Kaiser abdicated his power on 9 November, which prompted the German emperor to have fled on 10 November to Holland where he was exiled for the rest of his life. This is one of the turning points for world peace driven by the army and people alike. Overnight all minor regalities and monarchies toppled over each other to create the republic led by Von Hindenburg. At 5 am on 11 November the armistice was signed and it became effective by 11 am.

The greatest tragedy after the armistice was the betrayal to the faith of the masses of the Central Powers that there will be an honourable peace under the stewardship of President Wilson of the United States. What transpired was a fractured peace as President Wilson faced a combined and strategic move by the French, British and Italian powerbrokers. President Wilson wanted two important institutions in Europe: first and foremost, the disarmament of entire Europe so that MAED does not hang on their heads. Secondly, President Wilson wanted the establishment of self-determination for the people of the Central Powers. Very quickly, his ideals of the world peace were pushed to the periphery and petty sentiment broke out among the Allied Forces to enforce a one-sided and dictated peace to the Central Powers. Bitter verbal battles, as examples, between Wilson and Clemenceau

of France marred the possibility of negotiating a real peace in the region. Great Britain, France and Italy (GFI axis) virtually enforced one-sided disarmament and eviction of Germans from regions what the GFI axis felt important for their safety. It became a humiliating moment for the Central Powers which sowed the seeds of World War II (WWII): the Central Powers became a vanquished side with little perceived ability to pose a military threat to the Allied in future years. The Allied fought tooth and nails to render the League of Nations of Wilson ineffective. The Allied re-defined the boundaries of Europe. From the war and the fractured peace a new Europe emerged:

- Europe remained as fragmented as before whilst the United States arose as an industrial power of the new world order.
- Economic strengths of France and Great Britain were severely impaired.
- Germany tottered on the verge of anarchy.
- Local monarchies and feudal elements crumbled to pieces.
- Strong sentiments of nationalism started sweeping Europe again.
- Economic and social reforms were afoot, which changed the picture of Europe within a decade.

In some sense the seeds of WWII were shown in the endgame as depicted above. The greatest war of world history began on 1 September 1939 with the invasion of Poland by the German army. It took six years and an unprecedented bloodshed with unfathomably disturbing holocaust of the innocent Jewish people and a series of blazing and shameful nuclear holocausts at two Japanese cities. These two distinct holocausts will haunt the psyche of every common man on our earth for a long time beyond our current understanding of time of history. Even in the darkest corners of our globe, these holocausts have and will warn every people of a unipolar system in which a group of people can be singled out by the powerful for an outright annihilation. It is this fear that still drives various groups to arm themselves as a protection from a future annihilation. The gory history of WWII will take a lot of persuasion and continually peaceful coexistence to motivate the common people to shed their distrust to any unipolar, even a bipolar, system.

In the above context of fractured peace, it took less than 20 years for Germany to arm itself and to march back to the Rhineland (7 March 1936) wherefrom German nationals were expelled at the conclusion of WWI – against the wishes of President Wilson. The war machines under Adolph Hitler's dictatorship in Germany became evident. In Italy, a former ally of the Great Britain in WWI, the rise of fascism under Benito Mussolini led to

a quick-fire arms race. Both these nations tested out the new international water by attacking small nations: Germany marched through Austria and annexed parts of Czechoslovakia while Italy moved against Ethiopia. Unfortunately, the global players were caught napping as Great Britain and France and the United States tried to get a resolution from the impotent League of Nations. In spring of 1939, Germany and Italy got involved with Russia in a bigger conflict in Spain where a civil war had been raging since 1936. Germany and Italy quickly vanquished Russia and established another fascist state in Europe. On the other side of the world Japan had been steadily devouring China up, which yielded a mild protest from the world powers. Finally, the invasion of Poland by Germany triggered the onset of war while the attack of Pearl Harbour on 7 December 1941 by Japan led to the merger of two wars and cascaded into one of the worst war of the history of mankind.

Even though conflicts since the 1990s have gone local, what we argue is that there is a serious global element. For an ongoing conflict, both sides need economic resources, manpower, willingness to fight, fighting technology, training, arms and a whole gamut of logistics. Unless there is a global element in conflicts, conflicts will evaporate quickly into simple discontent without the paraphernalia of modern artefacts of war. As a result, behind most conflicts there will be the presence of some global divisions, hiatus, splits, cleavages – social, political, ideological that have spurned direct wars and conflicts in the European soil. If this proposition is true, from the statistics of conflicts we will offer a measure of the impact of international/global issues on local conflicts. In the following sections, we offer a tentative measure and explore its implications.

6.1.2. Mutual Assured Destruction and the Onset of the Cold War and the Fragmentation of the Globe

The Cold War was the modern era of rivalry, conflict and tension between the United States and the Soviet Union and their respective allies from the mid-1940s through to the early 1990s. In the specific sense of the post-WWII geo-political ambitions, rivalry and tensions between the Soviet Union and the United States, the *Cold War* term has been attributed to American financier and US presidential advisor Bernard Baruch. On 16 April 1947, in a much-famed speech Baruch said,

Let us not be deceived: we are today in the midst of a cold war.

The Cassell Companion notes that the expression was actually created by Baruch's speechwriter, Herbert Bayard Swope, who had been using it privately since 1940. Columnist Walter Lippmann is widely recognised to give the term a wide currency after his 1947 book titled 'Cold War'.

Throughout this period, the enmity and rivalry between the two superpowers spread to several arenas, such as military coalitions, ideology, propaganda, arms race, proxy wars and conflicts and space race – the list goes on. Even in the sphere of sports, rising strains between the United States and the Soviet Union (USSR) had triggered several boycotts of major sporting events. The overall effects of the Cold War are very costly for both superpowers – as examples costly defence spending, a massive conventional and nuclear arms race and a series of proxy wars and open conflicts. Note that there was never a direct war between the United States and the Soviet Union, there was a long-haul of military buildup, pseudo wars, shadows of nuclear holocaust and political battles for support around the world, including significant involvement of allied and satellite nations in local 'third party' wars.

As clear from our discussion, although the United States and the Soviet Union had been allied against the Axis Power, the two sides entertained serious differences on how to reconstruct the post-war Europe/world even before the end of WWII. Over the following decades, the Cold War spiralled outside Europe to every region of the world, as the United States looked for the 'containment and rollback' of communism and forged numerous alliances to this end, particularly in Western Europe and the Middle East. Meanwhile, the Soviet Union actively participated in the spread of Communist movements around the world, particularly in Eastern Europe and Southeast Asia. There were repeated crises such as the Berlin Blockade (1948–1949), the Korean War (1950–1953), the Vietnam War (1959–1975) and the Soviet–Afghan War (1979–1989). The fragility of our world was amply demonstrated especially in the 1962 Cuban Missile Crisis, when the world came to the brink of a new world war. There were also times when tension was reduced as both sides sought détente. Direct military attacks on rivals were deterred by the potential for 'mutual assured destruction' using deliverable nuclear warheads. The Cold War drew to a close in the late 1980s and the early 1990s. With the election of President Ronald Regan, the United States increased diplomatic, military and economic pressure on the Soviet Union. The Soviet Union – being led by the newly appointed Mikhail Gorbachev – wanted to keep up with the United States by introducing perestroika and glasnost and several internal reforms. Ironically, these reforms eventually led to the collapse of

the Soviet Union in 1991, leaving the United States the only superpower in a unipolar world.

6.1.3. Genesis of the Cold War

There is some disagreement over the time exactly when the Cold War started unfolding. While there is some sort of agreement among most historians that it began in the period just after WWII, some forcefully argue that it began towards the end of WWI. There is a strong belief that the Cold War was a continuation of the historical tensions and rivalries between two European powerhouses – the Russian Empire and the British Empire, which dates back to the middle of the 19th century. In some sense, the United States was dragged into this old enmity due mainly to the Russian Revolution. The ideological clash between communism and capitalism surfaced only after the Russian Revolution in 1917, when Russia emerged as the world's first communist nation. As discussed earlier, the establishment of Bolsheviks in Russia was the major event which made Russian–American relations a matter of major long-term concern to the leaders in each country.

Several events triggered the suspicion and distrust between the United States and the Soviet Union: the Bolsheviks' challenge to capitalism (through violent overthrow of 'capitalist' regimes to be replaced by communism), Russia's withdrawal from WWI in the Treaty of Brest-Litovsk with Germany as discussed before, the US backing of the White Army in the Russian Civil war, and the US refusal to recognise the Soviet Union until 1933.

6.1.4. War World II and Post-War Complexities (1939–1947)

During the course of the WWII, there had been a nagging suspicion among Russians that the British and the US crafted the war in such a fashion that the burden of the war turned on the Russian pivot. Thus, Soviet perceptions of the West and vice versa engendered a deep chasm and a strong undercurrent of tension and hostility between the Allied powers. It is also noteworthy that the Allies disagreed about how the European map should be drawn, and borders curved out, following the war. The issue of post-war security became a sticking point: both sides held very dissimilar ideas regarding the institution and maintenance of post-war security. The American concept of security put a strong emphasis on democracy and

free markets. The United States argued that, if US-style governments and markets were established as widely as possible, countries could amicably sort out their differences and live peacefully, through internationally brokered negotiations mainly under the umbrella of international organisations. On the other hand, the Soviet model of security critically rested on the integrity of the Russian borders. This reasoning was prompted by Russia's historical experiences, given the onslaught of invasions of the country from the West over the previous 150 years. There is no gainsaying to the fact that the German invasion of Russia had left a deep scar. The mammoth cost of the German invasion on Russia was unprecedented both in terms of death toll as 27 million Russians perished while the extent of destruction was unrivalled in the Russian history. It was thus reasonable that Moscow wanted to ensure that the new order in Europe can guarantee the Soviet Union a long-term security. The mechanism to ensure that became a source of rising tensions. The Soviet Union sought security through the elimination of the prospect of a hostile government reappearing along the USSR western border, by directly controlling the governments and people of these countries. Poland became a source of immediate tensions: in April 1945, both Churchill and the newly elected American President Harry S. Truman opposed the Soviet intervention in Poland especially the establishment of the puppet Lublin government. At the Yalta Conference in February 1945, the Allies had offered to define the framework for a post-war settlement in Europe but could not reach a firm consensus due to the Soviet persuasion to secure its own boundary. Following the Allied victory in May, the Soviets swiftly moved to the Eastern Europe to occupy the region while strong United States and Western Allied Forces remained in Western Europe. It is once again a divided Europe after the Allied victory. The division of Germany exemplified the new era of rivalry, suspicion and tensions: in occupied Germany, the United States and the Soviet Union created zones of occupation and a loose framework for four-power control with the fading French and British.

A serious attention was now given to the establishment of world peace through an international agency/organisation. For the maintenance of world peace, the Allies set up the United Nations, but the organisation was bereft of any real power since the enforcement capacity of its Security Council was effectively paralysed by the superpowers' use of the veto. This created a real vacuum in the making of institutions that can actively promote peace by mitigating aggression. To some observers, 'the UN was essentially converted into a forum for exchanging polemical rhetoric, and the Soviets regarded it almost exclusively as a propaganda tribune'.

Because of the Soviet masquerading of power, the British government led by Prime Minister Winston Churchill was alarmed by the enormous size of Soviet forces deployed in Europe at the end of the war. This alarm was further spurned by the perception that Soviet leader Joseph Stalin was unreliable. All on a sudden after the conclusion of WWII, British felt the materialisation of a Soviet threat to Western Europe. In April–May 1945, British Armed Forces developed Operation Unthinkable, the Third World War plan, the main purpose of which was 'to impose upon Russia the will of the United States and the British Empire'. However, the plan was rejected by the British Chiefs of Staff Committee as militarily unfeasible. Thus, the stage was set for another bipolar division of Europe and consequently the world, which cascaded into a full-blooded Cold War.

At the Potsdam Conference, starting in late July, serious differences emerged over the future development of Germany and Eastern Europe. It virtually became a verbal and propaganda battlefield for Truman and Stalin. At this Conference, Truman tried to cow down Stalin by disclosing the nuclear weapon whilst Stalin defiantly signalled the Soviet march towards the nuclear weapon. In February 1946, George F. Kennan's '*Long Telegram*' from Moscow helped to form the growing hard line that was being taken against the Soviets, and became the basis for US strategy toward the Soviet Union throughout the rest of the Cold War. At the same time, the Soviet government started taking similar hard line stance towards the United States. The perception of the Soviet about the United States was that the United States was 'being in the grip of monopoly capital building up military capability to prepare the conditions for winning world supremacy in a new war'. The culmination of tensions finally came from the former British Prime Minister Winston Churchill delivered his some-what reckless '*Iron Curtain*' speech in Fulton, Missouri in which he called for an Anglo-American alliance against the Soviets, whom he accused of establishing an 'iron curtain' from '*Stettin* in the Baltic to *Trieste* in the Adriatic'.

6.1.5. The Korean War and the First Battlefield after WWII (1947–1953)

By 1947, US president advisors of Harry Truman became increasingly preoccupied with Joseph Stalin and how to counter the influence of the Soviet Union. It became a common assumption in the US politics that Stalin was trying to weaken the position of the United States in the period of post-war rivalry by encouraging and playing to competition among capitalist

nations. A few important events rocked the US political mindset around the post-war reconstruction period:

- In Asia, the Red Army had come to control Manchuria in the last month of the war and then occupied Korea above the 38th parallel north.
- Mao Zedong's Communist Party of China, though receptive of minimal Soviet support, defeated the pro-Western and heavily American-assisted Chinese Nationalist Party in the Chinese Civil War.
- The USSR propped up puppet communist regimes in Eastern Europe: as in Bulgaria, Czechoslovakia, Hungary, Poland, Romania and East Germany while the Red Army kept a military presence and close vigil in most of these countries.
- In February 1947, the British government officially made it clear that it could no longer afford to finance the Greek monarchical military regime in the civil war against communist-led insurgents. Harry Truman openly started the discussion on how to contain the spread of communism in Asia and Europe, which became popular as the Truman Doctrine, which explained the post-war conflict as a contest between 'free' peoples and 'totalitarian' regimes. For US policy-makers, issues concerning Europe's balance of power were not necessarily military ones, but a political and economic challenge.
- In June, the Truman Doctrine was complemented by the Marshall Plan, a promise of economic assistance to reconstruct the Western economic system and thereby challenging the perceived threats of communism on the soil of Western Europe.
- To the Soviets and especially to Stalin the Marshall Plan came as a significant threat to Soviet control of Eastern Europe. Stalin argued that economic and social integration with the West would make Eastern Bloc countries to flourish and thereby pose a threat to its border. Stalin therefore prevented Eastern Bloc nations from receiving Marshall Plan aid. The Soviet Union's alternative to the Marshall plan, which was purported to involve Soviet subsidies and trade with Western Europe, became known as the Molotov Plan and later, the COMECON. A clear battle line was drawn on the European soil. The battle line was however mainly in terms of aggressive economic reconstruction and expansion, which could not hide the clear break-up of Europe into two hostile camps.
- At the same time, Stalin was apprehensive of a reconstituted Germany, as his vision of a post-war Germany to be of no threat to the Soviet Union. In restraining the Western efforts to re-industrialise and rebuild the German economy, Stalin put explicit blockades which prevented Western

materials and supplies from getting to West Berlin, which came to be known as the Berlin Blockade – an open propaganda war and conflict without ammunitions. This became the first major crisis after WWII.

- The United States formally formed an alliance with the Western European states in the North Atlantic Treaty of April 1949, establishing the North Atlantic Treaty Organization (NATO) group of nations. The formal split of Europe cascaded into the Soviet detonation of the first Soviet atomic device in 1949, which ended the US supremacy in nuclear warheads. This also initiated a new phase of US–Soviet rivalry as an open conflict became too costly.
- Germany came to be divided into the US-controlled West Germany and the Soviet-controlled German Democratic Republic in 1949, which prompted the re-arming of West Germany by the United States.
- As Europe became splintered into two rival camps, the new rivalry quickly spread into Asia, Africa and Latin America: two superpowers got their horns locked in order to counter revolutionary nationalist movements, often led by Communist parties financed by the USSR, fighting against the restoration of Europe's colonial empires in Southeast Asia. In the early 1950s, The United States formalised a series of alliances with Japan, Australia, New Zealand, Thailand and the Philippines and thereby guaranteeing the United States a number of long-term military bases.

One of the more significant impacts of the above confrontation between superpowers was the Korean War. As noted before, the United States and the Soviet Union had been fighting proxy wars, on a small scale, and without US troops. All on a sudden – to Stalin's surprise – Truman dispatched US forces to drive back the North Koreans, who had invaded South Korea. This unforeseen action was officially backed by the UN Security Council only because the Soviets were then boycotting meetings in protest that Taiwan and not Communist China held a permanent seat there. This became one of the major events that stamped out the faith of millions in the world in the true neutrality of the United Nations and its Security Council and a consequent polarisation of people between these two opposing camps of these two superpowers. The Korean War galvanised the solidarity of these two rival camps into two warring camps as NATO now developed a military structure while the communist world rallied behind the North Korea. The Korean War divided people in individual nations: in Great Britain there appeared a clear division of people who supported the Korean War and people who actively opposed it. Even if the Chinese and North Koreans were frustrated by the enormity and the

destructiveness of the war and were ready to end it by late 1952, Stalin insisted that they should continue fighting. Interestingly a ceasefire was approved only in July 1953, after Stalin's death.

6.1.6. An Era of Crisis after Crisis (1953–1962)

In 1953, changes in political leadership on both sides shifted the dynamics of the Cold War. The war horses like Joseph Stalin and Harry Truman disappeared from the global scene. Dwight Eisenhower took over the presidency and a legacy of the US rivalry:

- During the last 18 months of the Truman administration, the US defence budget had quadrupled.
- It became mandatory for Eisenhower to reduce military spending. He argued that the United States's nuclear superiority is the ultimate weapon against the Soviet Union.
- In March 1953, as Joseph Stalin died, Nikita Khrushchev soon became the dominant leader of the USSR. What is of critical importance is the revisionist view of Khrushchev about Joseph Stalin's work: he declared that the only way to reform and move away from Stalin's policies would be by acknowledging errors made in the past.
- By 1956 Khrushchev took a complete U-turn and started menacing threats to annihilate the Western civilisation by nuclear weapons. It became sickeningly popular as the 'we will bury you' statements. Khrushchev tried subsequently putting a polish of economic victory on his statements – not a nuclear victory. The Suez crisis only proved the importance of nuclear superiority of the United States. The situation in Europe remained like an active volcano – the US troops seemed stationed indefinitely in West Germany and Soviet forces seemed indefinitely stationed throughout Eastern Europe.
- Berlin remained divided and contested. In 1961, the East Germans erected the Berlin Wall to prevent the movement of East Berliners into West Berlin. From 1957 through 1961, Khrushchev constantly threatened the West with nuclear annihilation. He claimed that Soviet missile capabilities were far superior to those of the United States, capable of wiping out any American or European city.
- However, in 1961, Khrushchev rejected Stalin's belief in the inevitability of war, and declared his new goal was to be 'peaceful coexistence' with capitalism. He now argued that capitalism will gradually collapse in a

peaceful time and 'peace' now became a means to the end/goal of the triumph of communism and class struggle over capitalism. It is important to note that peace as a means also provided some leeway to the Soviet psyche to focus upon their crumbling economy.

- The new era modified the Stalinist Soviet stance, where international class struggle entailed the two opposing camps were on an inevitable collision course where Communism would triumph through global war; now, peace is meant to drive capitalism towards collapse on its own, as well as giving the Soviets the leeway to boost their military capabilities. However, by the late 1960s, the 'battle for men's minds' between two systems of social organisation that Kennedy spoke of in 1961 was largely over, with distrust and tensions henceforth derived primarily from clashing geo-political objectives rather than ideology.

- On the nuclear issue the United States and the USSR chose a position of mutual assured destruction. They pursued nuclear rearmament and developed long-range weapons with which they could strike and annihilate the territory of the other. The rivalry was intense: in August 1957, the Soviets successfully launched the world's first intercontinental ballistic missile (ICBM) and, in October, launched the first earth satellite, SPUTNIK.

- In the late 1950s the spat between the Soviets and China and various other internal problems led to a decline in the USSR. The period after 1956 was marked by serious setbacks for the Soviet Union, most notably the breakdown of the Sino-Soviet alliance. Mao had defended Stalin when Khrushchev attacked him in 1956, and hailed the new Soviet leader as a 'superficial upstart', accusing him of having lost his 'revolutionary edge'. After this, Khrushchev attempted to reconcile and reconstitute the Sino-Soviet alliance, but Mao stonewalled it and denied any proposal. Further on, the Soviets focused on a bitter rivalry with Mao's China for leadership of the global communist movement, and the two engaged in military conflicts in 1969.

- The nuclear arms race between the United States and the USSR came close to the possibility of nuclear war and annihilation. Khrushchev formed an alliance with Fidel Castro after the Cuban Revolution in 1959, which posed a direct threat to the United States. In 1962, President John F. Kennedy played a tit-for-tat strategy to the USSR installation of nuclear missiles in Cuba with a naval blockade. The Cuban Missile Crisis brought the world closer to nuclear war. It also established the theory that neither superpower was ready to use nuclear weapons for fear of the other's retaliation, and thus of mutually assured destruction.

The aftermath of the crisis paved the way for the first efforts at nuclear disarmament and improving relations, though the Cold War's first arms control agreement, the Antarctic Treaty, had come into force in 1961.

- The real change came with the Gorbachev era much later. The mindset started changing and a new horizon appeared with Gorbachev's 'new thinking'. This new vision portrayed a peaceful coexistence in the globe as an end in itself rather than a means that takes the form of class struggle. At the same time, the US visions centred on American strength abroad and the success of liberal capitalism.

- More broadly, one hallmark of the 1950s was the beginning of European integration – a direct spin-off of the Cold War that Truman and Eisenhower promoted politically, economically and militarily, but which later administrations viewed ambivalently, fearful that an independent Europe would launch a separate détente with the Soviet Union, which would use this to exacerbate Western disunity. Nationalist movements in some countries and regions, notably Guatemala, Iran, the Philippines and Indochina are a product of active support from the communist world or at least were perceived so in the West. In this context, the United States and the Soviet Union increasingly engaged in a global rivalry for influence by proxy in the Third World as decolonisation gained momentum in the 1950s and early 1960s. The US government sought help from the CIA to remove a host of unfriendly Third World governments and to support others. The United States used the CIA to overthrow governments suspected by Washington of turning pro-Soviet, including Iran's first democratically elected government under Prime Minister Mohammed Mossadegh in 1953. Between 1954 and 1961, the United States sent economic aid and military advisors to stop the collapse of South Vietnam's pro-Western regime. Both sides used propaganda to advance their cause. The Chinese and the Soviets got involved in an intra-Communist propaganda war after their split. Soviet propaganda used Marxist philosophy to attack capitalism, claiming labour exploitation and war-mongering imperialism were inherent in the system. Many emerging nations of Asia, Africa and Latin America resisted the pressure to choose sides in the East–West competition. In 1955, at the Bandung Conference in Indonesia dozens of Third World governments chose to stay out of the Cold War. The consensus reached at Bandung culminated with the creation of the Non-Aligned Movement in 1961. Meanwhile, Khrushchev broadened Moscow's policy to establish special ties with India and other key neutral states. Independence movements in the Third World transformed the post-war order into a more pluralistic world of

decolonised African and Middle Eastern nations and of rising nationalism in Asia and Latin America.

6.1.7. Emergence of Détente (1962–1979)

In the course of the 1960s and 1970s, both the United States and the Soviet Union tried to adjust to a new, more complex pattern of international relations in which the world was no longer divided into two clearly opposed blocs. From the beginning of the post-war period, Western Europe and Japan rapidly recovered from the destruction of WWII and registered strong economic growth through the 1950s and 1960s, increasing their strength compared to the United States. As a result of the 1973 oil crisis, coupled with the growing influence of Third World alignments such as the Organization of Petroleum Exporting Countries (OPEC) and the Non-Aligned Movement, less-powerful countries had more room to assert their independence and did not succumb to the pressure from either superpower. Moscow, meanwhile, was forced to turn its attention inward to deal with the Soviet Union's deep-seated domestic economic problems. During this period, Soviet leaders such as Alexei Kosygin and Leonid Brezhnev embraced the notion of détente. On 13 November 1968, during a speech at the Fifth Congress of the Polish United Workers' Party, Brezhnev outlined the Brezhnev Doctrine, in which he asserted the right to violate the sovereignty of any country attempting to replace Marxism–Leninism with capitalism. The reasons for adopting such a doctrine had to do with the failures of Marxism–Leninism in states like Poland, Hungary and East Germany, which were facing a declining standard of living, in contrast with the prosperity of West Germany and the rest of Western Europe.

Both superpowers wanted to reinforce their global leadership. Both the United States and the Soviet Union struggled to stave off challenges to their leadership in their own regions. The United States continued to spend huge sum of money on supporting friendly Third World regimes in Asia. Conflicts in peripheral regions and client states – most prominently in Vietnam – went on. Johnson sent 575,000 troops in Southeast Asia to defeat the National Front for the Liberation of South Vietnam (NLF) and their North Vietnamese allies in the Vietnam War, but his costly war policy weakened the US economy and, by 1975 the world witnessed a humiliating defeat of the world's more powerful superpower at the hands of one of the world's poorest nations. The USSR under Brezhnev, meanwhile, faced far more daunting challenges in reviving the Soviet economy, which was

declining due to heavy military expenditures. In the meanwhile, the Middle East continued to be a source of contention. Egypt, which received the bulk of its arms and economic assistance from the USSR, engaged in direct and tacit wars against US ally Israel; Syria and Iraq later received increased assistance as well as (indirectly) the PLO. During the Yom Kippur War, rumours of imminent Soviet intervention on behalf of Egypt brought about a massive US mobilisation that threatened to break détente. This escalation, the USSR's first in a regional conflict central to US interests, led to a new and more turbulent stage of Third World military activism and made use of the new Soviet strategic parity. Although indirect conflict between Cold War powers continued through the late 1960s and early 1970s, tensions began to ease as the period of détente began. The Chinese had tried to improve relations with the United States in order to gain advantage over the Soviets.

6.1.8. The Genesis of the 'Second Cold War' (1979–1985)

Historians use the term *second Cold War* to refer to the period of intensive reawakening of Cold War tensions and conflicts in the early 1980s. Tensions greatly increased between the major powers with both sides becoming more militaristic. During December 1979, about 75,000 Soviet troops invaded Afghanistan in order to support the Marxist government formed by ex-Prime Minister Nur Muhammed Taraki, assassinated that September by one of his party rivals. As a result, US President Jimmy Carter withdrew the SALT II treaty from the Senate and imposed embargoes on grain and technology shipments to the USSR, demanded a significant increase in military spending and further announced that the United States would boycott the 1980 Moscow Summer Olympics. He described the Soviet intervention in Afghanistan as 'the most serious threat to the peace since the Second World War'.

   In 1980, Ronald Reagan defeated Jimmy Carter in the US presidential election, vowing to increase military spending and confront the Soviets everywhere. In some sense the hawks were back to the White House. Both Reagan and Britain's new Prime Minister, Margaret Thatcher, denounced the Soviet Union in ideological terms that rivalled those of the worst days of the Cold War in the late 1940s, with the former famously vowing to leave the 'evil empire' on the 'ash heap of history'. Pope John Paul II helped provide a moral focus for anti-communism; a visit to his native Poland in 1979 gave a religious and nationalist upsurge that galvanised opposition.

With this background of mounting tensions between the Soviet Union and the United States, and the deployment of Soviet SS-20 ballistic missiles targeting Western Europe, NATO decided, under the impetus of the Carter presidency, to deploy Pershing II and cruise missiles in Europe, primarily West Germany. This deployment would have placed missiles just 10 min striking distance from Moscow. Yet support for the deployment was wavering and many doubted whether the push for deployment could be sustained. But on 1 September 1983, the Soviet Union shot down Korean Air Lines Flight 007, a Boeing 747 with 269 people aboard when it violated Soviet airspace just past the west coast of Sakhalin Island – an act which Reagan characterised as a 'massacre'. This act galvanised support for the deployment, which Reagan oversaw and stood in place until the later accords between Reagan and Mikhail Gorbachev.

In its bid for global supremacy, Moscow had builtup a military that partook as much as 25% of the Soviet Union's gross national product at the expense of the standard of living of its civilian population. Soviet spending on the arms race and other Cold War commitments both caused and exacerbated structural problems in the Soviet economic system, which saw at least a decade of economic stagnation during the late Brezhnev years.

Soviet investment in the defence sector was not driven by military necessity, but in large part by the interests of politicians and bureaucrats for their own power and privileges. The Soviet armed forces became the largest in the world in terms of the numbers and types of weapons they possessed, in the number of troops in their ranks and in the sheer size of their military–industrial base. However, the quantitative advantages held by the Soviet military often masked as the Eastern bloc dramatically lagged behind the West in the quality of war machines. By the early 1980s, the USSR had builtup a military arsenal and army surpassing that of the United States. Previously, the United States had relied on the qualitative superiority of its weapons, but the gap had been narrowed. Ronald Reagan began massively building up the United States military not long after taking office. This led to the largest peacetime defence buildup in United States history. Tensions continued unabated in the early 1980s when Reagan revived the B-1 bomber programme that was cancelled by the Carter administration, produced MX 'Peacekeeper' missiles, installed US cruise missiles in Europe, and announced his experimental Strategic Defence Initiative, dubbed 'Star Wars' by the media, a defence programme to shoot down missiles in mid-flight.

Reagan also imposed economic sanctions on Poland to protest the suppression of the opposition Solidarity movement. In response, Mikhail Suslov, the

Kremlin's top ideologist, advised the Soviet leaders not to intervene if Poland fell under the control of Solidarity, as it may have led to heavy economic sanctions representing a catastrophe for the USSR's. At the same time, Reagan persuaded Saudi Arabia to increase oil production, even as other non-OPEC nations were increasing production. These developments contributed to the 1980s oil glut, which affected the Soviet Union, as oil was the main source of Soviet export revenues. The decrease in oil prices and large military expenditures gradually brought the Soviet economy to a moribund state at this time.

6.1.8.1. The New Game of Armed Insurgency

US domestic public concerns about intervening in foreign conflicts persisted from the end of the Vietnam War. The Reagan administration emphasised the use of quick, low-cost counterinsurgency tactics to intervene in foreign conflicts: in 1983, the Reagan administration intervened in the multi-polar Lebanese Civil War, invaded Grenada, bombed Libya and backed the Central American Contras, anti-communist paramilitaries seeking to overthrow the Soviet-aligned Sandinista government in Nicaragua. While Reagan's interventions against Grenada and Libya were popular in the United States, his backing of the Contra rebels was controversial. Meanwhile, the Soviets incurred high costs for their own foreign interventions. Although Brezhnev was convinced in 1979 that the Soviet invasion of Afghanistan would be brief, Muslim guerrillas, aided by many countries (especially the United States), waged a fierce resistance against the invasion. The Kremlin sent nearly 100,000 troops to support its puppet regime in Afghanistan, leading many outside observers to dub the war 'the Soviets' Vietnam'. However, Moscow's entrapment in Afghanistan was far more disastrous for the Soviets than Vietnam had been for the Americans because the conflict coincided with a period of internal decay and domestic crisis in the Soviet system. A senior US State Department official predicted such an outcome as early as 1980, positing that the invasion resulted in part from a 'domestic crisis within the Soviet system. ... It may be that the thermodynamic law of entropy has ... caught up with the Soviet system, which now seems to expend more energy on simply maintaining its equilibrium than on improving itself'.

6.1.8.2. Apparent End of the Cold War (1985–1991)

By the time Mikhail Gorbachev had ascended to power in 1985, the Soviets suffered from an economic growth rate close to zero percent, combined with a sharp fall in hard currency earnings as a result of the downward slide in

world oil prices in the 1980s. To restructure the Soviet economy, Gorbachev announced an agenda of economic reform, called perestroika or restructuring. Within two years, however, Gorbachev came to the conclusion that fundamental structural changes were necessary. Gorbachev redirected the country's resources from costly Cold War military commitments to more profitable areas in the civilian sector. Many US Soviet experts and administration officials initially doubted that Gorbachev was serious about ending the arms race, but the new Soviet leader eventually proved more concerned about reversing the Soviet Union's deteriorating economic condition than fighting the arms race with the West. The Kremlin made major military and political concessions; in response Reagan agreed to renew talks on economic issues and the scaling-back of the arms race. The first was held in November 1985 in Geneva, Switzerland. There, Reagan invited Gorbachev to take a walk to a nearby boathouse and leave their aides. The two men, with only a translator, agreed on a proposal calling for 50% reductions of each country's respective nuclear arsenal.

The second summit was held the following year in Reykjavik, Iceland. Talks went smooth, except for when the focus shifted to Reagan's proposed SDI, which Gorbachev wanted eliminated and Reagan refused. The negotiations ended in failure, but achievements were made at the third summit in 1987 with the signing of the Intermediate Range Nuclear Forces Treaty, which eliminated all nuclear-armed, ground-launched ballistic and cruise missiles with ranges between 500 and 5,500 km (300–3,400 miles) and their infrastructure.

It was the first treaty to reduce nuclear arms. The East–West tensions that had reached intense new heights earlier in the decade rapidly subsided through the mid-to-late 1980s, culminating with the final summit in Moscow in 1988. The following year, the Soviets officially declared that they would no longer intervene in the affairs of allied states in Eastern Europe: oil and gas subsidies, along with the cost of maintaining massive troop's levels, represented an economic drain and the security advantage of a buffer zone was so reduced that by 1990 Gorbachev consented to German reunification. In 1989, Soviet forces finally withdrew from Afghanistan. In December 1989, Gorbachev and Reagan's successor, George H. W. Bush, declared the Cold War over at a summit meeting in Malta; a year later, the two former rivals were partners in the Gulf War against long time Soviet ally Iraq. By 1989, the Soviet alliance system was on the brink of collapse, and, deprived of Soviet military support, the Communist leaders of the Warsaw Pact states were losing power; Gorbachev's 'Common European Home' began to take shape when the Berlin Wall itself came down in November, the only

alternative (as he later admitted) being a Tiananmen scenario. In the USSR itself, Gorbachev had tried to reform the party to quash internal resistance to his reforms, but, in doing so, ultimately weakened the bonds that held the Soviet Union together.

By February 1990, the Communist Party was forced to surrender its 73-year-old monopoly on state power. At the same time, the festering 'nationalities question' increasingly led the Union's component republics to declare their autonomy from Moscow, with the Baltic States withdrawing from the Union entirely. At first, Gorbachev's permissive attitude toward Eastern Europe did not extend to Soviet territory; even Bush, who strove to maintain friendly relations, condemned the January 1991 killings in Latvia and Lithuania, privately warning that economic ties would be frozen if the violence continued. On 25 December 1991, with a growing number of SSRs, particularly Russia, threatening to secede, the USSR (fatally weakened by an August coup attempt) was declared officially dissolved. The Cold War was fought at an unsustainable cost globally over the course of more than four decades. It cost the United States up to $8 trillion in military expenditures, and the lives of nearly 100,000 Americans in Korea and Vietnam. For the Soviets the cost was even higher in terms of the percentage of gross national product. In Southeast Asia, local civil wars were intensified by superpower rivalry, leaving millions dead. After the dissolution of the Soviet Union, the post-Cold War world is widely considered as a unipolar world, with the United States as the world's sole remaining superpower.

Following the Cold War, Russia had the opportunity to reduce military spending drastically, but the adjustment was sluggish. The military–industrial sector employed at least one of every five Soviet adults. It's dismantling left millions throughout the former Soviet Union unemployed with a steady decline in living standards of the millions.

The legacy of the Cold War continues to structure world affairs. The Cold War institutionalised the role of the United States in the post-war global economic and political system. By 1989, the United States was responsible for military alliances with 50 countries and 1.5 million US troops were posted in 117 countries. The Cold War also institutionalised the commitment to a huge, permanent peacetime military–industrial complex and large-scale military funding of science. Some of the economic and social tensions that underpinned Cold War competition in parts of the Third World remain dangerously alive. The breakdown of state control in a number of areas formerly ruled by Communist governments has produced new civil and ethnic conflicts, particularly in the former Yugoslavia. In some countries,

the breakdown of state control was accompanied by state failure, such as in Afghanistan. In other areas, particularly much of Eastern Europe, the end of the Cold War was accompanied by a large growth in the number of liberal democracies.

In areas where the two superpowers had been waging proxy wars, and subsidising local conflicts, many conflicts ended with the Cold War; and the occurrence of interstate wars, ethnic wars, revolutionary wars or refugee and displaced persons crises declined sharply. While the explanations of the origins of the conflict in academic discussions are complex and diverse, several general schools of thought on the subject can be identified. Historians commonly speak of three differing approaches to the study of the Cold War: 'orthodox' accounts, 'revisionism' and 'post-revisionism'.

This 'orthodox' accounts place the responsibility for the Cold War on the Soviet Union and its expansion into Eastern Europe. 'Revisionist' writers placed more responsibility for the breakdown of post-war peace on the United States, citing a range of US efforts to isolate and confront the Soviet Union well before the end of WWII. Post-revisionists' saw the events in the Cold War as more nuanced, and attempted to be more balanced in determining what occurred during the Cold War. Much of the historiography on the Cold War weaves together two or even all three of these broad categories.

6.1.9. Emergence of the New Era of Globalisation

Globalisation is a multidimensional concept having various important facets that entail economic, financial, technological and social and political processes, which continually transform the global economy, society and polity. In this chapter, we focus on seven key aspects of globalisation: trans-border trade, trans-border movement of capital, emergence of a new international order, diffusion and homogenisation of economic cultures and institutions, labour market consequences, governance issues and finally prospects and problems of our global economy and society. The choice of these themes for the book is not fortuitous by any measure, these are rather carefully chosen to illuminate the complex path that globalisation has treaded. In the following paragraph, we explain the relevance of these themes in a coherent manner. It is generally recognised that the process of globalisation has been significantly aided by the fall in the costs of communication and transportation that has led to an inevitable shrinkage of our globe into a quasi 'global village' – characterised by an integration

typically observed in traditional village communes. We therefore view globalisation as a complex process that gradually unleashes a series of transitions: the process starts off with an increased integration of the world economy through trade and investment networks. It is well understood that the harbinger of this stage of increased integration turns on the pivot of decreasing transaction costs of trans-border trade and investment. Declining transactions costs are explained in terms of technical progress that reduces the cost of communication and transport costs. Declining transaction costs have direct and positive impact on cross-border trade and portfolio and direct investment.

The economic consequence of this increased integration is two-fold: first, nations become more interdependent in economic terms. Secondly, there arises a *perception* that trans-border trade and investment offer tremendous and often unprecedented economic opportunities for a nation. The first transition thus results in an increased integration of the world economy – through a mesh of multinational investment, trade flows and flows of financial capital – with an equally important transition in the *perception* about the importance of trans-border trade and investment as a vehicle of economic progress and prosperity for a nation. The second transition impacts on the realm of national management as national governments actively respond to this new perception that trans-border trade and investment offer great benefits to those nations that entertain relevant openness to foreign trade and investment. As a number of nations vie and compete against each other to take home the spoils of the world economy, policy-makers come to agree that the main barrier to the access of these spoils lies in the domestic economic structure characterised by the labyrinth of controls that has been a by-product of the Keynesian era of de-globalisation. This leads to the third transition that paves the way for homogenisation of economic ideologies, convergence of macroeconomic and trade policies and the consequent adoption of measures of domestic liberalisation. For any national government, options are pretty limited – either it chugs along with the pre-existing regime of economic control with limited global trade as pursued by China and India. Alternatively, the nation must ditch the *olden* economy and substitutes it with a functional market mechanism, openness to trans-border trade, liberalisation of domestic and external sectors and exchange rates, and privatisation of state-owned enterprises.

The hard fact is that the majority of nations went for the second option that represents an unprecedented *convergence* of economic ideologies during the 1980s and 1990s. This common act of nations, as though to the dictate of

a common script, has further consolidated the process of integration of the global economy. The final transition typically takes place in the social and economic spheres of our globe as a direct consequence of these previous transitions. The process of globalisation can thus be reduced to this simple and uncomplicated fable. Within this simple fable highlighting various, possibly virtuous, transitions lies a plethora of terribly complicated subplots without which it is impossible to understand the process and consequences and ramifications of globalisation.

6.2. A NEW INDEX OF INTERNATIONAL TENSION: THE β INDEX/INDICATOR OF CONFLICTS

6.2.1. Basics

The purpose of this section is to understand how to evaluate and measure the risk of conflict for an individual country, which is linked to international tensions (see Abolfathi, 1978 for the concept). In other words, how to measure to what extend local conflict in a country is driven by international tension/global factors. For modelling sake, we propose the following:

Assumption 1. Conflicts in a country/region are created and undertaken by a group of local agents. It is like organising a terror attack. Thus, conflict in our model is akin to a terrorist attacks and armed insurgency on a local/regional target. We call the group a terror group.

Assumption 2. We assume that there is a national/regional government that tries to prevent this local conflict either by enforcing the law and order arrangement or by offering economic incentives, which are costly. We call the law enforcement authority as the lawmaker.

The above two assumptions can easily be sustained from the standard model of arms race between nations as expounded and developed by Intriligator and Britto (1985). Instead of a terror group, they have two nations engaged in conflict.

Assumption 3. We take the technology of a terror attack as given. We also assume the technology of law enforcement as given.

Assumption 4. We assume that the terror group needs both financial resources and technological and logistic resources in order to carry out

the terror strike or conflict. The terror group depends on an international group/countries/organisation for these resources. In a similar vein, the lawmaker needs recourses, technology and information that they can partly raise locally and partly receive from an international group/countries/organisations.

Assumption 5. The fundamental assumption is that the world is split up in two or more, rival groups and for each nation/region the terror group and lawmakers they receive help from distinct rival groups consisting of many agents or decision-makers. The spilt of a nation into rival groups (terrorist groups and law enforcers) is partly a product of international tension or *international rivalry*.

Assumption 6. For the sake of tractability, we focus only on the decisions by either of rival (international) groups to fund terrorist activities. We do not model the funding of the lawmaker, which we take as a datum.

Thus, in our model there are many decentralised decision-makers at the global level who belong to a rival group and sponsor a set of terrorist activities with the ultimate eye on reducing the influence of their rival group. In a similar vein the other rival group's members behave. It is like the re-enactment of the Cold War game, which relies on some kind of continuing international tension between rival global players/groups.

At the micro level, for each decision-maker the question is how to allocate their resources or assets, into alternative terrorist groups located in different nations across the globe. The goal for these decision-makers is to get a return from a terror attack as sponsored by them. The cost is the resource cost as well as the risk of losing/wasting the scarce resources for two sets of reasons: first, the terror attack can be foiled by the relevant lawmaker. The terror attack may not take place because ultimately the attack is to be undertaken by local agents who can easily divert resources for their personal use – it is the classic case of moral hazard.

Our model therefore portrays conflicts as the following: there are several production units of terror attacks in each country of our world. The funding, logistics and technology are given by global financiers (or players) who are the relevant decision-makers in our model. Actual conflicts are carried out by foot soldiers – mostly as terror attacks or open insurgencies. These terror attacks by a unit can range from a simple demonstration to an actual warfare. The larger the casualty of an attack, the bigger is the return for the global financiers/decision-makers.

The following axioms are necessary for characterising behaviour of the global financiers/decision-makers:

Axiom 1. Risk averse decision-makers.

Axiom 2. Homogenous expectations about returns from conflicts. Returns are (jointly) normally distributed.

Axiom 3. There is a risk-free return on terror attacks/conflicts in a country or hypothetical country.

The country can be a forgotten part of our world, say Timbaktu or a desert in Afghanistan before US attack of the country, where the law enforcement is virtually non-existent and moral hazard is zero. However, the return from the attack is low zero given the cost of organising it. This is a hypothetical nation/region, which is possible to be derived from the global data. Alternatively, one can argue that the risk-free rate is the return from 'verbal bashing'. It is similar to the idea of cheap talk as introduced by Murshed and Cuesta (2008) in the conflict literature.

Axiom 4. For decision-makers there is perfect divisibility for resources. This is just an abstraction.

Axiom 5. Frictionless and costless information about terror units are available to all terrorists/decision-makers at a point in time.

Axiom 6. For each decision-maker, investing in a terror unit is akin to investing in an asset. Hence, the decision to invest in different terror units is like holding a portfolio of assets.

An Example: Suppose there are two countries and each country has two terror units. Suppose $E(R_1)$ and $E(R_2)$ are the expected returns from these distinct units, $\text{Var}(R_1)$, $\text{Var}(R_2)$ and $\text{Cov}(R_1, R_2)$ are the variances and covariance. We assume that R_1 and R_2 are random returns and suppose w_1 and w_2 are the percentages of a portfolio invested in two terror assets, the expected return from a portfolio $E(R_p)$ is:

$$E(R_p) = w_1 \cdot E(R_1) + (1 - w_1) \cdot E(R_2) \tag{A.1}$$

The variance of the portfolio is

$$\text{Var}(R_p) = w_1^2 \cdot \text{Var}(R_1) + (1 - w_1)^2 \cdot \text{Var}(R_2) + w_1 \cdot (1 - w_2) \cdot \text{Cov}(R_1, R_2)$$

$$(\text{A.2})$$

where Var is variance and Cov is covariance.

Observation 1. The risk-return trade-offs, available to a decision-maker, is given by the bullet AB in Fig. 6.1. The minimum variance opportunity set is the locus of risk and return combinations offered by the portfolios risky assets, which yield the minimum variance for a given return rate.

Axiom 6. The goal of a typical decision-maker in our model is to maximise the utility from expected return and variance of portfolios given the risk-return trade-offs.

If there are no risk-free assets, optimal portfolios are determined by the point of tangency between the minimum variance opportunity set and the indifference curve involving risk and return.
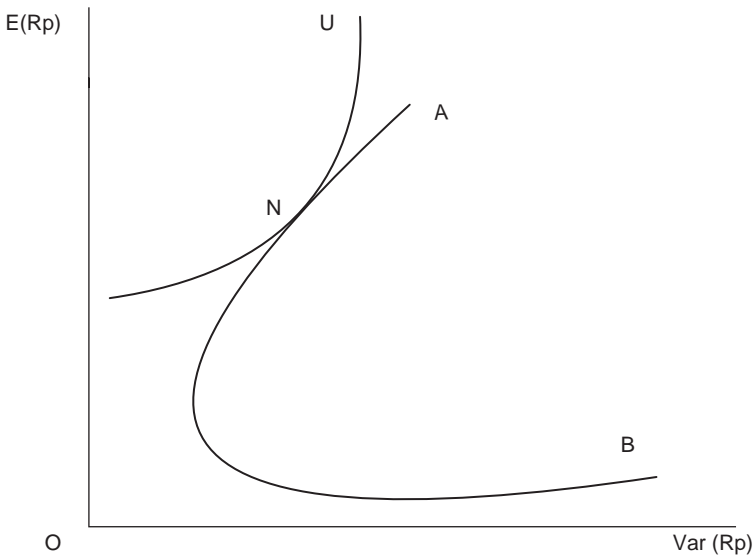
Fig. 6.1.   Risk-Return Trade-Off.

6.2.2. Global Portfolio of Terror Assets

If the global decision-makers are rational and they have homogenous information, the chosen portfolio must be at the upper half of the opportunity set AB. They will choose different points on the opportunity set if they have different degrees of risk-tolerance. If each decision-maker chooses an efficient portfolio, the overall/global portfolio will also be efficient. Note that if global decision-makers have non-homogenous decisions, there is no reason to believe that the global portfolio of terror assets will be efficient.

6.2.3. The Efficiency of the Global Portfolio

In order to simplify the situation, let us draw the efficient portfolio in Fig. 6.2.

Note that the point of tangency between the indifference curve of the global decision-maker and the minimum variance opportunity set, point E, gives the equilibrium choice of one decision-maker.
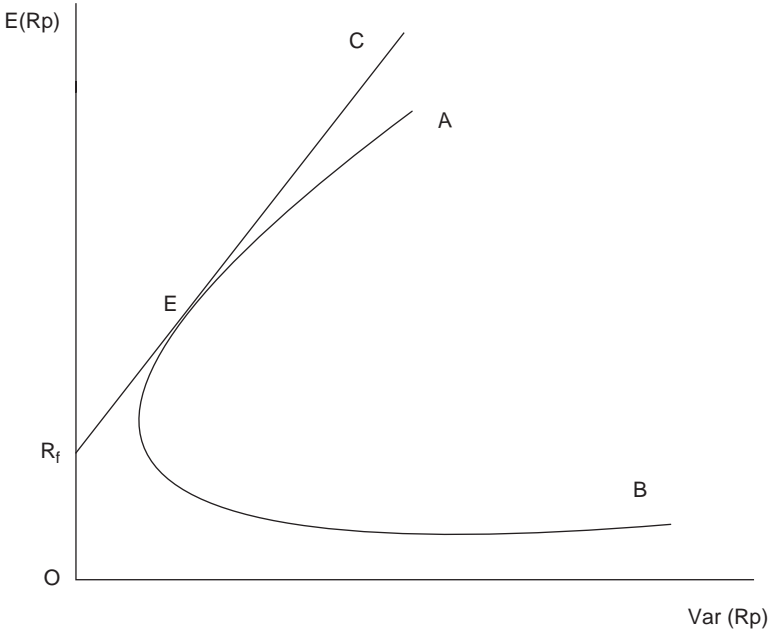
Fig. 6.2. Efficient Portfolios.

6.2.4. Derivation of Market Beta as a Measure of Risk of Conflict due to International Tension

If a global decision-maker puts a% of his resources in a country-specific asset I and (1-a%) in the global portfolio, which consists of terror activities all across the globe. The average return from this portfolio and the variance of the portfolio are known to be functions of the expected returns, and the variance of asset I and the variance of the global portfolio and the covariance between asset I and the global portfolio R_G. The slope of the opportunity set AB can be shown to be equal to:

$$\frac{[\text{Var}(R_G)]^{1/2} \cdot [E(R_I) - E(R_G)]}{[\text{Cov}(R_I, R_G) - \text{Var}(R_G)]} \tag{A.3}$$

where R_I is the return from asset I, R_G the return from the global portfolio, $E(\cdot)$ the expectation operator, $\text{Var}(R_G)$ the variance of the global portfolio, $\text{Cov}(R_I, R_G)$ the covariance between return from asset I and return from the global portfolio G.

If there is a risk-free rate, which is similar to just spending resources on 'bad mouthing' the rival as explained by Abolfathi (1978) in the context of international tension, we can derive the line, similar to the security market line, joining the global portfolio and the risk-free rate. The slope of the constraint line will be

$$\frac{E(R_G) - R_f}{[\text{Var}(G)]^{1/2}} \tag{A.4}$$

where R_f is the risk-free rate.

The equalisation of (A.3) and (A.4) in equilibrium gives us

$$E(R_1) = R_f + [E(R_G) - R_f]\beta_I \tag{A.5}$$

where

$$\beta_I = \frac{\text{Cov}(R_I, R_G)}{\text{Var}(R_G)} \tag{A.6}$$

Note that the beta index measures the relative variance of the country-specific terror asset I with respect to the return from the global portfolio of terror asset. If the beta value of a country is greater than 1, the country's

terror activities or conflicts, are more sensitive to the global terror activities. Hence, the country is more exposed to the global or international tension. On the contrary, if a country's beta value is less than 1, the country is less susceptible to international tension. In the following, we try to capture the value of beta for several nations for which we have data by assuming the return from conflicts to a terror group being equal to actual victims from conflicts in the relevant country.

6.3. EMPIRICAL FOUNDATION OF β INDEX OF CONFLICTS DUE TO INTERNATIONAL TENSION

Before undertaking the empirical study let us explain the beta index of conflict due to global tension in terms of an artificial construct that closely resembles the data that we will use. Suppose there are three countries for which we have data on conflicts, mainly victims of conflicts, n_{ij} for country i in year j (we will describe the data soon) for five years that we present in Table 6.1.

The beta indicator of conflict in country i due to global tension is estimated by regressing n_{ij} on K_j:

$$n_{ij} = a_i + \beta_i N_j \qquad (A.7)$$

The fundamental notion of (A.7) is to estimate the percentage change in conflict incidents in country due to a percentage change in conflict incidents at the global level.

6.3.1. Data Type and Data Source

See Section 6.3.3 for the relevant details.

Table 6.1. Measuring Beta Risk of Conflict – A Hypothetical Case.

	Year 1	Year 2	Year 3	Year 4	Year 5
Country 1	n_{11}	n_{12}	n_{13}	n_{14}	n_{15}
Country 2	n_{21}	n_{22}	n_{23}	n_{24}	n_{25}
Country 3	n_{31}	n_{32}	n_{33}	n_{34}	n_{35}
Average	N_1	N_2	N_3	N_4	N_5

Note: N_j is the global average of conflict in year j.

6.3.2. Observed Values of Beta Index for Nations

In Table 6.2, we offer the beta values of 92 nations for which we have data from 1970–2004. One can see over the period, India is the country that had the highest risk due to international ideological tension while New Zealand and Fiji had the lowest such risks. A few quick observations are in order: first, 57 (61%) out of 92 nations display violent conflicts due to international tension during 1970–2004. Their beta index has a value in excess of 1. Secondly, in the top end, we see countries from the developing world and Africa and countries with significant ethnic polarisation (like South Africa and Turkey). There is a reason to believe that their regional/internal conflicts might have been exacerbated by international tensions. Possibly, the developing world became the region of contest between superpowers for influence peddling. Finally, it is interesting to note that in the bottom end, we have countries mainly from the developed world and also from the communist world where global tensions failed to reach because of their firm commitments to their respective ideologies or because conflicts were kept at bay.

6.3.3. Further Tables and Figures on Beta Index: Beta Instability

In what follows in Table 6.3 we document the changes in beta values over time (Tables 6.4 and 6.5).

6.3.4. Examining the Change in Beta during Three Different Time Periods

Fig. 6.3 examines the change of beta (β) during three different time periods: 1970–1982, 1983–1991 and 1992–2004. In each figure, x-axis is (β) and y-axis is the three different periods where 1 represent 1970–1982 time period, 2 represent 1983–1991 time period and 3 represent 1992–2004 time period. Some countries are excluded due to missing data or the country itself did not exist at that time (e.g. countries such as Armenia, Tajikistan, Ukraine, Georgia, Latvia and Azerbaijan were under the USSR (The Union of Soviet Socialist Republics)) before 1991. Examining the figures given below one can see a few quick observations: first, 47 (75%) out of 63 nations had a maximum beta during 1983–1991; while 16 countries experienced the opposite. Secondly, all the countries experienced a major change in their beta during 1983–1991. A possible reason behind might be the Cold War between the United States and the USSR has reached its peak during 1983–1991 period of time. The Cold War was the modern era of rivalry, conflict

Table 6.2. The Beta Values from 1970 to 2004.

Country	Beta	Country	Beta
1. India	5.613346	47. Chad	1.238572
2. Sri Lanka	5.554203	48. Senegal	1.22476
3. Peru	5.490042	49. Zaire	1.195171
4. Iraq	5.392892	50. Bolivia	1.1362
5. Colombia	5.291034	51. Ukraine	1.106495
6. Turkey	4.306994	52. Brazil	1.100961
7. South Africa	4.081396	53. China	1.096769
8. Pakistan	3.475795	54. Spain	1.076031
9. El Salvador	3.455051	55. Latvia	1.064141
10. Congo	3.398666	56. Thailand	1.055881
11. Nepal	3.372004	57. Mexico	1.03266
12. Philippines	3.219123	58. Ecuador	0.984186
13. Mozambique	3.147505	59. Hong Kong	0.972697
14. Azerbaijan	3.084427	60. Germany	0.942986
15. Burundi	2.914972	61. Israel	0.942142
16. Lebanon	2.869654	62. Cameroon	0.941914
17. Yemen	2.780782	63. Panama	0.912444
18. Liberia	2.719958	64. Dominican Republic	0.911662
19. Sierra Leone	2.628883	65. West Germany (FRG)	0.885651
20. Algeria	2.621261	66. Belgium	0.878498
21. Georgia	2.564439	67. Japan	0.823205
22. Mali	2.425716	68. Jamaica	0.770122
23. Egypt	2.33049	69. Australia	0.76102
24. Bangladesh	2.327651	70. France	0.754993
25. Guatemala	2.288403	71. Croatia	0.750206
26. Niger	2.215417	72. Romania	0.703743
27. Nicaragua	2.211287	73. Poland	0.651146
28. Angola	2.091481	74. Portugal	0.646673
29. Ethiopia	1.947742	75. Cuba	0.638666
30. Armenia	1.894427	76. Ireland	0.592373
31. Tajikistan	1.872893	77. Cyprus	0.574653
32. North Ireland	1.864145	78. Morocco	0.553491
33. Uganda	1.784351	79. Tunisia	0.538577
34. Bosnia-Herzegovina	1.77974	80. Albania	0.527318
35. Cambodia	1.712936	81. Bahrain	0.482598
36. Indonesia	1.711453	82. Kuwait	1.243582
37. Haiti	1.702804	83. Costa Rica	0.460931
38. Venezuela	1.680841	84. Trinidad and Tobago	0.43549
39. Djibouti	1.658493	85. Laos	0.423761
40. Ghana	1.482598	86. Paraguay	0.350199
41. Rwanda	1.45097	87. Denmark	0.34692
42. Afghanistan	1.426441	88. Malaysia	0.32913
43. Honduras	1.366786	89. Singapore	0.314451
44. Myanmar	1.336633	90. Norway	0.229586
45. Chile	1.331035	91. New Zealand	0.214716
46. Tanzania	1.315899	92. Fiji	0.202974

Table 6.3. Estimates of Beta Values from 1970 to 1982.

Country	Beta	Country	Beta
1. India	3.22346	47. Chad	0.854123
2. Sri Lanka	1.904541	48. Senegal	0.754266
3. Peru	5.036339	49. Zaire	1.012542
4. Iraq	1.697809	50. Bolivia	0.935215
5. Colombia	7.187298	51. Ukraine	
6. Turkey	2.434453	52. Brazil	2.369577
7. South Africa	2.408747	53. China	0.542157
8. Pakistan	2.185016	54. Spain	2.989019
9. El Salvador	10.75633	55. Latvia	
10. Congo		56. Thailand	2.777604
11. Nepal		57. Mexico	1.365217
12. Philippines	4.863364	58. Ecuador	1.699147
13. Mozambique	1.887235	59. Hong Kong	
14. Azerbaijan		60. Germany	1.311376
15. Burundi	1.625145	61. Israel	2.012569
16. Lebanon	6.367534	62. Cameroon	0.951293
17. Yemen		63. Panama	0.561246
18. Liberia		64. Dominican Republic	1.630508
19. Sierra Leone	1.210541	65. West Germany (FRG)	1.194399
20. Algeria	0.852146	66. Belgium	1.738317
21. Georgia		67. Japan	0.155093
22. Mali		68. Jamaica	1.105048
23. Egypt	1.972334	69. Australia	1.077141
24. Bangladesh	0.650417	70. France	1.110374
25. Guatemala	9.856839	71. Croatia	
26. Niger		72. Romania	2.126089
27. Nicaragua	3.813608	73. Poland	0.435487
28. Angola	1.054908	74. Portugal	1.162542
29. Ethiopia	1.218754	75. Cuba	0.521699
30. Armenia		76. Ireland	1.952337
31. Tajikistan		77. Cyprus	0.421549
32. North Ireland	4.231962	78. Morocco	0.539852
33. Uganda	2.151783	79. Tunisia	0.312549
34. Bosnia-Herzegovina		80. Albania	0.211545
35. Cambodia	0.982154	81. Bahrain	0.254286
36. Indonesia	0.845857	82. Kuwait	0.485489
37. Haiti	0.915425	83. Costa Rica	0.612985
38. Venezuela	1.012457	84. Trinidad and Tobago	0.389249
39. Djibouti	1.421549	85. Laos	0.518752
40. Ghana	0.845215	86. Paraguay	0.264783
41. Rwanda	2.125145	87. Denmark	0.248524
42. Afghanistan	0.565317	88. Malaysia	0.548752
43. Honduras	2.126089	89. Singapore	0.216287
44. Myanmar	1.621548	90. Norway	0.168725
45. Chile	2.408747	91. New Zealand	0.298346
46. Tanzania	0.752146	92. Fiji	0.329617

Table 6.4. Estimates of Beta Values from 1983 to 1991.

Country	Beta	Country	Beta
1. India	8.873651	47. Chad	3.145273
2. Sri Lanka	9.172513	48. Senegal	2.254904
3. Peru	6.421587	49. Zaire	1.319091
4. Iraq	2.012598	50. Bolivia	1.383649
5. Colombia	4.173165	51. Ukraine	
6. Turkey	6.975746	52. Brazil	1.174465
7. South Africa	5.668867	53. China	1.053215
8. Pakistan	5.156094	54. Spain	1.825148
9. El Salvador	5.056079	55. Latvia	
10. Congo		56. Thailand	2.948476
11. Nepal	1.10103	57. Mexico	0.57296
12. Philippines	6.532015	58. Ecuador	0.699418
13. Mozambique	8.544477	59. Hong Kong	0.516328
14. Azerbaijan		60. Germany	0.457777
15. Burundi	4.71791	61. Israel	2.722209
16. Lebanon	8.24162	62. Cameroon	0.826196
17. Yemen		63. Panama	0.602875
18. Liberia	2.923367	64. Dominican Republic	0.602875
19. Sierra Leone	4.71791	65. West Germany (FRG)	1.026525
20. Algeria	3.335526	66. Belgium	0.832151
21. Georgia		67. Japan	1.140971
22. Mali	4.447716	68. Jamaica	0.826772
23. Egypt	1.967348	69. Australia	0.727767
24. Bangladesh	5.046111	70. France	1.097015
25. Guatemala	2.718805	71. Croatia	
26. Niger	1.073153	72. Romania	0.743796
27. Nicaragua	6.224424	73. Poland	1.201548
28. Angola	2.365806	74. Portugal	0.497897
29. Ethiopia	4.51352	75. Cuba	0.823518
30. Armenia		76. Ireland	0.628717
31. Tajikistan		77. Cyprus	0.70796
32. North Ireland	2.001254	78. Morocco	1.353445
33. Uganda	3.385918	79. Tunisia	0.650783
34. Bosnia-Herzegovina		80. Albania	0.521548
35. Cambodia	1.93863	81. Bahrain	0.621852
36. Indonesia	2.94849	82. Kuwait	2.136329
37. Haiti	2.842275	83. Costa Rica	0.365993
38. Venezuela	2.373882	84. Trinidad and Tobago	0.508211
39. Djibouti	1.881117	85. Laos	0.621875
40. Ghana	1.012504	86. Paraguay	0.433513
41. Rwanda	4.242729	87. Denmark	0.531295
42. Afghanistan	5.023498	88. Malaysia	0.403074
43. Honduras	2.305421	89. Singapore	0.503165
44. Myanmar	3.332617	90. Norway	0.382652
45. Chile	1.725487	91. New Zealand	0.652319
46. Tanzania	2.466831	92. Fiji	0.628514

Table 6.5. Estimates of Beta Values from 1992 to 2004.

Country	Beta	Country	Beta
1. India	1.792444	47. Chad	2.196901
2. Sri Lanka	4.449713	48. Senegal	1.114939
3. Peru	4.538879	49. Zaire	2.503254
4. Iraq	5.129824	50. Bolivia	1.379061
5. Colombia	2.46899	51. Ukraine	1.106495
6. Turkey	4.946283	52. Brazil	1.75969
7. South Africa	3.061179	53. China	1.832015
8. Pakistan	3.625396	54. Spain	1.021549
9. El Salvador	3.221969	55. Latvia	1.064141
10. Congo	3.398666	56. Thailand	1.149524
11. Nepal	3.372684	57. Mexico	2.51569
12. Philippines	4.620154	58. Ecuador	1.037157
13. Mozambique	3.133014	59. Hong Kong	1.034536
14. Azerbaijan	3.084427	60. Germany	0.892594
15. Burundi	2.740498	61. Israel	2.134569
16. Lebanon	2.288183	62. Cameroon	2.051046
17. Yemen	2.780782	63. Panama	0.742313
18. Liberia	2.574915	64. Dominican Republic	1.722376
19. Sierra Leone	2.160225	65. West Germany (FRG)	
20. Algeria	3.776511	66. Belgium	0.464242
21. Georgia	2.564439	67. Japan	0.876741
22. Mali	2.404973	68. Jamaica	1.391084
23. Egypt	2.928791	69. Australia	0.60971
24. Bangladesh	1.249603	70. France	0.919087
25. Guatemala	1.969864	71. Croatia	0.750206
26. Niger	2.602703	72. Romania	1.174305
27. Nicaragua	2.053667	73. Poland	0.823515
28. Angola	2.21346	74. Portugal	0.843013
29. Ethiopia	3.111885	75. Cuba	1.401697
30. Armenia	1.894427	76. Ireland	0.465454
31. Tajikistan	1.872893	77. Cyprus	0.50572
32. North Ireland	1.090438	78. Morocco	0.69986
33. Uganda	3.354757	79. Tunisia	0.472816
34. Bosnia-Herzegovina	1.77974	80. Albania	0.723589
35. Cambodia	2.459048	81. Bahrain	0.901999
36. Indonesia	1.533876	82. Kuwait	1.102558
37. Haiti	1.945489	83. Costa Rica	0.710476
38. Venezuela	2.556161	84. Trinidad and Tobago	0.54545
39. Djibouti	2.357232	85. Laos	0.713613
40. Ghana	0.901999	86. Paraguay	0.391242
41. Rwanda	3.252307	87. Denmark	0.640878
42. Afghanistan	2.193947	88. Malaysia	0.489086
43. Honduras	1.138982	89. Singapore	0.382155
44. Myanmar	2.333373	90. Norway	0.205217
45. Chile	1.163692	91. New Zealand	0.250152
46. Tanzania	1.346813	92. Fiji	0.392154
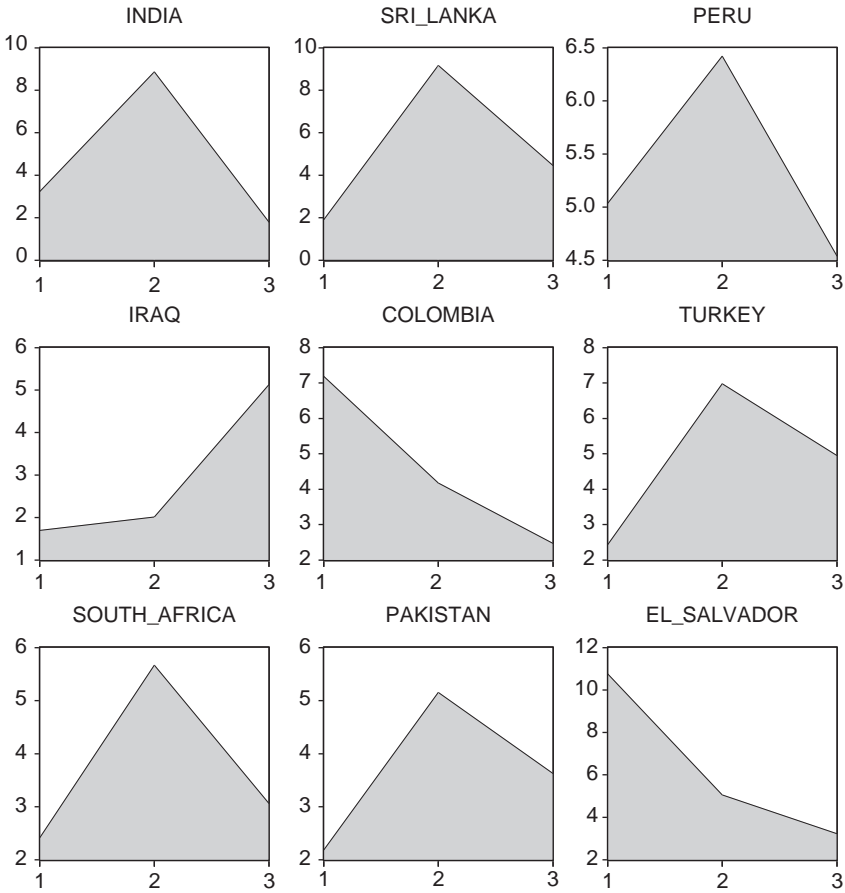
Fig. 6.3. The Change in Beta During Three Time Periods.

and tension between the United States and the Soviet Union and their respective allies from the mid-1940s through to the early 1990s (Table 6.2).

6.4. TEMPORAL FLUCTUATIONS IN CONFLICT LEVELS AND MATRIX OF BETA MOBILITY

In this section, we apply the concept of income mobility to the field of conflicts. The original work of income mobility seeks to answer the twin question: do people stay poor over time? Do the rich stay rich over time?
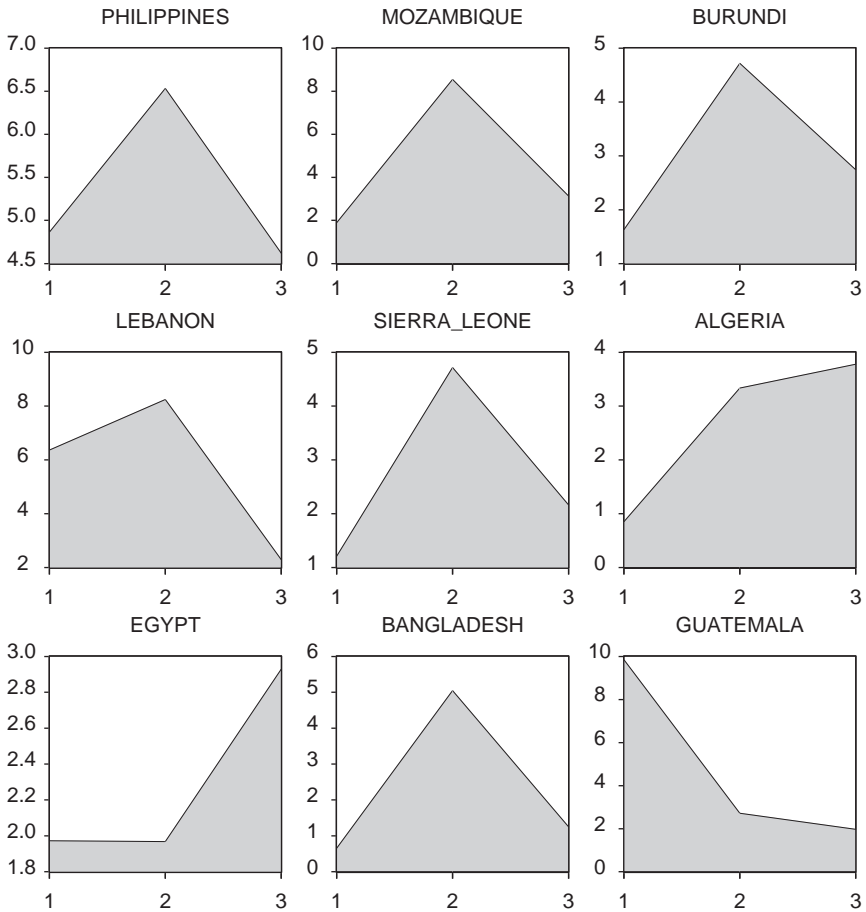
Fig. 6.3. (*Continued*).

These questions are intimately associated with the issue of income inequality since a high mobility makes the question of income inequality less serious. In empirical works, the emphasis is on the income bracket climbing (up or down). A low level of mobility is considered bad while a high level of mobility is taken for reducing the burden of inequality (see Shorrocks, 1978). In Fields and Ok (1919) we see the most general definition of income mobility: income mobility represents the process of income distribution taking place between two points in time. Such mobility has been perceived both positively and negatively: Jarvis and Jenkins (1998) argued that one may view this as a positive
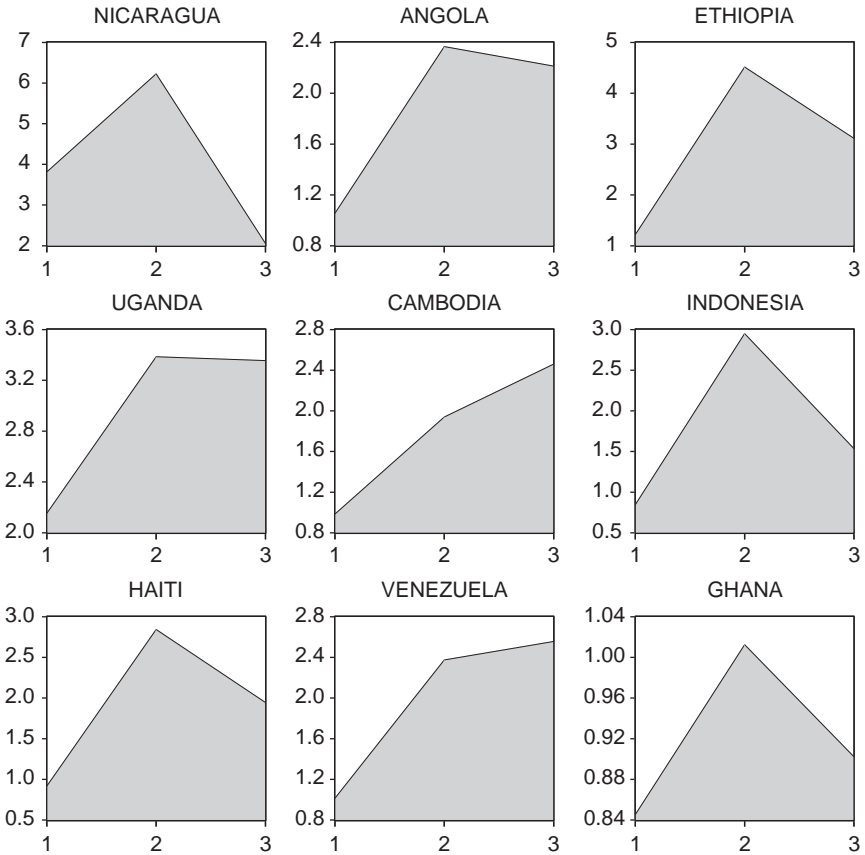
Fig. 6.3. (*Continued*).

phenomenon since income mobility represents an equality of opportunity while income mobility can be bad as it implies an economic instability.

We ask similar questions to drive our point home: do countries stay conflict-ridden over time? Do countries with little conflict stay conflict-free over time? Our main goal here is to see if the international tension remained static or it changed its course. This is the notion of temporal fluctuations. In order to understand the dynamics of the international tension, we consider the beta values of 92 countries at three different points in time and measure the index of mobility of conflict that we can attribute to international tension. There are two ways one can generate an index of mobility of conflict that we call beta mobility matrix.
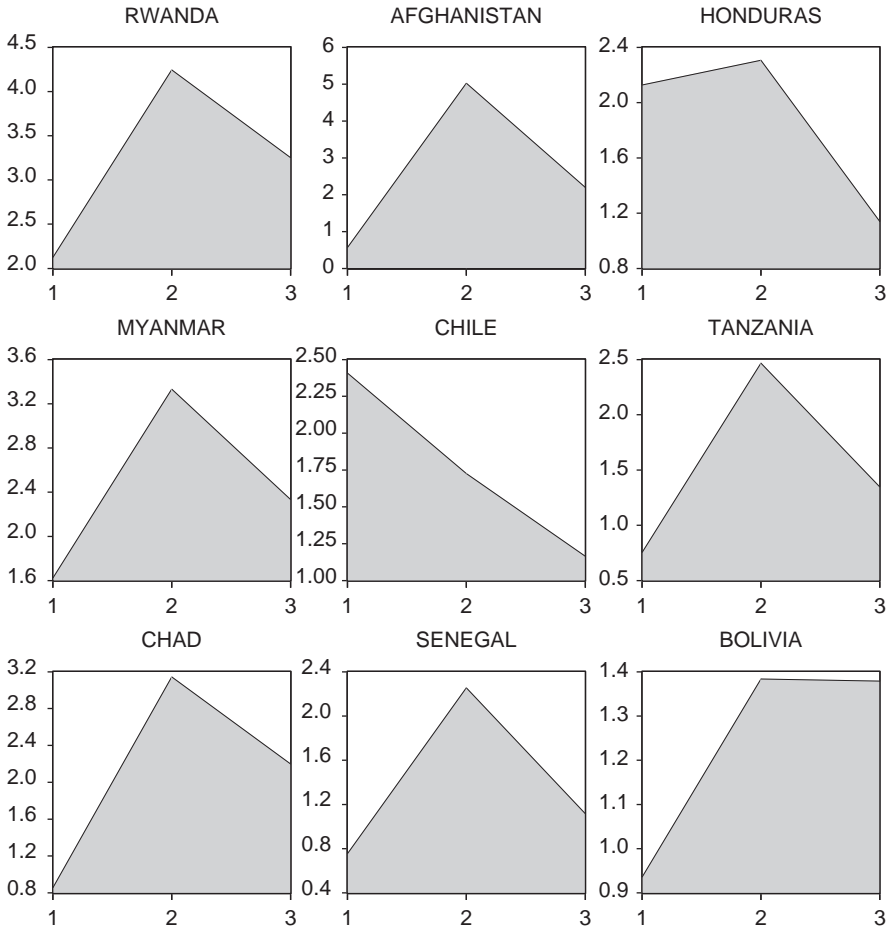
Fig. 6.3.   (*Continued*).

Definition 1. Consider a population of n countries and two vectors $X(= X_1, X_2, X_3 \ldots X_n)$ and $Y(= Y_1, Y_2, Y_3, \ldots Y_n)$ at two different points in time. Each vector gives the rank of a country in terms of its beta value. The Spearman's mobility index is given as

$$M = \frac{1 - [\mathrm{Cov}(X, Y)]}{[\mathrm{Var}(X) \cdot \mathrm{Var}(Y)]^{1/2}} \tag{A.8}$$
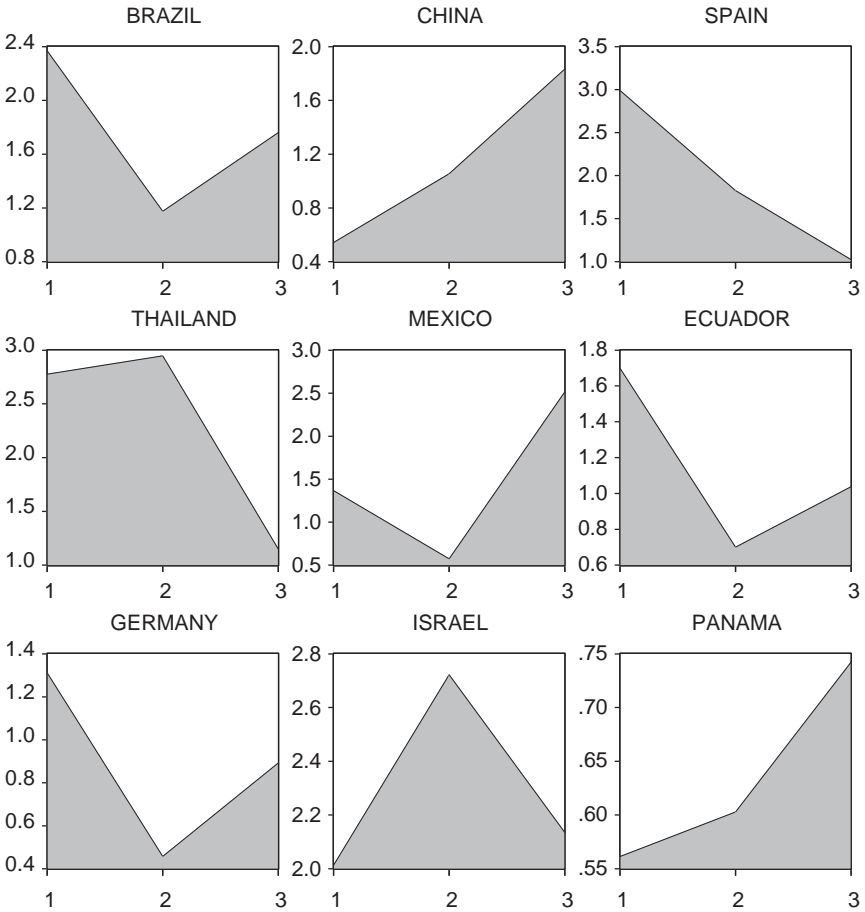
Fig. 6.3. (*Continued*).

Definition 2. The second measure of income mobility depends on a transition matrix that. In order to do that we rank nations in terms of their betas and create deciles (or groups of nine) at two dates. The transition matrix defines the movement of nations from one decile to another. The mobility index is defined as M

$$M = \frac{1 - \Sigma t_{ij}}{9} \tag{A.9}$$
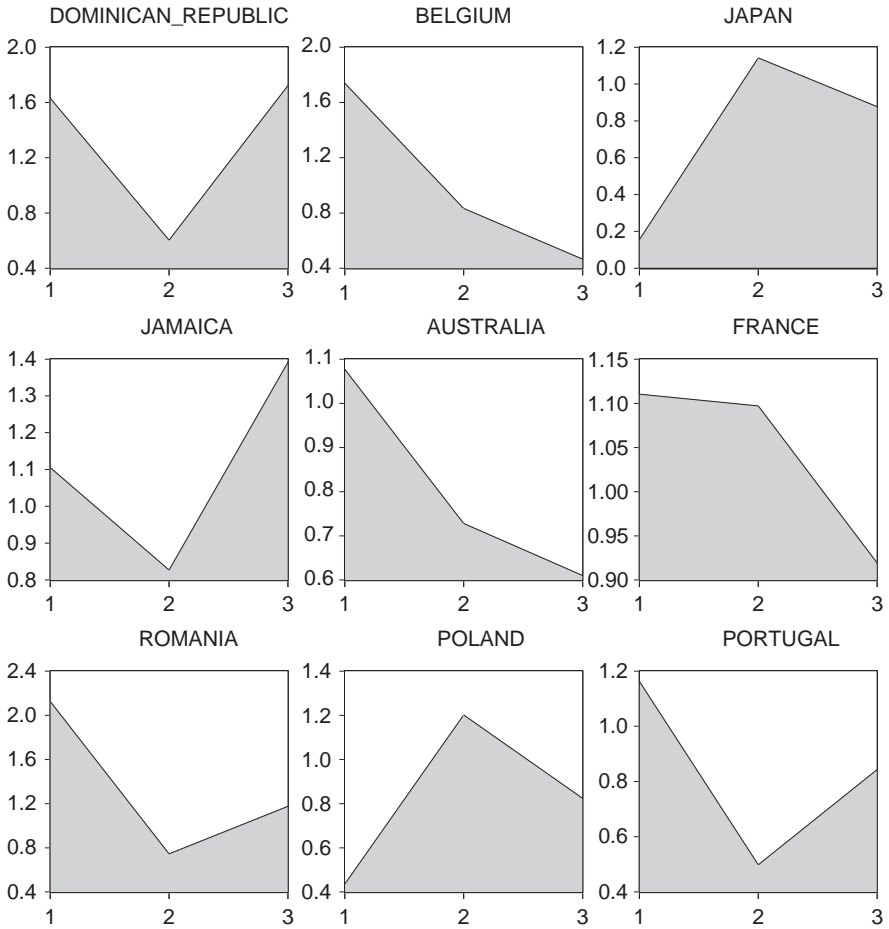
Fig. 6.3.   (*Continued*).

where t_{ij} = percentage of countries that do not change their ranking from deciles j and the summation is undertaken from 1 to n and nine is the number of country in each group.

In Table 6.6, we present the transition matrix from 1970–1982 to 1983–1991. The year 1983 is one of the most important years as the second Cold War started in 1983 when the USSR unleashed its attack on Afghanistan. It is important to note that the matrix's diagonal elements give the number of countries, which did not change their deciles over time. Thus, the diagonal elements give
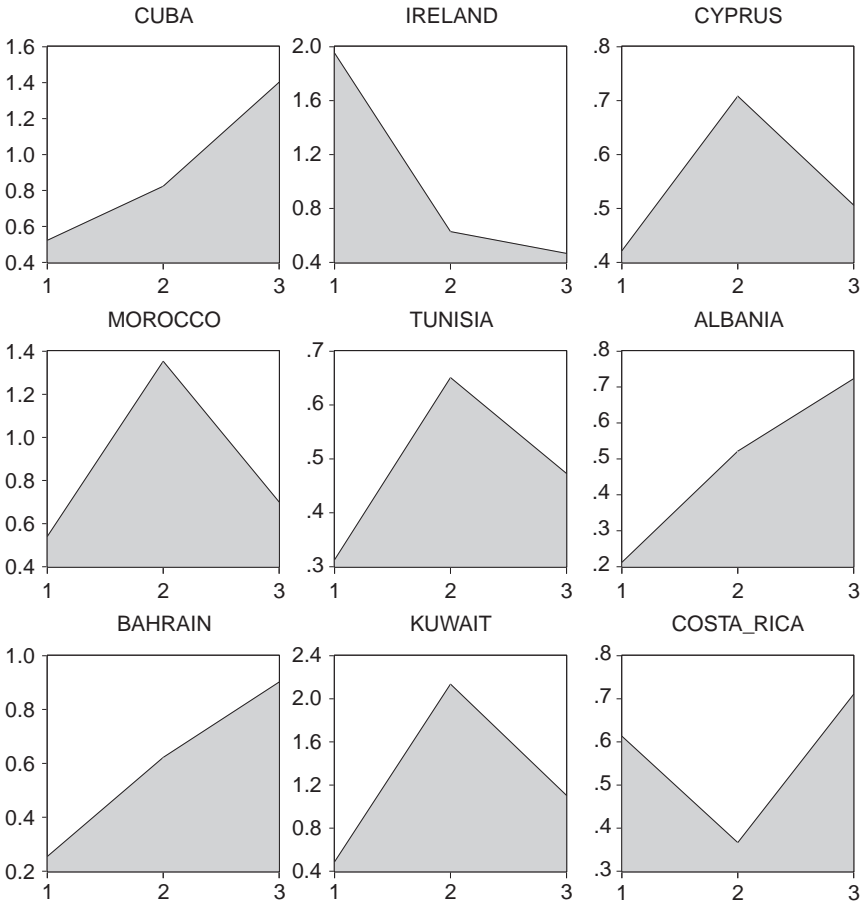
Fig. 6.3. (*Continued*).

an indication of immobility between two points in times. The off-diagonal elements capture mobility and the mobility is measured as a horizontal move.

We have ranked 92 nations in a descending order in terms of their beta values in 1970 and 1983. The first deciles comprises the countries with the highest values of beta and the second deciles is composed of the next nine nations as ranked in terms of descending values of their beta. And we thus derive the countries of 10 deciles in 1970 and 1980. Then we construct the transition matrix by looking at the movement of countries from one decile to another.
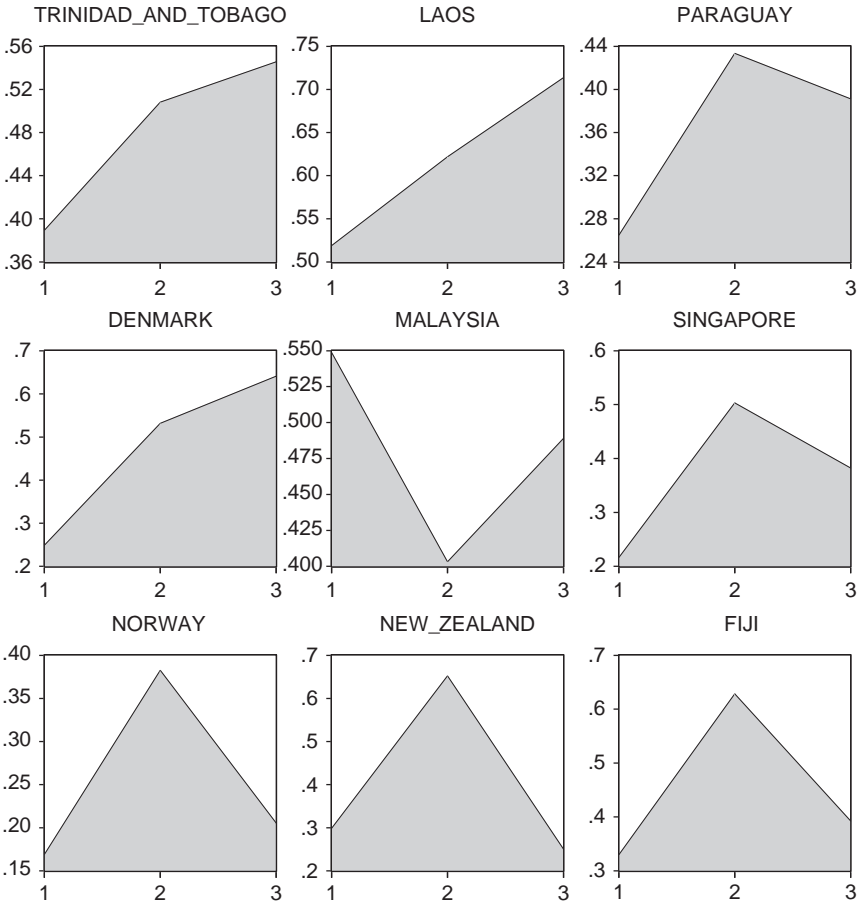
Fig. 6.3. (Continued).

The rightward movement in the transition matrix along a row captures a decline in the beta value while a leftward movement captures an increase in the beta value. Let us look at the first row called Decile 1 in Table 6.6: in 1970–1982 there are nine countries in Decile 1 who had the largest values of beta. In 1983–1991, five countries out of these nine countries remained in Decile 1 while one moved to Decile 2, one to Decile 3, one to Decile 4 and one to Decile 5. No nations moved any further away from Decile 1. Let us call M^* as the value of the mobility index for conflict during 1970–1982 to 1983–1991 and M^{**} the index for the period from 1983–1991 to 1992–2004.

Table 6.6. Beta Transition/Mobility Matrix 1970–1982 to 1983–1991.

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Decile 1	5	1	1	1	1					
Decile 2	2	1	2		2	1	1			
Decile 3	2	1		2	1		2	1		
Decile 4		3	1	1	1			2	1	
Decile 5				2	2	2	2		1	
Decile 6			3	3	1	1	1			
Decile 7		2			1	1	1	2	1	1
Decile 8				1		2	2	2	2	
Decile 9							1	1	3	
Decile 10										

Note: Some nations are missing since the data did not exist or the nation did not exist in 1970.

We calculate the values of M^* and M^{**} by applying (A.9):

$$M^* = 0.814 \tag{A.10}$$

$$M^{**} = 0.802 \tag{A.11}$$

The index should offer us a picture of how the relevance of international tension has transpired over time in our globe. If the index increases, one can argue that international tension has become more relevant in local and regional conflicts. On the other hand, if the index registers a decline, one can conclude a diminished role for international tension in triggering and driving local conflicts.

What is important for us is the observation that the mobility index based on the transition matrix shows a mild decline of 1.47%. This has some message for us: during the full blast of the Cold War, the role of international tension was as high as the influence of international tension on conflicts during the post-Iraq war days. In the light of the beta mobility matrix of conflicts, one can argue that the role of international tension has not changed much in determining the local/country-specific conflicts – subject to the limitations of the proposed measures.

6.5. DATA

6.5.1. Data on Conflict and Inequality

Beta is the risk of conflict due to international tension. Measuring conflict is the main problem in examining the relationship between conflicts and other

variables. If we look at the existing literature on conflicts, we will find that most of the papers use the Correlates of War (COW) database. Nevertheless, the lack of transparency of the COW database has been the focus of an exhaustive assessment by Sambanis (2002). Moreover, the COW database excludes conflicts which have a lower number of 1,000 combat related deaths per year. As a substitute to the COW database, we will use the new Armed Conflict Data database developed by the International Peace Research Institute of Oslo, Norway and the University of Uppsala, Sweden (we refer to it as PRIO/Uppsala). The PRIO/Uppsala database is more transparent and consistent than COW database in its construction. The PRIO/Uppsala database records smaller conflicts with a threshold of 25 battle-deaths per year.[1] In the PRIO/Uppsala database, there are three different intensity levels for a conflict: Minor, Intermediate and War. For the empirical work, if the conflict is either minor or intermediate then zero will stand for the intensity level of a conflict; whereas if the level of conflict is war then one will stand for the intensity level of a conflict.

As for the inequality data, it is drawn from the Estimated Household Income Inequality Dataset (EHII) – is a global dataset, derived from the econometric relationship between UTIP-UNIDO, other conditioning variables, and the World Bank's Deininger and Squire dataset (see http:// utip.gov.utexas.edu/about.html). The UTIP-UNIDO dataset source computes inequality measures for nearly 3,200 country/year observations, covering over 150 countries during the period 1963–1999.

Inequality is linked to a number of mathematical concepts such as skewness, variance and dispersion. Consequently, there are several methods to compute inequality, for example the McLoone Index, the coefficient of variation, range, range ratios, the Gini coefficient and the Theil's T-statistic. The main justification for choosing Theil's T-statistic is that Theil's T has a more flexible structure that often makes it more suitable compared to other measures.[2] If we had always access to every necessary individual level data for the population of interest, in that case measures like the Gini coefficient or the coefficient of variation would be generally satisfactory for describing inequality. Yet, in real world, individual data is hardly ever reachable, and researchers are asked to make due with aggregated data.

6.5.2. Data for Other Variables

The remaining data is drawn from several resources:

- Military expenditure: The data of military expenditure for some countries will be gathered from SIPRI military expenditure database, others will be

taken from the United States Arms Control and Disarmament Agency (ACDA) and COW (Correlates of War NMC_3.0.csv) dataset.
- GDP per capita: From World Development Indicators (2004 CD) and The World Economy: Historical Statistics and OECD Development Centre (see http://www.eco.rug.nl/%7EMaddison/Historical_Statistics/ horizontal-file.xls).
- Openness data: Centre for International Comparisons of Production, Income and Prices (CIC), University of Pennsylvania (Penn World Table).
- Polity index: From Integrated Network for Societal Conflict Research (INSCR), Polity IV Project (see http://www.systemicpeace.org/inscr/ inscr.htm).

$$\beta_{it} = \lambda_i + \lambda_1 \mathrm{GDP}_{it} + \lambda_2 \mathrm{Ineq}_{it} + \lambda_3 \mathrm{Int}_{it} + \lambda_4 \mathrm{Polindex}_{it}$$
$$+ \lambda_5 \mathrm{Milex}_{it} + \lambda_6 \mathrm{Open}_{it} \lambda_7 \mathrm{Dum}\,1 + \lambda_8 \mathrm{Dum}\,2 + \lambda_9 \mathrm{Dum}\,3 + \varepsilon_{it}$$

where i stands for country index; t represents time period; β_{it} the beta, λ_i a country-specific intercept; GDP_{it} the estimated average real GDP growth for three periods (1970–1982, 1983–1991 and 1992–2004); Ineq_{it} the average inequality for three periods; Milex_{it} the average military expenditure as percentage of GDP (constant 1995 US\$); Int_{it} the internationalisation index; $\mathrm{Polindex}_{it}$ the political index, polity scale ranges from $+10$ (strongly democratic) to -10 (strongly autocratic); Open_{it} the average openness level for each country in 2000 constant prices, (openness level equals to exports plus imports divided by GDP); Dum1 a dummy variable where 1 represents time period between 1970 and 1982 and 0 for the other two periods; Dum2 a dummy variable where 1 represents time period between 1983 and 1991 and 0 for the other two periods; Dum3 a dummy variable where 1 represents Middle Eastern countries and 1 for non-Middle Eastern countries.

In this conceptual model, the risk of conflicts due to international tension is considered a function of inequality, as well as of GDP growth, military expenditure, internationalisation index, political index and openness. The model is based on three main time periods: first period between 1970 and 1982, second period between 1983 and 1991, third period between 1992 and 2004. In this work, we will use the panel data that will allow us to control for unobservable time-invariant country-specific effects that result in a missing-variable bias. This problem is recognised in many studies such as Bruno, Ravallion, and Squire (1995), Ravallion (1995), Bourguignon and Morrison (1998), Deininger and Squire (1998) and Forbes (2000). The fixed effect model setting will be used in this study for three main reasons. First, the fixed model will control the unobservable country-specific characteristics and will reduce possible hetero-scedasticity problems rooting from probable differences

across countries (Greene, 1997). Second, the fixed model is preferred for the reason that the most important objective of this chapter is to explore what factors have caused changes in intensity of conflicts over time within countries rather than to explain variation in the intensity of conflicts across countries. Another reason for choosing the fixed effect model is because it is more appropriate when the focus is on a precise number of countries and the inference is limited to these countries (Baltagi, 1995).

The results shown in Table 6.7 indicate that the signs of the parameters are almost all as hypothesised. Inequality, military expenditure increases beta. Moreover, GDP growth, internationalisation index and political index lower beta. Inequality and military expenditure have a positive coefficient and statistically significant with beta. A unit increase in inequality

Table 6.7. Regression Results.

Variable	(1) Pooled	(2) Fixed Effects
GDP growth	−0.13474***	−0.122***
	(−3.17785)	(−2.82105)
Inequality	0.042839***	0.065038***
	(2.931436)	(2.707881)
Military expenditure as % of GDP	0.198228***	0.233973***
	(2.816221)	(3.138729)
Internationalization index	−0.71536*	−0.67743*
	(−1.8392)	(−1.74142)
Political index	−0.03368	−0.02106
	(−0.68671)	(−0.4361)
Openness	−0.00821***	−0.00777**
	(−2.65211)	(−2.49622)
Dum1	1.715026***	
	(2.6297)	
Dum2	1.205299*	
	(1.674345)	
Dum3	0.122102	
	(0.327491)	
Constant		0.16747
		(0.129326)
Observations	276	276
Countries	92	92
Years	1970–2004	1970–2004
Adjusted R^2	0.323368	0.329175
R^2	0.366673	0.372108

*Note: t-*statistics in parenthesis. ***, ** and * indicate, respectively, statistically significance at the 1, 5 and 10% levels.

Table 6.8. Beta Transition/Mobility Matrix 1983–1991 to 1992–2004.

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Decile 1	3	1	1	1	2	1				
Decile 2	1	3	1	3		1				
Decile 3	1	1	2	2	1	1	1			
Decile 4	1		1	3		1	3			
Decile 5		1	2	1		1	2	1	1	
Decile 6	1		1		1	1		4		
Decile 7					1	3	1		1	3
Decile 8			1			1		1	3	3
Decile 9							1	3	2	3
Decile 10	1								1	

Note: Some data missing as the nations or their data did not exist in 1983.

and military expenditure causes an increase in the level of intensity of conflicts by 4.28 and 19.82% respectively. Conversely, GDP growth, internationalisation index and openness index negatively affect beta. A unit decrease in GDP growth, internationalisation index and openness index causes an increase beta by 13.47, 71.54 and 0.82% respectively. This result is consistent with support that a lower growth rate would increase the risk of conflict, as individuals have less to lose from conflict in low-income situations. The period dummy variables Dum1 and Dum2 are statistically significant and have a positive coefficient which increases beta by 1.21 and 0.122 respectively (Table 6.8).

As for the fixed effect model, we find that there is a significant positive relation between beta and inequality. A one unit increase in inequality would result a decrease in beta by 6.5%. Beta decreases by 12.2, 67.74 and 0.77%, for a one unit increase in GDP growth, internationalisation index and openness index respectively. On the other hand, a one unit decrease in military expenditure would cause a decrease in beta by 23.4%.

6.6. LOCAL CONFLICTS WITH ENDOGENOUS GLOBAL PARTNERSHIP FORMATION AMONG TERRORIST ORGANISATIONS

Our main contention here is that local and regional factors create a ground for local agents to engage in conflicts to redress local problems. However, in their conflictual pursuits local agents need help in terms of technology,

logistics and funding either from friendly nations or international sources. The main goal of this section is to explain how such a partnership between local and international and also among local agents can take place. Once again we will explain the partnership formation as an equilibrium phenomenon that can explain the persistence of conflicts and also the incentive structures of conflicts at the local level.

6.6.1. Brief Introduction to Group Formation: Background Models

Formation of group and group behaviour offer time-honoured challenges and facile opportunities to economists for a long time. There are two distinct approaches to the formation of alliance or groups in economics. First, a considerable attention has been accorded to the problem of group formation from the perspective of cooperative games (Aumann, 1989; Aumann & Peleg, 1960; Gillies, 1959; von Neumann & Morgenstern, 1944, pp. 583–584; Shapley & Shubik, 1969). In these models, potential members decide whether to join a group/association/alliance. Once they join and the group is formed, actions of all these members are constrained by the dictate of a mutually agreed contract. The focus is on the collection of joint actions that the group can take independent of the action of non-group members. In order to highlight group formation, these models typically examine the terms of the contract that is mutually acceptable. These models also examine the joint action of the group and also the related issue of limits to group size. More complex models examine the possibility of simultaneous formation of multiple groups. The crux of the analysis is to home in on the formation of a group and the joint action it broaches on itself. The natural extension of this line of reasoning is to attribute some kind of stability to such groups: the major requirement is to have groups and their joint action to be immune to deviations either by a member or by a sub-group of members (see Gangopadhyay, 2000; Harsanyi, 1974).

On the other hand, the non-cooperative approach highlights the formation of a group in the light of the internal functioning of the group. To put it boldly, in non-cooperative games, the focus of research is on how members choose their joint actions (see Gangopadhyay, 2000, 2002; Harsanyi, 1974; Chatterji, Dutta, Ray, & Sengupta, 1993). Outcomes of cooperative games or coalitional games, do not depend on the details of individual actions. Our focus is the on non-cooperative aspect of the formation of equilibrium group. But once the group is formed, the group behaves like a single entity in choosing the group activity and, in this regard, our model belongs to the former class of models.

Possibilities of cooperative ventures in oligopolies have been examined in Katz and Shapiro (1985); Kamien, Muller, and Zang (1992); Matutes and Padilla (1994) and Yi (1997). Katz and Shapiro (1985) examine incentives for firms to reach perfect compatibility with all the products in the industry. Kamien, Muller and Zang highlight research joint ventures in the context of industry-wide agreements. Matutes and Padilla (1994) consider formation of groups as a simultaneous game (like ours) and consider coalition-proof Nash equilibrium as their solution concept (as opposed to Cournot–Nash equilibrium of this study). Yi (2000) develops non-cooperative games of coalition formation to compare equilibria of different group-formation games.

We apply a model of endogenous group formation in the highly simplified context of symmetric oligopoly with a linear demand function. In this model, firms form groups in order to reduce their marginal cost of production by harnessing economies of scale. They also form groups to capture the largest possible market spoils by acting as a single entity to enhance their market power. The management of a group has a compensation function that depends on the own-profit as well as on the group size. We assume that the management of a group has an incentive to increase the group size in order to increase their power, prestige and influence. In such a scenario, firms simultaneously decide to form groups in response to each other. The proposed equilibrium is a combination of mutual-best responses. The main result of this baseline model shows that firms, in equilibrium, form two symmetric and equal groups whilst the group structure is inefficient. Each group has too many members in relation to the efficient scale of operation as dictated by the finite supervising limits that constrain the management. A simple extension of the model with asymmetric supervising limits of managements across the groups can easily explain asymmetric group structures in equilibrium. Similarly, if managements across groups have asymmetric incentives to enhance own-group size, firms will then form asymmetric groups in equilibrium. We thus argue that the larger the supervising limit of a group, the larger will be the group size. Similarly, the stronger the passion (preferences) for power, prestige and influence of the management of a group, the larger will be the group size.

Bloch (1995) and Belleflamme (2000) consider cases where firms form groups in order to decrease costs. Existing theory of partnerships highlights that partners get together to exploit economies of scale wherefrom groups form (Farrell & Scotchmer, 1988). Yi (1997) shows in the context of coalitional games that the group/coalition contains too many members in equilibrium. Our chapter bears some apparent similarities with Bloch's paper. But there are major differences: Bloch considers the group formation

in a sequential setting in which one group acts as a Stackelberg leader and, thereby, captures more than three-quarters of the market by forming an alliance with roughly three-quarter of firms in an industry. The followers are forced to accept a lower share by the formation of a smaller group. We, on the other hand, postulate simultaneous moves by two endogenous groups who respond to each other in the forming alliance. One may therefore call our model one of endogenous and reciprocal group formation. Bloch has a very restrictive assumption about group formation that drives his findings: he posits a two-stage model such that firms form irrevocable alliance in the first stage in a sequential fashion as described above. In the second stage, they compete against each other for market shares in order to maximise their individual market spoils.[3] The formation of an alliance is thus limited to the first stage. In the second stage, these firms do not take any joint action. Such a setting may be appealing for some scenarios such as common R&D projects, common use of facilities and network externalities as stressed by Bloch. But there are important cases when the group/alliance formation takes place for the simple motive of seizing larger market shares and thereby capturing larger profits. A common example is merger and acquisitions. Our model considers the formation of groups in a scenario in which once groups are formed, members of a group take joint actions to vie/compete against member of other group as unified entities.

In Farrell and Scotchmer (1988), the possibility arises that an efficient industry-wide grand coalition of firms is feasible if there are economies of scale. Our model is different from that of Farrell and Scotchmer on two important counts: we make a more general assumption about scale economies. Initially, as the size of the group increases, the marginal cost of production of firms in the group declines due to economies of scale till a point. Beyond this point, diseconomies of scale set in due to supervising constraints. As a result, we postulate an average cost function that displays the usual U-shape. Secondly, we assume that the executive compensation of a group partially depends on the profit of this group and partially on the size of this group. Based on these twin assumptions, we derive the equilibrium size of two symmetric groups of firms that endogenously decide to form groups in response to each other.

6.6.2. A Simple Model of Terrorism as a Partnership Formation

The goal of a terrorist group is to obtain some political concessions for its constituency from a state or a group of states. We are not modelling

the state in our work, whose goal is to resist the concessions. Terror activities and eliciting concessions are not free and a terrorist group incurs a pecuniary cost. We label the political concession as 'a', which is the objective of a terror group while the cost of group i as 'c_i' for undertaking the conflict or terror attacks. For tractability, we assume that each agent in a group has one unit of capital. These agents or producers of terrors, endogenously decide to join groups or associations. For our analysis, we assume that two groups are being formed and we label them as M_1 and M_2. This idea of two group formation is akin to duo-polisation of an industry is widely known in the literature on group formation due to the findings in Horn and Persson (2001). This is also similar to the bipolar model of superpowers.

At the outset, we neither know the size of each group of terrorists nor its membership. By construction of the problem, the size of the group is captured by its capital stock that acts as a proxy for its membership. Once these groups are formed, they engage in a simple one-shot game as will be outlined in due course. The utility/return to group i is defined by Eq. (1a) π_i^*:

$$\pi_i^* = \frac{(a - 2c_i + c_j)^2}{9b} \tag{1a}$$

Note that 'a' is the political concession whilst $(c_i - c_j)$ is a measure of cost disadvantage for group i if $(c_i - c_j) > 0$ for eliciting the same political concession 'a'. Similarly, $(c_i - c_j)$ is a measure of cost-advantage for group i if $(c_i - c_j) < 0$. The cost disadvantage or advantage, enters the return function as a reputation effect that is necessary for converting the decisions of terror games as games. The average cost of production of the ith group is c_i, $(a_i - c_i)$ is the net political concession over cost for group i then (1a) gives, in some measure, the quadratic utility function from the net concessions of the ith group, with the reputation cost/advantage integrated into the system.

We assume a supervising constraint that the leaders/senior management of a terrorist group faces as the size of the group increases. Due to this constraint the average cost of a group falls with an increase in its size or capital, but beyond a critical size the average cost starts rising. In order to highlight this aspect, we introduce an average cost function that is U-shaped:

Assumption 7. As the capital stock increases, the average cost of a group declines till a particular level of capital stock and then starts rising.

That is,

$$c_i = c_0 - c_{11}k_i + c_{12}k_i^2 \quad c_{11} > 0, c_{12} > 0 \tag{1b}$$

$$\frac{dc_i}{dk_i} = -c_{11} + 2c_{12}k_i$$

Hence $(dc_i/dk_i) > 0$ for $k_i < [c_{11}/(2c_{12})]$ and $(dc/dk) < 0$ for $k_i > [c_{11}/(2c_{12})]$. We assume the structure of the average cost, c_i, is the same for each group.

We posit that the leaders/managerial compensation function has two components: we retain the usual assumption that managers are compensated on the basis of their performance measured in terms of group returns as highlighted in Eq. (1b). We also assume that the senior management of a group also derives benefits from the size of the firm. This may be due to their enhanced power, prestige and improved position in the world of terrorists. We formalise this in Assumption 8:

Assumption 8. The compensation, L_i, of the leaders/senior management of the group i is given by:

$$L_i = m(\gamma - c_i) + \pi_i* \tag{1c}$$

Note that m and γ are constants, whilst c_i the cost function of group i. The first component is the managerial return from the size of the group that increases with k_i until $k* = c_{11}/2c_{12}$ and starts declining thereafter as the group becomes less efficient beyond this point. The second component is the usual the group return. The group return of a group is given by Eq. (1a).

Corollary 1. The group return functions of these two groups M_1 and M_2 are given by:

$$\pi_1* = \frac{(a - c_0 + (2k_1 - k_2)c_{11} - (2k_1^2 - k_2^2)c_{12})^2}{9b} \tag{2a}$$

$$\pi_2* = \frac{(a - c_0 + (2k_2 - k_1)c_{11} - (2k_2^2 - k_1^2)c_{12})^2}{9b} \tag{2b}$$

Proof. Substituting (1c) into (1b) yields (2a) and (2b) (Q.E.D.).

Lemma 1. The optimal capital stock (size) of the first group in response to the optimal capital stock (size) of the second group is given by:

$$(a - c_0 + 9bm) + 2c_{11}k_1 - c_{11}k_2 - 2c_{12}k_1^2 + c_{12}k_2^2 = 0 \tag{2c}$$

Similarly the optimal capital stock of the second group is:

$$(a - c_0 + 9bm) + 2c_{11}k_2 - c_{11}k_1 - 2c_{12}k_2^2 + c_{12}k_1^2 = 0 \qquad (2d)$$

Proof. Substituting (2a) into (1c) and differentiating it with respect to k_1 and setting it equal to zero yields (2c). Similarly substituting (2b) into (1c) and differentiating it with respect to k_2 and setting it equal to zero yields (2d). Eqs. (2c) and (2d) are the (implicit) reaction functions of these two groups M_1 and M_2 (Q.E.D.).

From the construction of the problem k_1 and k_2 are the proxy for the group size in two these two groups M_1 and M_2. The larger the values of k_1 and k_2, the larger are group sizes. Similarly, the lower the values of k_1 and k_2, the lower are the group sizes. Now we determine the equilibrium size of each group from the reaction functions. We apply the simple notion of the Nash equilibrium: the equilibrium sizes of these groups are the values of k_1 and k_2 that are the mutual-best responses. What incentives firms have to form for these groups? In the merger literature the traditional criterion states that a group M^A would dominate M^O if total returns from M^A are larger than the total returns from M^O. In this chapter, we apply the same criterion (see Horn & Persson, 2001, footnote 7).

In order to characterise the equilibrium we prove the following.

Corollary 2. Define K^* as

$$\frac{k^* = k_1^* = k_2^* = c_{11}}{2c_{12}} \qquad (3a)$$

There does not exist a pure-strategy Nash equilibrium in the game if $k_1 < k^* = c_{11}/(2c_{12})$, $k_2 < k^* = c_{11}/2c_{12}$ or both these inequalities are true.

Proof. Suppose Nash equilibrium exists. We can show at least one of these groups will have incentive to deviate unilaterally from this equilibrium by increasing its size. By definition, this is not Nash equilibrium.

Corollary 3. The slope of the reaction function, R^i, of the ith group is given by:

$$\left(\frac{dk_2}{dk_1}\right) R^i = \frac{2(c_{11} - 2c_{12}k_1)}{c_{11} - 2c_{12}k_2} \qquad (3b)$$

Proof. From Corollary 2 we know that $(\mathrm{d}k_2/\mathrm{d}k_1)R^i > 0$ for $k_i > (c_{11}/2c_{12})$ for $i = 1, 2$.

The curvature of the reaction function R^i is given by

$$\left(\frac{\mathrm{d}^2 k_2}{\mathrm{d}k_1^2}\right) R^i = 4c_{12} \frac{(c_{11} - 2c_{12}k_1)^2 - (c_{11} - 2c_{12}k_2)}{(c_{11} - 2c_{12}k_2)^3} \tag{3c}$$

It is also instructive to note that $(\mathrm{d}^2 k/\mathrm{d}k_1^2)R^i > 0$ for values of (k,k) lying below the 45° line passing through the origin. For all values above this 45° line, $(\mathrm{d}^2 k_2/\mathrm{d}k_1^2)R^i < 0$.

Corollary 4. The reaction function of group i has an intercept at the k_i axis at k_i** such that:

$$k_i^{**} = \frac{c_{11}}{2c_{12}} + \frac{\sqrt{c_{11}^2 + 2c_1 h_i}}{2c_{12}} \tag{4a}$$

$$h_i = a + 9bm - c_0 - c_{11}k^* + c_{12}k^* \tag{4b}$$

Proof. Details available upon request.

Theorem 3. The proposed game as characterised by the reaction functions (2c) and (2d) has a unique Nash equilibrium that gives us the equilibrium group size. In the unique Nash equilibrium, $c_{11}/2c_{12} + \sqrt{c_{11}^2 + 2c_1 h_i}/2c_{12}$ agents endogenously form a group in response to the formation of another group by $c_{11}/2c_{12} + \sqrt{c_{11}^2 + 4c_{12}(a - c_0 + 9bm)}/2c_{12}$ agents. In this equilibrium, the system will be beset with inefficiency as measured by $\sqrt{c_{11}^2 + 4c_{12}(a - c_0 + 9bm)}/2c_{12}$.

Proof. We will provide a qualitative proof first. The Nash equilibrium is given by the values of k_1 and k_2 which simultaneously solve the nonlinear Eqs. (2c) and (2d). Due to Corollary 2 through to Corollary 4, we are able to draw the reaction functions in Fig. 6.4 as they are. The Nash equilibrium is given by the point of intersection of these two reaction functions along the 45° line.

In regions I–III there does not exist any pure-strategy Nash equilibrium since one or both firms have incentive to deviate unilaterally from these
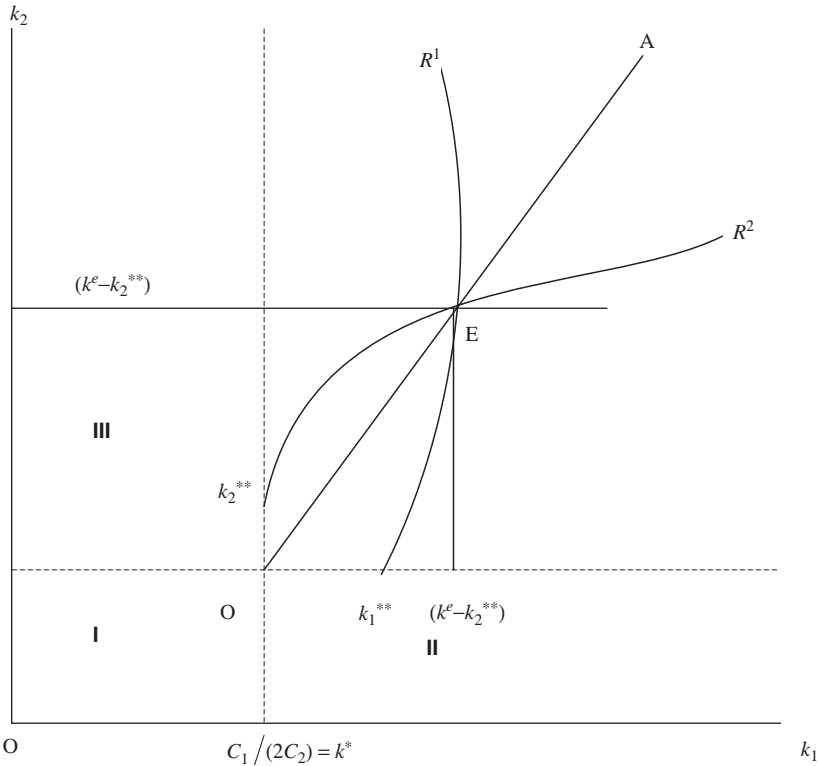
Fig. 6.4. Unique and Stable Nash Equilibrium.

regions. In the relevant region OA is the 45° line above which the reaction functions are concave and below which reaction functions are convex from the horizontal axis. In this region both reaction functions are positively sloped and R^1 and R^2 represent the reaction functions of group 1 and group 2. It is instructive to note that there is an economic justification for R^1 to start from k_1** and to rise with an increasing slope. Similarly, R^2 starts at k_2** and rises with a declining slope. The curvatures and positions of these reaction functions ensure the existence of the equilibrium E. We also derive the equilibrium as an explicit solution of the reaction functions. The stability of the equilibrium is ensured by the fact that the R^1 function is steeper than the R^2 function at E. The uniqueness is also guaranteed from these slopes.

We calculate the symmetric and pure-strategy Nash equilibrium by substituting $k_1 = k_2 = k$ into either (2c) or (2d). This substitution yields the quadratic equation:

$$(a - c_0 + 9mb) + (c_{11}k - c_{12}k^2) = 0 \qquad (4c)$$

The larger of the twin roots of the quadratic Eq. (4c) gives the (Nash) equilibrium group size:

$$k^e = \frac{c_{11}}{2c_{12}} + \frac{\sqrt{c_{11}^2 + 4c_{12}(a - c_0 + 9bm)}}{2c_{12}} \qquad (4d)$$

It is instructive to note that the average cost is minimised at $k^* = c_{11}/2c_{12}$ whilst the endogenous formation of group creates too much of capital in equilibrium since $k^e > k^*$. The inefficiency due to this overcapitalisation is measures as the difference between k^* and k^e. From (3a) and (4d) we calculate the inefficiency as $\sqrt{c_{11}^2 + 4c_{12}(a - c_0 + 9bm)}/2c_{12}$ (Q.E.D.).

Corollary 5. From the above formulation we can note that an asymmetric equilibrium, with asymmetric equilibrium group sizes, will exist when the optimal size of operation $k^* = c_{11}/2c_{12}$ and m will vary across groups.

6.6.3. Discussion

We are able to evince that there exists a unique, symmetric and stable equilibrium size of terrorist group that is self-enforceable: each group is endogenously formed as the best response to the formation of the other group. The critical factor behind this equilibrium is two-fold: first, the marginal cost function of each group is U-shaped since there exists an efficient scale of operation/production for a group due to supervising limits/constraints of its leaders/management. Secondly, the compensation function of leaders/managers is not only influenced by net returns from concessions but also by the size of this group. The return from the size may be pecuniary or non-pecuniary such as power, prestige and influence that the size can offer. Due to the second component in the compensation function, each group has an incentive to accumulate its size beyond the efficient scale. The excess of scale beyond the efficient scale can be used as a measure of inefficiency associated with terrorist group formation. In some sense, the

inefficiency in size can be used as an explanation of the rising incidents of conflicts and terrorist attacks in the modern world.

As a corollary, we also find that an asymmetric equilibrium, and hence asymmetric group sizes exist for two sets of reasons in our model: first, the asymmetric group size, in equilibrium, will exist when the managements across these groups have asymmetric supervising limits. Secondly, the asymmetric group sizes, in equilibrium, can be explained by asymmetry in passions/preferences of managements for power, prestige and influence across these groups.

Thus, the larger the supervising limits/constraints of a group, the larger will be the group size. One may like to call the supervising limit as an objective factor that drives the size of groups in equilibrium. This is similar in spirits to the established result in this context: the more efficient a group is, the larger is the equilibrium group size (Farrell & Scotchmer, 1988). Our model also singles out a subjective factor – the passion for power, prestige and influence – that can seriously influence the equilibrium group size. The larger is the passion for power, prestige and influence of the management, the larger will be this group size in equilibrium. Variations in these objective and subjective factors can have profound effects on the equilibrium group size, asymmetry of equilibrium group sizes and industry-wide inefficiency.

6.7. DYNAMICS OF CONFLICT CYCLES: TERROR CYCLES AS A SPECIAL CASE

The focus of our current research is on conflicts induced by terror strikes and armed insurgencies. We examine violent conflicts. As our empirical findings highlight there seems to be reasons to believe that there is some kind of cyclical fluctuations in the intertemporal conflict data as the beta values show some sort of instability over time.

Our findings are in consonance with earlier studies on the time series of terrorist activities. As examples, Enders, Parise, and Sandler (1992) and Enders and Sandler (2000) have unravelled cycles in the time series data on various indices of terror activities around the globe. As an example, Enders and Sandler (2000) looked at the quarterly data from 1970 to 1996 on the indices of transnational terrorist activities and established several types of cycles such as long-term primary cycle of 18.57 quarters and medium-term secondary cycle of 7.65 quarters while the index used is the number of

terrorist attack. Several such cycles have been demonstrated to exist with other measures of terrorist activities. Our empirical findings point to the fact that there may exist cyclical fluctuations in violent conflicts driven by the international factors. There is very little attention that researchers have spent on the development of theoretical models that can explain these cycles.

There are some conjectures that terrorism displays some kind of clustering as terror groups tend to copy each other's action plans. The cascade of terrorist activities induces law enforcers to come heavily on terrorists by adopting suitable preventive measures, which gradually reduces the incidence of terrorist attacks – a virtuous cycle is thereby created. Once the terror attacks are on the low ebb, the vicious cycle arises as law enforcers go soft, which in turn increases the incidents of terrorism. Some ad hoc modelling took place by postulating ex ante and unexplained relationships between terrorist activities and law enforcements, as in Faria (2003), however the field is replete with gaps since consistent and rigorous modelling are still not available. In the following, we try to provide some theoretical conjectures about the possibility of endogenously driven terror cycles.

6.7.1. The Model

The starting point of our analysis is to model the 'quality' of terror plans of terror groups and the quality of governance within terror groups. The terror groups, as postulated in this chapter receive funding, technology and logistic support from international sources – globally located decision-makers. These decision-makers supply these inputs only when they are convinced that the plans of the terrorist are feasible and the governance of the local terrorist group is of high quality so that an 'appropriate course of terror activities' can be unleashed by the groups. This is where the quality of terror projects and terror group's governance bites in: if the perception of the international supporter/financier is that the governance of terror groups and their projects and plans are not of high quality – the terror groups receive no or little material support. The lack of resources then starves the specific group that gradually reduces the viability of the organisation in carrying out terror attacks. For the sake of brevity, in the modelling section we will call quality of governance to label the internal governance of terror groups and their quality of terror plans and projects. By available resources we mean the financial, technical and logistic support as given by the global decision-makers.

The point of departure of our model is a straightforward postulation of a two-way interaction between quality of governance and the available resources of a terror group: quality of governance, G, is an increasing and nonlinear function of their available resources, T. On the other hand, T is an increasing linear function of quality of governance. We write them as:

$$G = G(T) \text{ with } G' > 0 \tag{5a}$$

$$T = T(G) \text{ with } T' > 0 \tag{5b}$$

This is a model of 'mutual causation' between two variables G and T (see Kaldor, 1940; Swan, 1962). We postulate that G is S-shaped. For low values of T, $G'' > 0$ and for high values of T, $G'' < 0$. For initial low values of T, the value of G is low as the group is severely resource-constrained to attract appropriate 'talents' for terror strikes. As resources increase, for low values of G, the terror group starts attracting high-quality terrorists that will, in turn, reinforce the quality till a limit-beyond which the traditional diminishing productivity sets in and the quality function G flattens out. We label this production function of quality of governance (of terrorism) relation as G in Fig. 6.5. We label the resource function as T in Fig. 6.5 that linearly increases with increasing quality. We postulate that G and T mutually 'cause' each other: the greater the quality of governance, the greater the international revenues that the terror group can attract. The lower is the resource the lower is the quality of governance. The point of intersection between T and G characterises an equilibrium as E_1.
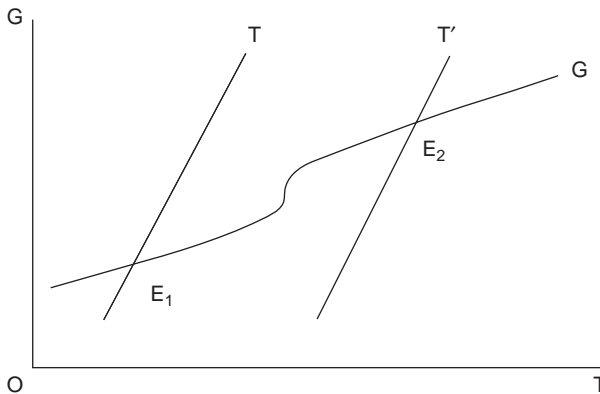
Fig. 6.5. Equilibrium Quality of Governance.

Why is this an equilibrium?

At E_1 there is no tendency for either G or T to change, since the 'causal' relationships are simultaneously satisfied. Equilibrium E_1 is locally stable: in the vicinity of E_1, quality of governance and resources move in right direction to restore the system back to E_1. The condition for a stable equilibrium is that the T line is steeper than the slope of the G function at the point of intersection. However, there is nothing sacrosanct about it.

Now, from a simple comparative-static exercise one can easily establish that a shift in the T line will result in a change in equilibrium. For small shifts, the new equilibrium will be fairly close to the original one at E_1. However, if there is a significant shift of the T line, then the new equilibrium will go beyond the increasing productivity zone and the T line and Q functions will intersect at a new equilibrium E_2 at a high-quality level. Such a movement from E_1 to E_2 can be very quick and if the T line is steeper than the slope of the Q function at E_2, then E_2 is also a stable equilibrium that will persist until further shocks to T. It is worth noting that the quality of governance is much higher at E_2, and this equilibrium involves a deadly series of successful terror attacks given the security and safeguard measures of the law enforcement agency. The increase in quality, following further increases in T, becomes sluggish. But a sudden and sharp decline in T can easily take the system back to the low-level equilibrium E_1.

6.7.2. An Extension

Now suppose that the T line is also nonlinear and inverse S-shaped: the ability to raise resources of a government decreases at the outset till a critical quality is achieved. Once the critical quality of governance is reached, the terror group starts attracting larger resources leading to an increasing rate of growth of T beyond the critical level T_c (Fig. 6.6). Thus:

$$T' < 0 \text{ for } T < T_c \tag{5c}$$

$$T' > 0 \text{ for } T > T_c \tag{5d}$$

It is possible that the system is now characterised by three equilibria E_1, E_2 and E_3. Equilibria E_1 and E_3 are stable and separated by an unstable equilibrium E_2. E_1 is the low-quality equilibrium with a low incidence of terror attacks while E_2 is the high-quality equilibrium with a high incidence of terror attacks. Any temporary perturbation from E_3 (or, E_1) beyond E_2 can lead to E_1 (or, E_3).
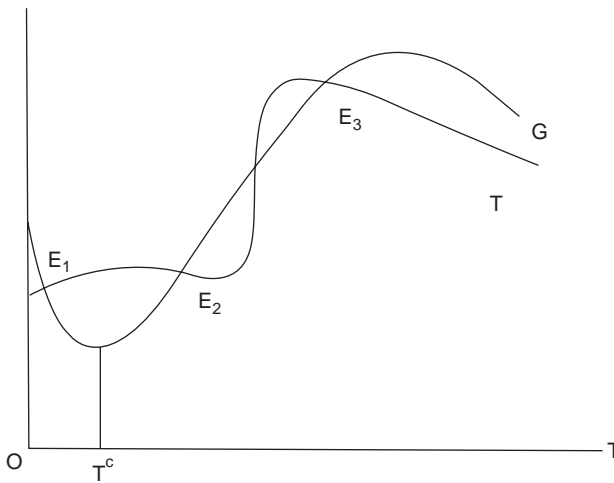
Fig. 6.6. Nonlinearities in Governance and Resources.

Even more interesting cases arise when the equilibria are unstable: a small change leads to a 'vicious' or 'virtuous' cumulative process. Starting from an unstable equilibrium, any temporary improvement in quality of governance or resources, will mutually reinforce each other to take the economy along a virtuous cumulative process. Similarly, a temporary decline in resources or quality of governance, will mutually reinforce each other to engender a vicious cumulative process. In order to have unstable equilibrium, we need G and T to be strongly sensitive to each other near their intersection. The context of multiple stable equilibria can adequately explain the experience terror cycles. The low-level equilibrium E_1 depicts a relatively stable position wherefrom the terror situation does not improve. But this low-level equilibrium of terrorist activities and can be destroyed by a momentary, but sufficiently powerful, improvement in governance or resource availability. Even a few talented guys to the terrorist fold can significantly alter the situation for ever: such changes can bring about a new era of high governance as captured by E_3 and a sudden and sustained upsurge of terrorist activities in the region given the level of deterrence activities. On the contrary, if the system is perched on E_3 already, shocks and changes cannot deteriorate things permanently; yet adverse shocks may initiate changes that can pull the system back to the low-level equilibrium E_1 of terrorist activities. In the following section, we try to offer a full-blown model.

6.7.3. The Full-Blown Model

We postulate that the quality of governance (G) is influenced by the level of economic development – as captured by the level of national income (Y) – and the overall quality of human capital (H). We similarly assume that external resources (T) are also influenced by H and Y as the global decision-makers' decision of funding is influenced by H and Y. We will explain that in a moment. It is postulated:

$$G = G(Y, H) \text{ with } G_Y > 0, \ G_H > 0 \tag{6a}$$

$$T = T(Y, H) \text{ with } T_Y > 0, \ T_H > 0 \tag{6b}$$

We define E as the expenditure of the terror group that is influenced by the quality of governance (G) and the level of economic development (Y). Ceteris paribus, as the quality of governance rises the group needs less money to carry out the same terror plan. As Y increases, it becomes more expensive to carry out the same terror attack due to increased cost of operation and also because of increased vigilance by law enforcement agencies. We postulate the above in Eqs. (6c) and (6d) as:

$$E = E(G, Y) \tag{6c}$$

$$E_G < 0 \text{ and } E_Y > 0 \tag{6d}$$

We write

$$E = E(G, Y) = E(G(Y, H), Y) \tag{6e}$$

$$= E(Y, H) \tag{6f}$$

with

$$E_Y > 0, \ E_H < 0 \tag{6g}$$

The balanced budget of the terror group requires (static sense):

$$E(Y, H) = T(Y, H) \tag{7a}$$

We know

$$T_H - E_H > 0 \tag{7b}$$

$$\frac{\mathrm{d}Y}{\mathrm{d}H} = \frac{T_H - E_H}{E_Y - T_Y} \tag{7c}$$

Hence

$$\frac{\mathrm{d}Y}{\mathrm{d}H} > 0 \tag{7d}$$

if

$$E_Y > T_Y$$

$$\frac{\mathrm{d}Y}{\mathrm{d}H} < 0 \tag{7e}$$

if

$$E_Y < T_Y$$

The simple dynamic system can be reduced to

$$\frac{\mathrm{d}Y}{\mathrm{d}t} = \beta[E(Y, H) - T(Y, H)] + b \tag{8a}$$

Ignoring the balanced budget multiplies, it implies pump-priming.

$$\frac{\mathrm{d}H}{\mathrm{d}t} = \alpha E(Y, H) + h \tag{8b}$$

Let us simplify our calculations by setting $b = h = 0$, which do not change any of our conclusions. The locus along which national income growth is constant is given in the following. From (8a) and (8b) we know:

$$E_Y > (<) T_Y$$

$$\left.\frac{\mathrm{d}Y}{\mathrm{d}H}\right|_{\dot{Y}=0} = \frac{T_H - E_H}{E_Y - T_Y} > (<) 0 \tag{8c}$$

Postulate 1. At a lower level of development $E_Y < T_Y$ and hence

$$\left.\frac{\mathrm{d}Y}{\mathrm{d}H}\right|_{\dot{Y}=0} < 0 \tag{8d}$$
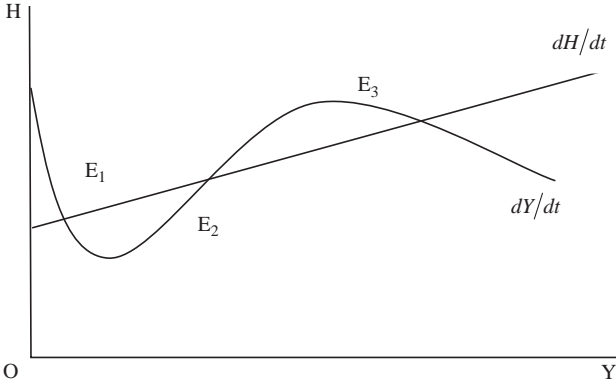
Fig. 6.7. Existence of Multiple Equilibria.

Postulate 2. At an intermediate range $E_Y > T_Y$ and, hence,

$$\left.\frac{\mathrm{d}Y}{\mathrm{d}H}\right|_{\dot{Y}=0} > 0 \qquad (8e)$$

Postulate 3. Beyond a critical value of Y, say Y_c, $E_Y < T_Y$, and hence (8d) holds (Fig. 6.7).

6.7.3.1. Limit Cycles

In the following case, when $E_Y > T_Y$ at the point of intersection, the focal point node E is unstable that will cause limit cycles. This can be seen from the characteristic roots of the dynamic system by applying the Poincare and Bendixson theorem (Fig. 6.8):

From Bendixson's criterion, we know the cycle will exist if

$$\beta(E_Y - T_Y) + E_H \text{ cannot be of fixed sign (zero excepted)}$$

In terms of characteristics roots of the dynamic system:

$$\text{Product of the characteristics roots} = \beta(T_H E_Y - T_Y E_H) > 0$$

$$\text{Sum of the characteristics roots} = \beta(E_Y - T_Y) + E_H$$

Thus, the equilibrium is stable or unstable depends on whether the sum of the characteristics roots are < 0 or > 0.
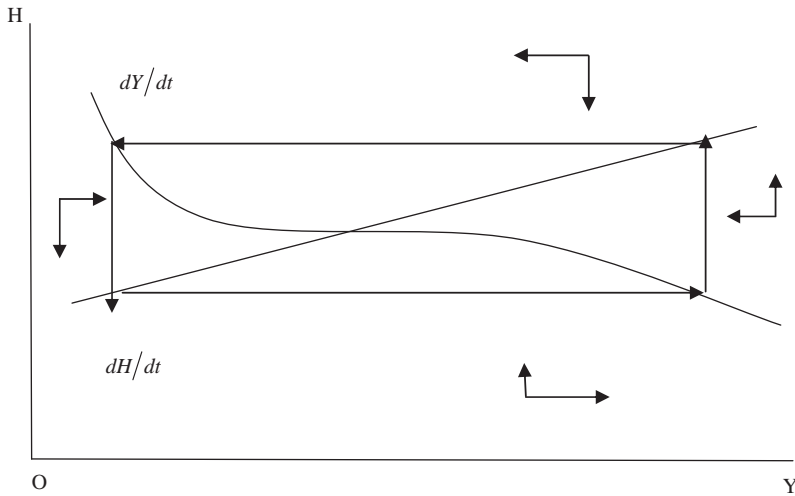
Fig. 6.8. Possibility of Limit Cycles.

These ideas are similar to Myrdal's 'simplified mental model' as poignantly articulated by Swan (1962): White prejudice and Black standards mutually 'cause' each other. The higher the prejudice, the lower the standards that Blacks can achieve. The lower their standards, the greater will be the prejudice against them.

6.8. GLOBAL PARTNERSHIPS IN CONFLICTS AND TERRORISM: CAN THERE BE ENDOGENOUSLY DRIVEN TERROR CYCLES?

6.8.1. Introduction

Chaotic behaviour can characterise many important facets of economics (Saari, 1996). We now know that complex and unpredictable behaviour is not only a product of complex systems with many degrees of freedom but can also be caused by simple and deterministic dynamic systems. Since the early 1980s a series of important papers highlighted the relevance of nonlinear dynamic models exhibiting chaotic dynamical behaviour in economics (see Benhabib & Day, 1982; Day, 1982; Jensen & Urban, 1984; Hommes, 1991, 1993). From the previous sections, we formulate the terror

groups as specific assets which are financed and 'owned in some sense' by the global/international decision-makers. Like any asset we now postulate a quasi market for terror assets and explore how the market equilibrium and the equilibrium asset price dynamics will evolve. In this segment, we draw attention to some very complex behaviour that occurs in simple models of equilibrium asset prices in quasi markets that we have postulated. In our quasi market for each asset there is a group of buyers and a group of sellers. We posit that both buyers and sellers of an asset face a gamble regarding the future value of an asset due to the unknown element of law enforcement. At the point in time, one can only make honest guesses. In reality the value of the asset may go up or decline. We derive the asset price dynamics associated with terror activities based on the expected value of this gamble. This example is, in its context, structurally stable while the underlying dynamics are not straightforward. We find that the dynamics of this model are represented by a quadratic map of the type that is well recognised in the literature on chaos. Despite the fact that the asset price dynamics are completely deterministic, yet we show that these dynamics can evolve in a chaotic fashion under a set of usual parametric restrictions.

6.8.2. Basic Heuristics

Here we posit no fundamental difference between the price of a terror asset and the value of the terror asset. The price reflects the value completely. At date t the asset price can take two values – either a high or a low one. We define the high value as $(R^N + \Delta_t)$ whilst the probability of its occurrence is $(1 - \lambda)$; and the low value is $(R^N - \Delta_t)$ and the corresponding probability is λ. One may presume that R^N is the long-run value/price of the asset and Δ represents a short-run deviation from the long-run value. It is further postulated that the probability of low price (λ) is positively related to the magnitude of deviation Δ (ignoring the time subscript):

$$\lambda = \eta\Delta \quad \text{where } \eta > 0 \text{ and } \Delta \neq 0 \qquad (9a')$$

Eq. (9a') purports to indicate that the larger the magnitude of deviation from the long-run value/price, the larger is the probability the asset price will assume the lower of the two possible values. We expect to stamp out any irrational exuberance by the assumption in (9a').

We call V_t as the expected value of a gamble of holding the terror asset at date t, which is given as:

$$V_t = R^N + (1 - \eta R^N)\Delta_t - n\Delta_t^2 \tag{9a}$$

We postulate that the demand for the asset at date $t+1$ (D_{t+1}) bears a positive relation with the expected value of the gamble at date t (V_t):

$$D_{t+1} = c + dV_t \tag{9b}$$

The assumption (9b) is free of controversies.

We postulate the supply of the asset at date $t+1$ (S_{t+1}) bears a negative relation with the value of the asset at date t (V_t):

$$S_{t+1} = a - bV_t \tag{9c}$$

The assumption (9c) is not too comfortable: as the value of the asset increases the terror groups find it difficult to supply more units. One way of rationalising the assumption is that the terror groups have finite and fixed need for financial resources which they can raise with lower floating of terror asset given the increase in the price/value of each unit of asset. If Eq. (9c) is different to what has been postulated, we will need additional conditions to derive our central results.

The excess demand for this asset at date $t+1$ is X_{t+1}:

$$X_{t+1} = (c - a) + (d + b)V_t \tag{9d}$$

The price of the terror asset is assumed to display a finite pace of adjustment as described in

$$\Delta_{t+1} = KX_{t+1} \tag{10a}$$

$$\Delta_{t+1} = k(c - a) + k(d + b)V_t \tag{10b}$$

while k is the speed of price adjustment.

Thus,

$$\Delta_{t+1} > 0 \quad \text{if} \quad \frac{k(a - c)}{d + b} < V_t \tag{10c}$$

and

$$\Delta_{t+1} < 0 \Delta_{t+1} < 0 \quad \text{if} \quad \frac{k(a - c)}{d + b} > V_t \tag{10d}$$

Based on these we propose the following lemma.

Lemma 1. The dynamics of price of the terror asset is captured by the following difference equation:

$$\Delta_{t+1} = m - h\Delta_t + A\Delta_t^2 \tag{11a}$$

where

$$m = k(c - a) - k(d + b)R^N \tag{11b}$$

$$h = k(1 - nR^N)(d + b) \tag{11c}$$

$$A = k(d + b)n \tag{11d}$$

Proof. Substitution of (10b) and (10c) into (11b) yields the result (Q.E.D.).

Lemma 2. The above dynamics has two fixed points Δ^*, Δ^{**}:

$$\Delta^* = \frac{(1 + h) - \sqrt{(1 + h)^2 - 4Am}}{2A} \tag{12a}$$

$$\Delta^{**} = \frac{(1 + h) + \sqrt{(1 + h)^2 - 4Am}}{2A} \tag{12b}$$

Δ^{**} is always unstable. Δ^* is stable if

$$\sqrt{(1 + h)^2 - 4Am} < 2 \tag{12c}$$

Proof. The derivation, being simple, is omitted (Q.E.D.).

If Δ^* is stable, then the asset price dynamics (11a) will drive prices to equilibrium if the initial price is close enough as dictated by (12c). If the price at any date t should go beyond Δ^{**}, then this unstable fixed point will cause the asset price to diverge to infinity. Therefore, for the asset prices to be bounded it is imperative that the following is true:

$$\Delta_t < \Delta^{**} = \Delta^{\max} \text{ for } t = 0, 1, 2, 3 \dots \text{ and} \tag{12d}$$

$$\Delta_t > \frac{h}{A - \Delta^{**}} = \Delta^{\min} \text{ for } 0, 1, 2, 3 \dots \tag{12e}$$

Thus, asset prices will be bounded if the initial price lies on the interval $[\Delta^{\min}, \Delta^{\max}]$ and

$$\sqrt{(1+h)^2 - 4Am} < 3 \tag{12f}$$

If the restrictions on the parameters and initial prices, Eqs. (12d)–(12f) hold the asset price dynamics remain bounded between $\Delta^{\min}$ and $\Delta^{\max}$. Following Feigenbaum (1978) we now apply the change of variable technique that will transform the nonlinear price dynamics to the logistic equation of May (1976).

Lemma 3. The quadratic asset price dynamics (11a) is equivalent to the following logistic equation with an appropriate transformation of the variable Δ:

$$P_t = \frac{h(\Delta^{**} - \Delta_t)}{M} \tag{13a}$$

$$M = 1 + \sqrt{(1+h)^2 - 4Am} \tag{13b}$$

$$P_t = BP_{t-1}(1 - P_{t-1}) \tag{13c}$$

Proof. The derivation is omitted (Q.E.D.).

For $1 < M < 3$ the price converges to the stable equilibrium Δ^*. If $M > 3$ then Δ^* becomes unstable and the asset prices converge to a stable two-period cycle. As M is increased further the stable period cycles of period n bifurcates into cycles of $2n$. At $M = 3.57$ the asset prices evolve through a cycle of infinite period. The asset prices are within the relevant bounds but they never repeat. For a higher order, the asset prices may look like a random process but they are fully deterministic. For values of M greater than 3.57 we can have even more complex behaviour.

Result 1. The asset prices evolve through a cycle of infinite period and hence never repeat themselves if

$$Am > \frac{6.60 - (1+h)^2}{4} \tag{14a}$$

As a result, it is not possible for agents to have self-fulfilling expectations.

Result 2. In order to place these results in a sharper focus we consider a special case when $R^N = 1/\lambda$, then we know $h = 0$, $A = k(d + b)\lambda$, $m = (c - a) - k(d + b)(1/\lambda)$. Then the chaotic dynamics emerges at

$$(1 + h)^2 - 4Am > 6.60 \tag{14b}$$

The substitution of h, A and m will reduce (6b) to

$$1 + 4k(d + b)(d + b + \lambda a - \lambda c) > 6.60 \tag{14c}$$

Thus, the chaotic dynamics emerges if the speed of price adjustment is beyond a threshold:

$$k > k^* = \frac{1.4}{(d + b)(d + b + \lambda a - \lambda c)} \tag{14d}$$

The price dynamics converges to the stable equilibrium if the speed of price adjustment k is such that

$$k < k^{**} = \frac{0.75}{(d + b)(d + b + \lambda a - \lambda c)} \tag{14e}$$

6.8.3. Observation

It is now well recognised in economics science that chaos cannot be given a short shrift as an outcome of highly artificial models. Seemingly innocuous models can exhibit chaotic dynamical behaviour as confirmed in this chapter. The source of the chaotic behaviour in this chapter is in the series of complicated decisions that economic agents make to buy or sell, an asset on the basis of expected value of the proposed gamble involving unknown future (asset) prices. The resultant asset price dynamics, as a result, do not have sufficient refined properties that may eventually lead to a radical behaviour (Saari, 1996). It is therefore the basic nature of economic problems that confront decision-makers in the asset market, which triggers the chaotic dynamical behaviour in asset prices. The upshot is that the speed of price adjustment can be a critical factor in determining whether the asset price dynamics evolve through a cycle of infinite period. We are able to derive two critical values of the speed of price adjustment k^* and k^{**}: if the actual speed of price adjustment k is such that $k > k^*$ then the asset prices remain bounded but never repeat. Thus the price dynamics exhibit chaotic dynamical behaviour for $k > k^*$. Asset prices can show time behaviour that

is seemingly random but is purely deterministic. In this case, agents fail to make long-run predictions even though they act in a deterministic world. Time profiles that start very close together will separate exponentially. On the other hand, for values of speed of price adjustment k such that $k > k^{**}$, the asset price dynamics converge on a stable equilibrium.

6.9. CONCLUDING COMMENTS

The main proposal of this chapter is to posit conflicts as a product of continuing international chasms, splits and differences of political and social ideologies in our modern world. Thus, we argue that conflicts are, to some extent, driven by international tension or global, ideological and geo-political factors. Notwithstanding the global influence, local factors – such as income inequality, income growth or lack of it, political institutions – can and do exacerbate conflicts. This chapter started with a detailed summary of the evolution of global rivalry and conflicts since the First World War. In the next section we provided a basic theoretical analysis of a new index, what we call beta index, of conflicts driven by international tension. We offer the beta values of 92 nations for which we have data from 1970 to 2004. Then we examine the intertemporal movement of the beta index of these 92 nations to explore how international tension traversed over time from one region to another. In order to that we introduce a new concept of beta mobility that is akin to the measures of income mobility in the context of income distribution. We reached a conclusion that the role of international tension has not changed much in determining the local/country-specific conflicts – subject to the limitations of the proposed measures.

Also, this chapter offers an empirical foundation to the sensitivity of the beta index of a country to its economic inequality, GDP growth, military expenditure, internationalisation index, political index and index of openness. The results indicate that the signs of the parameters are almost all as hypothesised. Inequality, military expenditure increases beta. Moreover, GDP growth, internationalisation index and political index lower beta. Inequality and military expenditure have a positive coefficient and statistically significant with beta.

Furthermore, this chapter offered a major theoretical model to explain how local conflicts can be created by international tension. We examine conflicts mainly in the context of violence perpetrated by terrorist groups. Ours will be a first model in understanding the economics of terrorist group

formation in a competitive model. This model depends on the endogenous partnership formation between terrorist agencies/organisations across borders. The findings of the model explain how local and global issues of conflict can mix to give rise to an equilibrium conflict, which therefore has a tendency to self-perpetuate. The model also explains the incentive structures of terrorist organisations and their sizes. Finally, we explained the possibility of endogenous-driven cyclical paths for conflicts and terrorist activities through developing a simple model of terror assets.

NOTES

1. An armed conflict is defined in the PRIO/Uppsala database as follows: 'a contested incompatibility which concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths'. Refer to the PRIO website (www.prio.no/cwp/ArmedConflict) or the University of Uppsala website (www.pcr.uu.se).

2. Pedro Conceição and Pedro Ferreira provide a much more detailed analysis of these issues in their UTIP working paper 'The Young Person's Guide to the Theil Index: Suggesting Intuitive Interpretations and Exploring Analytical Applications'.

3. The equilibrium in Bloch's paper derives from this assumption: since these firms still compete in the product market as oligopolists, the formation of a group has dual effects. First, the reduction in a firm's – own marginal cost increases its profit. Second, the cost reduction of its competitors induce more aggressive behaviour on their part and causes a decline in its profit The implicit assumption is that as a new firm enters a group it has a enjoys a larger decline in its cost the larger is the group size. Thus, as the group size increases, the incentive to admit one more members into the group decreases wherefrom the critical size is arrived at. Beyond the critical size, the admission of a new member lowers the profit of each member.

CHAPTER 7

FOOD ENTITLEMENTS, PUBLIC POLICY AND CONFLICTS IN BACKWARD SOCIETIES

7.1. INTRODUCTION

In many societies, conflicts of violent nature regularly spring up that usually cause a destruction of economic and social assets and needless loss of human lives. Violent conflicts and food entitlements seem to bear mutual feedbacks: first and foremost, as violent conflicts result in destruction of economic assets, conflicts usually tell upon the cultivation of foods, procurement and storage of foods and also the distribution and marketing of foods. The disruption in the agrarian sector can lead to serious decline in food availability and consequent famines, which can exacerbate and fuel further conflicts. On the other hand, the distribution and availability of foods can trigger violent conflicts in backward societies as a means to acquire and retain food entitlements, which can in turn jeopardise the agrarian equilibrium. Thus, the relationship between food entitlements and conflicts are a double-edged sword that can lend precarious instability to a backward society. During the last five decades, governments in developing nations have kept a close vigil on their agrarian sector, yet there is a clear indication in the global economy that warns of a looming food crisis, especially in the poorer regions of our globe. Food crises can seriously challenge global peace. Conflicts and hunger are hence complex phenomena. This chapter provides a comprehensive, and possibly the first, study of the economics of food entitlements and potential threats of conflicts in the current conjuncture.

Conflicts regularly take place in some societies. In similar societies, on the contrary, a peaceful resolution of serious conflicts often takes place. Even many societies seem to traverse from conflicts to peace and to costly conflicts again. It is also important to note that some societies do seem to

enjoy a lasting peace. The literature on the economics and politics of peace and conflict has been with us now for several decades.

An abundant crop of excellent work has appeared supporting, critiquing and complementing the original ideas that economic development is a precursor to an effective resolution of conflicts and, hence, to sustainable and lasting peace. The frequency of international and civil wars, as well as their lethality and indirect costs, declined substantially from the end of the 1980s until 2003. As we argue below, conflicts since the end of 1980s seem to have concentrated in the poorer regions of our globe in which the availability and distribution of foods play an important role. It is important to make a few important observations in the context of conflicts:

- The frequency of armed conflicts fell by about 40% in the 1990s except in sub-Saharan Africa where the incidence remains high,
- Genocides and politicides declined by 80%,
- International arms transfers went down by 33% in value,
- Forced migration of refugees fell by about 45%,
- Battle-deaths declined by about 80%,
- War-death rates came down by about 35%,
- Military spending as a percent of GDP declined in most countries and globally by almost 50%,
- The number of soldiers per 1,000 people went down by 35%.

The above picture of statistics suggests that the forces supporting peaceful settlements of conflicts and violent disputes have been gaining a significant momentum in our globe. There are many apparent factors that led to significant improvements in the global picture of conflict, which are as follows:

- First, the period witnessed a gradual withering of colonial states in the less developed world. Violent conflicts of liberation wars fought against European colonial powers in developing countries gradually came to an end as these colonies achieved independence by the early 1980s.
- Second, with the end of the Cold War, the United States and the Soviet Union have scaled down their military and logistic support to their respective allies in developing nations. As a result, the war fields of the Cold War were drastically transformed into spheres of economic progress and development since the mid 1990s.
- Third, the United Nations and other international agencies asserted themselves with the end of the Cold War and started to play a more significant role in peacekeeping and peacemaking.

- Fourth, the 1990s also experienced unprecedented times of global growth from which many, but not all, previously conflicted regions benefited, which resulted in a further decline in violent conflicts.

Now let us have a cursory look at the regions of violent conflicts in our contemporary world and their relationship with the availability and distribution of foods: according to the 2006 Global Hunger Index of the International Food Policy Research Institute (IFPRI), of the 12 countries with the highest levels of hunger, 9 were affected by civil wars and costly and violent conflicts. The 10 countries that scored the worst are all in sub-Saharan Africa, but South Asia is also a hotspot of conflicts, hunger and malnutrition. The three indicators are: child malnutrition, child mortality and estimates of the proportion of people who are calorie deficient. Doris Wiesmann, the IFPRI researcher who developed the Global Hunger Index, states:

> This index provides a particularly comprehensive measure of global hunger because it ranks countries on three leading indicators and combines them into one.

The researcher continues:

> Alone, each indicator has limitations, but put together, they give us a much more complete picture of the state of hunger around the world.

The latest hunger index ranks 97 developing countries and 22 countries in transition, the data is not available for three nations – Afghanistan, Iraq and Somalia where violent conflicts have reached unprecedented and unfathomable depths. The index indicates that scores have improved in South Asia and in most other parts of Asia since 1981, though many countries in this region suffer from high levels of hunger. Several countries, such as Botswana and Namibia, do worse than expected on the index, relative to their level of development, or gross national income per capita. High income inequality is one of the major factors that push these countries towards high levels of hunger and malnutrition. With the adoption of the Millennium Development Goals, hunger and poverty have become the prime targets of the global development agenda, with the target of cutting hunger in half by 2015.

As a result, the major exception and continuing source of conflicts has been sub-Saharan Africa whose growth of real GDP per capita adjusted for PPP halved from the 1980s to the 1990s. A recovery since 2000 has started, which can reverse the trend in violent conflicts. The region is also known to

have serious problems with fragile availability of foods and hunger. However, there are a host of other problems in these regions.

- According to the World Bank's World Development Indicators of 2005, the number of people living in extreme poverty (at less than $1 a day) doubled in sub-Saharan Africa from 1981 to 2001.
- Since the end of the 1980s, 80% of the world's 20 poorest countries (many in the sub-Saharan region) have suffered from a major war.
- Military expenditure as a proportion of GDP and the number of soldiers per 1,000 people changed little.
- Battle-deaths actually fell in sub-Saharan Africa through the 1990s (apart from an all-time high spike from 1998 to 2000 due to the Eritrean war). However, war-deaths in this region have vastly exceeded battle-deaths due to indirect deaths.
- Compared to the wars from the 1950s to the 1970s, most of the recent conflicts are between badly equipped government troops and lightly armed, untrained rebel forces in poor countries. Most of these violent conflicts have been set in remote rural areas, where national governments have limited presence and where insurgent groups can find easier hideouts.
- On one hand, conflict caused increased vulnerability of the population, often spreading epidemics and intensifying famines in the region. On the other hand, diseases and famines are likely to have a feedback effect on the incentives for war. Thus, one expects a positive correlation between the incidence of conflict and disease or famines, which has been evident in sub-Saharan Africa.
- The aim in controlling valuable natural resources such as timber, diamonds, oil and minerals has precipitated some of these violent conflicts. Governments and insurgent forces usually utilise the revenues from these products to finance military activities.
- Disputes over natural resources triggered some region's long-standing ethnic tensions that have contributed to violent conflict.
- The trade of 'conflict timber' has been a source of conflicts in many countries with tropical forests, as it has been the direct cause of violent conflicts and also used to finance conflicts.
- The timber benefits some groups under conditions of violent conflict, or it is produced and traded in the wake of recent violent conflict.
- The World Health Report 2004 of the World Health Organization stated that the HIV/AIDS epidemic had its 'most explosive growth' in the mid-1990s in Africa, and that by 2003, it was 'home to two-thirds of the

world's population living with HIV/AIDS'. Human undernutrition, HIV/AIDS, onslaught and continuing human hunger and personal insecurities can turn some of the backward regions into veritable minefield wherefrom one can only expect holocaust. The persistent famines in the Horn of Africa coincided with violent conflicts within and between Ethiopia, Eritrea and Somalia in the last 15 years.

Against the backdrop of regional concentration of violent conflicts since the late 1980s, we also witness unprecedented increases in food prices during 2006–2008. Some prices of food grains have more than doubled in two years. For the first time in several decades, violent riots spread from countries to countries.

- Violent protests erupted in Senegal and Mauritania late last year. Indian protesters set ablaze hundreds of food-ration stores in West Bengal in October 2007.
- Rioters wrecked havoc through three cities in the West African nation of Burkina Faso in 2008, burning government buildings and looting stores.
- In 2008 in Cameroon, a taxi drivers' strike over fuel prices escalated into a massive protest against food prices, leaving around 20 people dead. Similar riots took place in Mexico and Pakistan.

Food riots were controlled by armed forces in several of these nations. National governments are seemingly unable to crush the source of the problem, which is a mismatch between current demand for food and the current supply of food in the global and regional markets. What we will discuss in the next section is to draw a picture of the modern food markets that prevail mostly in developing nations where speculation can play a seriously destabilising role. Once we understand a regional market, we try to develop new insights in the global food market and roles of biofuels in the current food shortage and actual and potential conflicts.

7.2. SPECULATION AND FOOD MARKETS: EARLY WORK

It is important to highlight the following:

- In recent times, both developed and developing worlds have been hit hard by spiralling food prices, which led to violent food riots, starvation and deep crises in poorer regions in many developing nations like Haiti, Indonesia, Ethiopia and the Philippines and the list goes on.

- Global food prices have risen significantly during the last three years (2006–2008), which the world has not witnessed in the last 30 years: during 2008, the average food price has risen by 56% while the rice price rose by 96% and the wheat price by 92% that can easily lead to a severe food crisis and famines in various parts of our world.
- The productivity in agricultural has registered a decline while the growth in the demand for food is fast rising.
- Very little attention has been given to the modelling of food crises in recent years, though there is an early and compelling literature on famines and food crises (Sen, 1983). Sen (1983) established how starvation and famines can take place due to a failure of exchange entitlement for which an overall decline in per capita food availability is not a necessary condition.

In order to understand regional food market and regional distribution of food that tends to determine local hunger, we examine some important past work of development economists in the context of food speculation. It is important to note that speculative activities in food-grain markets of developing nations have been a serious concern for policy-makers (Mellor & Dar, 1968; Rakshit, 1982, Dutt, 1982). Early research by Taylor (1982, 1983) on flex-price models of the agricultural markets completely ignored speculative activities by applying the concept of flow equilibrium to these markets. In a flow equilibrium, agricultural prices are determined by the balance between the flows of current demand and current supply and, hence, speculation and stockholding have no role in determining the prices (see Taylor, 1982, 1983). Baland (1993) and Dutt (1982, 1986) highlighted food speculation by applying the concept of stock equilibrium to the flex-price agricultural markets. These new works establish that the earlier models might have provided wrong insights concerning price and output behaviour of agricultural markets in developing nations. It is widely held that farmers strategically manipulate stocks to influence food prices in order to increase their income shares (see Sanyal, 1995 among others). Farmers can and do utilise food stocks for strategic purposes in order to influence current and future food prices. The upshot is that strategic stockholding of agricultural products, especially food items, will not only determine agricultural prices and income shares but will also impinge on the inflationary experiences of a developing country (Taylor, 1982).

Strategic stockholding in food markets leads to artificial 'shortages' that can have severe destabilising impact on food prices and human sufferings. Governments in developing nations have, therefore, attempted to control such speculative activities in their pursuit of fighting inflation and potential

famines (Rakshit, 1982; Dutt, 1986; Ravallion, 1987; Dréze & Sen, 1990). In order to effect intersectoral resource transfers, governments of developing nations also seek to achieve a balance between income shares of rural and urban sectors by influencing food prices (see Sah & Stiglitz, 1986).

Food speculation and its consequences, hence, critically, depend on the ability and willingness of the government to curb such speculation. As a result, the food markets in developing nations are typically characterised by a circular interdependence: the state of the market affects the speculative stockholding by farmer–traders that in turn affects the government's hoarding behaviour and this, in turn, affects the state of the market. The major contribution of this chapter is to model this circular interdependence to capture the nature of gaming between food speculators and governments in developing nations. To our knowledge, ours is the first work to address the question and consequences of this circular interdependence in food markets in a game-theoretic framework.

We develop a two-period game to endogenously derive the optimal stock-holdings as the outcome of strategic interactions between the speculators and the government that would unravel the nature of equilibrium in such markets. From the solution to the proposed game, we establish that such a market is beset with multiple equilibria: a pair of stable equilibria is separated by an unstable equilibrium. Thus, momentary changes in stocks and expectations may have a strong and lasting impact on speculative behaviours, stocks of food and their prices. We also explain when governments in developing nations can successfully limit such speculation.

The plan of the rest of the chapter is as follows: we present the basic model in Section 7.3.1 and the game is presented in Section 7.3.2. In Section 7.3.3, we characterise the rational expectations equilibrium of Stage II, the proposed two-stage game. In Section 7.3.4, we highlight the market-clearing solution of Stage I. Sections 7.3.5 and 7.3.6. examine strategic aspects of stockholding and characterise the perfect Nash equilibrium of the proposed game. Section 7.4 offers a discussion, Section 7.5 builds a model on the basis of observations in Section 7.4. In Section 7.6 we conclude.

7.3. THE BASIC MODEL

7.3.1. An Outline

For simplicity and tractability, we consider three periods (0, 1 and 2) and two types of agents – namely farmer–traders and government. We simplify

the analysis by assuming that farmers sell their products without a middle man. Hence, we call a farmer a farmer–trader in our chapter. Farmer–traders produce food only in Period 0. In Period 1, the available food stock includes the supply from Period 0 and imports by the government. The supply in Period 1 equals the Period 0 output (Y) minus the stocks (S) withheld by farmer–traders. The government buys food in Period 1 from farmer–traders to build its stock. The government sells this food stock in Period 2 and also engages in imports of food both in Period 1 and Period 2. Thus, in Period 1, $Y-S$ is released in the market by farmer–traders. The stock S is to be released in Period 2. In Period 2, the demand for food is met from three sources: from the food stocks of the farmer–traders, food stocks of government and the food imports by the government. We assume a simple storage technology for farmer–traders:

$$s = \lambda(S) = S \tag{1a}$$

where s is the food stock released in Period 2 while S the stock accumulated in Period 1 by farmer–traders. In Period 0, the farmer–traders have already decided how much to produce (Y) and in Period 1, they decide how much to store (S). For the rest of the chapter, for the sake of exposition, we use the terms ‘*hoarding*’ and ‘*dishoarding*’ to respectively represent building and releasing food stocks without any pejorative hint. The farmer–traders expected profits are given by

$$\Pi = P(Y - S) + E(p)s \tag{1b}$$

where $E(p)$ is the expected price of food in Period 2, p the price of food in Period 2, P the price of food in Period 1 and E represents the typical expectation operator.

The demand system is assumed to be linear and invariant through time:

$$Q = A - BP \tag{1c}$$

$$q = A - Bp \tag{1d}$$

Eq. (1c) represents the current demand, Q, as an inverse function of current price P, while Eq. (1d) posits that the demand for food in Period 2, q, is an inverse function of the price at Period 2.

The government has a simple goal in our model. The government has a weighted average of current price and future price as a target (x^T): the government attempts to minimise the deviation of the average food price over the two periods (x) from their target price. We postulate the loss

function of the government as

$$\Pi_G = -[x - x^T]^2 \tag{1e}$$

$$x = wp + (1 - w)P \tag{1e$'$}$$

where $(1-w)$ and w are the weights that the government attaches to current and future food prices in setting up the average price (x). We posit that the government is subjected to the following budget constraints:

$$PG + p_w M = T \tag{1f}$$

$$p_w m = t + pg \tag{1g}$$

where Eqs. (1f) and (1g) represent the budget constraints of the government in Period 1 and Period 2, respectively. T and t are the government revenues in Period 1 and Period 2, respectively. G and g the hoarding (i.e., storage) and dishoarding of food by the government in Period 1 and Period 2, respectively. M and m the imports of foods by the government in Period 1 and Period 2, respectively, and p_w the world price of food.

7.3.2. The Proposed Game

The heart of price determination in the proposed model is a circular interdependence between the activities of the farmer–traders and the government: the amount of current hoarding, S, by farmers–traders will depend on the price ratio $p/E(P)$. Given the food output Y in Period 0, it is obvious that $E(P)$ will depend on g and m given S which will, in turn, depend on P, G and M given the government's revenues T and t. But P, G and M will, in turn, depend on S. Thus, the food stock/hoarding (S) of farmer–traders will depend on the government hoarding (G) and dishoarding (g) decisions, while G and g will depend on S through the price mechanism. We develop an interactive model to capture this circular interdependence.

The proposed game is a two-stage game as outlined in Section 7.2. The game is played out over two periods: in Period 1, the farmer–traders build their food stock S and the government also commits to food stock G. The demand function, and hoarding decisions would determine the food prices in Period 1. The resultant food price in Period 1 would determine the profits of the farmer–traders in Period 1. In Period 2, the dishoarding by

farmer–traders (s), and the dishoarding by the government (g) and the government's imports, m, will determine the food price in Period 2 given the demand function for food. Thus, the profits of the farmer–traders and the price of food in Period 2 will critically hinge on S and G at Period 1. We assume that the relevant information is a common knowledge. We attempt to solve the game recursively by applying the logic of backward induction: we first determine the market outcome and accompanying payoffs to the farmer–traders and the government in Period 2. Being rational and completely informed all agents, at Period 1, correctly expect the market outcome of Period 2. This is the rational expectations equilibrium. Since the market outcome in Period 2 depends on their actions in Period 1, in a perfect Nash equilibrium of the sequential game, both the farmer–traders and the government choose their Period 1 actions to maximise their two-period payoffs subject to the underlying economic relations captured by the rational expectations equilibrium in Period 2. In the following section, we solve the proposed game by applying the logic of backward induction: we start with Period 2 and characterise the rational expectations equilibrium of Period 2. Rationality and complete information dictate that all agents would form their expectations about the food price and associated payoffs at Period 2 by looking ahead and foreseeing the rational expectations equilibrium. In Period 1, agents would adopt the optimal actions based on the rational expectations about Period 2. The resultant outcome is the perfect Nash equilibrium that is a solution to the sequential game.

7.3.3. Rational Expectations Equilibrium in Period 2

The market clearing in Period 2 calls forth

$$s + g + m = A - Bp \qquad (1a')$$

From the postulated demand and supply functions, Eq. (1a') follows. We know from the budget constraint of the government that m is given by

$$m = \frac{t + pg}{p_{\mathrm{w}}} \qquad (1b')$$

From (1′a) we know

$$p = \frac{A - (s + g + m)}{B} \qquad (1c')$$

Substituting (1b′) into (1c′) yields the market-clearing price, p^E, of Period 2:

$$p^E = \frac{p_w(A - s - g)}{p_w B + g} - \frac{t}{p_w B + g} \tag{1d′}$$

Statement 1. The market-clearing price, p^E, of Period 2 is the rational expectations of the agents at Period 1 about the food price in Period 2. The rational expectations price p^E depends on the demand parameters that are exogenously determined. The p^E also depends on the endogenous variables of Period 1 which determine s, g and t at Period 2. Thus, Eq. (1d′) is the equilibrium price schedule for Period 2 that is driven by the endogenous variables of Period 1. In order to determine the actual price in Period 2, we need to determine these endogenous variables of Period 1.

7.3.4. Market Clearing in Period 1

Temporary equilibrium in Period 1 calls forth

$$Y - S + M = Q + G \tag{2a}$$

To recap, $Y-S$ is the supply of food by farmer–traders, M the import of food, Q the private demand for food for consumption and G the government's demand for food for building stocks in Period 1. From the budget constraint of the government we know

$$M = \frac{T - PG}{p_w} \tag{2b}$$

We know that the private demand for food in Period 1 is

$$Q = A - BP \tag{1c}$$

Substituting (1c) and (2b) into (2a) yields the equilibrium price of food in Period 1, P^E:

$$P^E = \frac{p_w(A + S + G - M - Y)}{Bp_w - G} - \frac{T}{Bp_w - G} \tag{2d}$$

Statement 2. The equilibrium price of food at Period 1 is given by Eq. (2d) and the rational expectations (future) price is given by Eq. (1d′).

Thus, the economic fundamentals of the proposed model are reduced to these two equations. Rational agents, both farmer–traders and the government, have prior knowledge about these equations and adopt hoarding and dishoarding strategies to maximise their respective payoffs. The equilibrium of the game will unfold from their optimal hoarding and dishoarding strategies given the price Eqs. (1d′) and (2d).

7.3.5. Strategic Hoarding and Dishoarding by Farmer–Traders and Government

The government knows Eqs. (1d′) and (2d) and chooses G and g given S to affect P and p in order to minimise its loss function Π_G:

$$\Pi_G = -[x - x^T]^2 \tag{1e}$$

Farmer–traders know Eqs. (1d′) and (2d) and choose S to maximise their profits Π:

$$\Pi = P(Y - S) + E(p)s \tag{1b}$$

For simplification and tractability, we assume $p_w = 1$, $T = t$, $S = s$, $G = g$ and zero discounting of the future. The simplification does not affect the analytical bite of the following results.

7.3.5.1. Optimal Hoarding by Farmer–Traders (Period 1)
Farmer–Traders have the following optimisation problem:

$$\underset{\{S\}}{\text{Maximise}} \, \Pi = P(Y - S) + E(p)s \tag{3a}$$

Subject to the price equations where we assume $p_w = 1$:

$$P^E = \frac{A + S + G - Y}{B - G} - \frac{T}{B - G} \tag{2d}$$

$$p^E = \frac{A - S - G}{B + G} - \frac{T}{B + G} \tag{1d′}$$

They have the Cournovian expectations as they treat G and g as given.

The other first-order condition with respect to S is the following:

$$\frac{\delta \Pi}{\delta S} = 0 \tag{3b}$$

From (3b) we derive the other reaction function of the farmer–traders:

$$S = \frac{Y(B+G)}{2b} - \frac{G}{2} + \frac{G(T-A)}{2B} \tag{3c}$$

The Eq. (3c) gives the reaction functions of the farmer–traders which represents their optimal stockholding (S) as a function of the hoarding, G, given their output Y at Period 0 and the rational expectations equilibrium at Period 2 and the market-clearing equilibrium in Period 1. This element reflects the Cournot–Nash characterisation of the behaviour of the farmer–traders. Now we turn to the government.

7.3.5.2. The Optimal Hoarding Food by the Government (Period 1)
The government seeks to minimise its loss subject to the price equations. Hence, we write the optimisation problem of the government as

$$\underset{\{G\}}{\text{Minimise}} \ \Pi_G = -(x^T - x)^2$$

Subject to

$$x = wp^E + (1-w)P^E \tag{1e'}$$

$$P^E = \frac{A+S+G-Y}{B-G} - \frac{T}{B-G} \tag{2d}$$

$$p^E = \frac{A-S-G}{B+G} - \frac{T}{B+G} \tag{1d'}$$

Note that the choice variable of the government is G and the government has the Cournovian expectation as it treats S as well as Y given. Hence, it is assumed that there is no conjectural variation. Based on the Cournot–Nash characterisation, we derive the optimal hoarding of the government as

$$w\frac{(A-S-G-T)}{(B+G)} + (1-w)\frac{(A+S+G-Y-T)}{(B-G)} = x^T \tag{3e}$$

7.3.5.3. Optimal Production Y by Farmer–Traders (Period 0)

Now we turn to the determination of optimal output Y at Period 0 that depends on the rational expectations prices P and p that are in turn driven by the hoarding decisions of farmer–traders and the government. To derive the optimal output Y in Period 0, we differentiate Π to get the following:

$$\frac{\delta \Pi}{\delta Y} = 0 \tag{4a}$$

From (4a) and (4b), we derive the optimal output as a function of S and G:

$$Y = \frac{A - T}{2} + S + \frac{G}{2} \tag{4b}$$

7.3.6. Deriving the Perfect Nash Equilibrium of the Sequential Game

The farmer–traders choose the optimal output Y at Period 0 and the optimal stock S at Period 1 in anticipation of the current and future prices of the food that in turn depend on the stockholding G of the government in Period 1. Given the current and future equilibrium price Eqs. (1e′) and (2d), Eqs. (3c) represents the reaction functions of the farmer–traders: their optimal hoarding decision in response to the government's decision to hoard and dishoard. Similarly, Eq. (3d) represents the reaction function of the government which provides the optimal hoarding and dishoarding decisions of the government in response to S given the price Eqs. (1e′) and (2d). Both Eqs. (3c) and (3d) are influenced by the production of food (Y) by farmer–traders. We derive the optimal output Y as a function of S and G, and this function is given by Eq. (4b). We assume that farmer–traders and the government know this function (4b), and an overall equilibrium requires that farmers produce output Y on their expectations of S and G and these expectations are self-confirming. In order to have their expectations fulfilled, we substitute (4b) function into (3c) and (3d) and look for the solution to the game.

By substituting (4b) into (3c), we derive the (implicit) reaction function of farmer–traders as a function of S and G:

$$\frac{G^2}{4B} + \frac{GS}{2B} - \frac{S}{2} + \left[\frac{A - T + B}{2B} - \frac{1}{4} - \frac{A - T}{4B} \right] a + \frac{A - T}{4} = 0 \tag{5a}$$

By substituting (4b) into (3e), we derive the reaction function of the government as a function of S and G:

$$2w(A - T)(B - G) - 2w(S + G)(B - G)$$
$$+ (1 - w)(B + G)(A - T) - (1 - w)(B + G)G - 2X^T(B^2 - G^2) = 0 \quad (5b)$$

The solution to the game is given by the values of S and G which simultaneously satisfy reaction functions (5a), (5b). These values of S and G, in turn, engender the equilibrium current and future prices and production decision that ex post confirm all expectations. Since these values of S and G are the mutual-best responses, the solution to the simultaneous equation system constitutes the perfect Nash equilibrium of the proposed sequential game. It is difficult to derive the equilibrium values explicitly; hence, in what follows we characterise the perfect Nash equilibrium qualitatively.

7.3.6.1. Characterising the Perfect Nash equilibrium
From the reaction function of farmer–traders, (5a), we derive the inverse of the slope of the reaction function as

$$r_F = \frac{B - G}{G + BH + S} > 0 \quad (5c)$$

since $H = ((A-T)/(4b)+1/4) > 0$ and $B < G$ from the second-order condition of maximising profits with respect to S. We draw the reaction function in the diagram with intercept in the S axis as $(A-T)/2$.

The slope of the reaction function of the government is given as

$$r_G = \frac{(4x^T + 2w + 2) - 2wS + (1 - w)(A - T - B) - 2w(A - T)}{2w(B + G)} \quad (5d)$$

Whether the reaction function slopes upward, or downward, depends on the value of S. For a critical value of S, S^*, $r_G > 0$ for $S < S^*$ and $r_G < 0$ for $S > S^*$. S^* is given by

$$S^* = \frac{(4x^T + 2w + 2) + (1 - w)(A - T - B) - 2w(A - T)}{2w} \quad (5e)$$

Thus, the reaction function of the government is backward bending at S^*. We depict the following equilibrium outcomes in the following diagrams. In Diagram 7.1, we show the possibility of multiple equilibria with their stability properties.
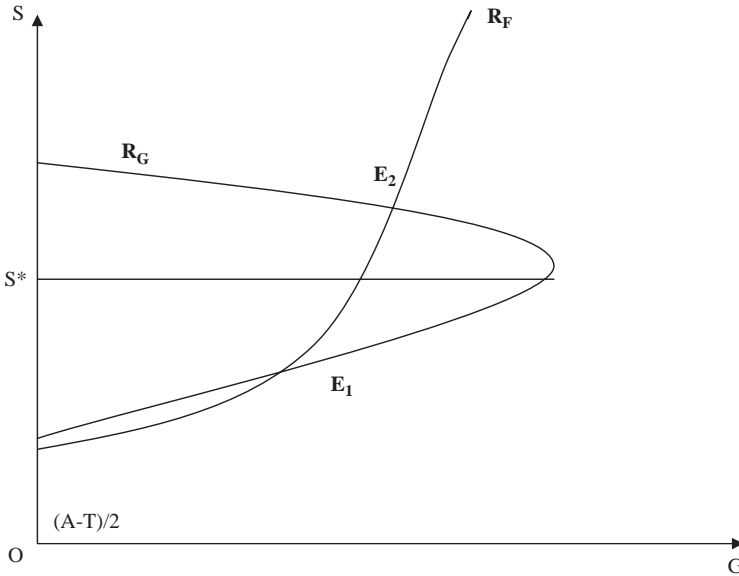
Diagram 7.1. Perfect Nash Equilibria in Food Market.
Note: R_F represents the reaction function of the trader–farmer while the reaction function of the government is depicted as R_G. The perfect Nash equilibria are E_1 and E_2. The stability of these equilibria depends on the absolute values of the slopes of R_F and R_G at E_1 and E_2. E_1 is patently unstable while E_2 is stable if the absolute value of $r_G > r_F$.

Diagram 7.2 entertains the possibility of a unique equilibrium with its stability properties.

Diagram 7.3 shows the possibility of an absence of pure-strategy equilibrium.

Diagram 7.4 shows the possibility of three equilibrium outcomes – two stable equilibria being separated by an unstable equilibrium.

Consider the multiple equilibrium case as described in Diagram 7.4: Which equilibrium gets established? From Krugman (1992), we know that there are two critical determinants of an equilibrium in such a scenario:

1. History determines whether it is established. If the initial values of S and G are contained within the catchment area of E_1, then the system steadily converges to E_1. Otherwise, the system converges to E_3. Thus, the initial values of S and G are critical in determining whether E_1 or E_3 is established. Thus, either there is a high-speculation equilibrium or a
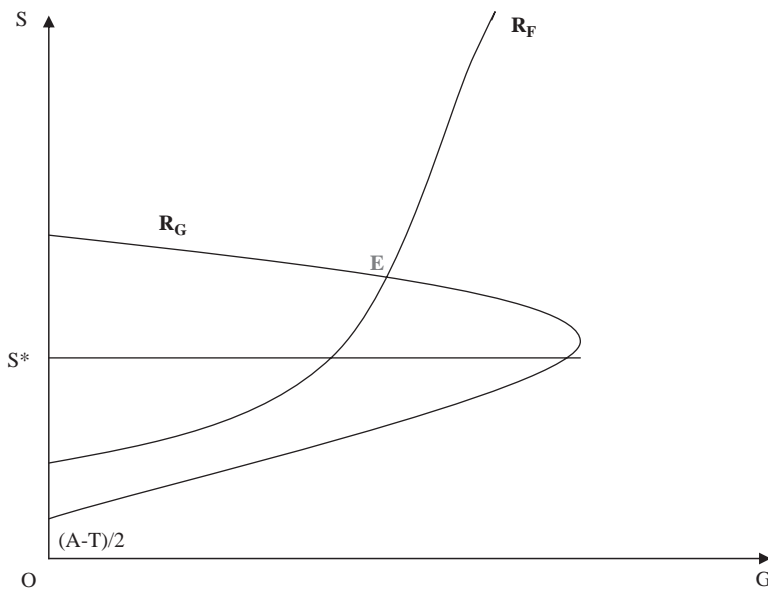
Diagram 7.2.   Unique Perfect Nash Equilibrium in Food Markets.
Note: R_F represents the reaction function of the trader–farmer while the reaction function of the government is depicted as R_G. The perfect Nash equilibrium is unique at E. The stability of the equilibrium depends on the absolute values of the slopes of R_F and R_G at E.

low-speculation equilibrium depending on the initial values of S and G. If the initial values are high and exceed the values given by E_2, then the government may fail to contain the equilibrium speculation at a low level.
2. Expectations play a crucial role in determining the equilibrium outcome. If all agents expect E_1 to be established, then E_1 is established. On the other hand, if all the agents expect E_3, then E_3 materialises. Hence, the government plays an instrumental role in stabilising speculation by influencing the expectations of the speculators. Thus, in achieving a low level of speculation, the government has a central role in such markets.

Suppose there is a sudden change in food availability, say, due to weather factor. Also suppose that this decline prompts the speculators to build stocks beyond the value of E_2, which will gradually take the system to E_3 that characterises a high level of speculation. Alternatively, if there is a bumper crop, the system may converge to E_1 which embodies low level of speculative activity.
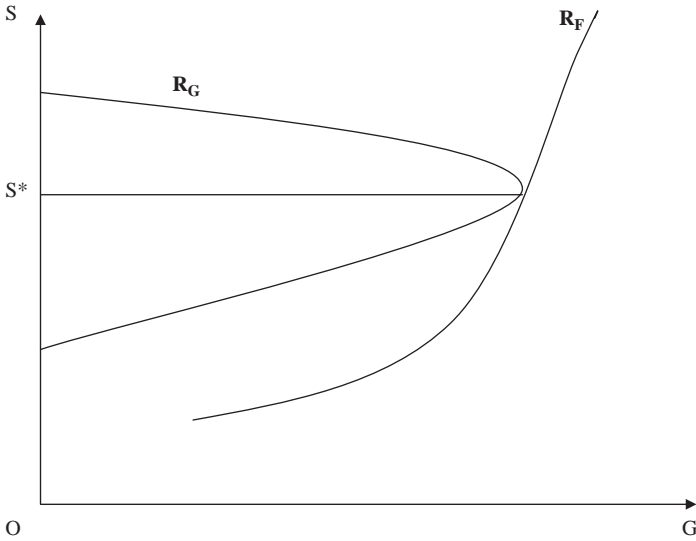
Diagram 7.3. No Pure-Strategy Equilibrium in Food Markets.
Note: R_F represents the reaction function of the trader–farmer while the reaction function of the government is depicted as R_G. There does not exist any pure-strategy equilibrium in the food market.

7.4. IS THERE AN IMPENDING GLOBAL FOOD CRISIS?

Food prices registered unprecedented increases during 2006–2008, some of which have more than doubled in two years. For the first time in several decades, violent riots spread from countries to countries. Violent protests erupted in Senegal and Mauritania late last year. Indian protesters set ablaze hundreds of food-ration stores in West Bengal in October 2007. Rioters wrecked havoc through three cities in the West African nation of Burkina Faso in 2008, burning government buildings and looting stores. In 2008 in Cameroon, a taxi drivers' strike over fuel prices escalated into a massive protest against food prices, leaving around 20 people dead. Similar riots took place in Mexico and Pakistan. Governments in several countries chose a host of policies to stamp out the looming food crises. 'This is a serious security issue', says Joachim von Braun, director general of the IFPRI, in Washington. In recent weeks, he has been bombarded by calls from officials around the world, all asking one question: How long will the crisis last?
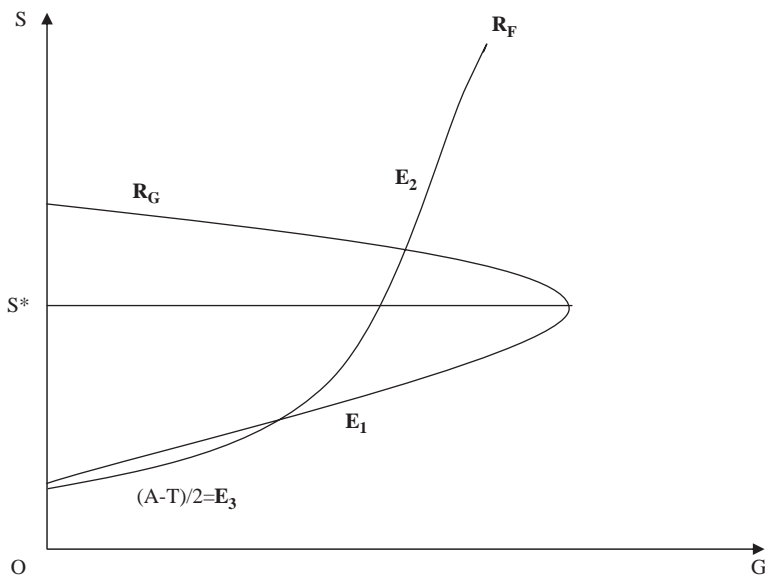
Diagram 7.4. Multiple Equilibria in Food Markets.
Note: R_F represents the reaction function of the trader–farmer while the reaction function of the government is depicted as R_G. The perfect Nash equilibria are E_1, E_2 and E_3. Two stable equilibria E_2 and E_3 are separated by an unstable equilibrium E_1.

The protests have been sporadic and governments quickly brought the situation under control by preventing violent riots, though the underlying sources of the problems are still at large.

It seems food prices will take a long time to stabilise: first and foremost, the unprecedented economic growth in the global economy created the purchasing power for billions of people who are to buy ever-greater quantities of food. This is especially the case for China and India due to decades of their economic boom. On the supply side, the spike in oil prices resulted in unprecedented hikes in fertiliser prices and spiralling cost of trucking food from farms to local markets and shipping it abroad. The decline in food availability has been caused by climate change. Harvests have been adversely affected by disruption in weather conditions and examples are a plenty:

- Prolonged droughts in Australia and southern Africa,
- Floods in West Africa,
- Winter's deep frost in China,
- Record-breaking warmth in northern Europe.

The situation has also been aggravated by the push to produce biofuels as an alternative to hydrocarbons, which is further restricting food supplies, especially in the United States. In the United States, generous subsidies for ethanol have lured thousands of farmers away from growing traditional crops for food. Some serious and disconcerting pictures have been emerging in this context:

- Global stockpiles of some basics have dwindled to their lowest point in decades.
- Rice that is consumed by billions of Asians witnessed its highest price in 20 years, while supplies are at their lowest level since the early 1980s.
- The global supply of wheat is lower than it has been in about 50 years.
- In late 2008, just five weeks' worth of world consumption is on hand, according to the UN Food and Agricultural Organization.
- In a single day in February 2008, global wheat prices jumped 25% after the government of Kazakhstan announced plans to restrict exports of its giant wheat crop for fear that its own citizens might go hungry.
- Governments of India and Egypt also placed embargos on food exports.
- For the world's poorest people, the price spikes are disastrous as millions who previously eked out enough to feed their families do not have the sufficient purchasing power to buy food any more. The conservative estimate puts 73 million people who are directly dependent on the UN's World Food Program (WFP). This is somewhat similar to Amartya Sen's perceptive observation on the entitlement failure (see Sen, 1983).
- Yet despite the widespread demonstrations, the food crisis has been largely ignored until recently by the United States and European officials, who pay for much of the world's food aid.
- The attitude of governments in the western nations could change if food riots begin to threaten the survival of governments in developing nations in 2009.
- In many poor countries, the protests have been fuelled by pent-up anger against authoritarian or corrupt officials as well, some of who have earned fortunes from oil and minerals and mining booms while locals are now struggling to buy food. Thus, increased inequality can play havoc in many poorer nations as the food availability declines.

7.4.1. Long-Term Strategy

- Several African countries have begun planting high-protein, pest-resistant rice crops, and aid organisations are beginning to hire locals for new job programs to help people pay their food bills.
- In the poorest parts of Asia and Africa, officials hope that sky-high food prices might lift out of poverty small farmers who have barely

scraped by on low crop prices – a hope that would get a big boost if the rich world agreed to cut agricultural subsidies in the current round of trade talks.

- In parts of Bangladesh, farm workers' wages have doubled in a year. But they too need to buy food and for most people, food prices have been rising faster than their earnings.
- In many nations like Pakistan, Burkina Faso and Senegal, supermarkets are stocked with unaffordable food, people might choose violence as the last option.
- A UN food agency asked for a review of biofuel subsidies and policies, noting that they had contributed significantly to rising food prices and the hunger in poorer countries.
- With policies and subsidies to encourage biofuel production in much of the developed world, farmers often find it more profitable to plants crops for fuel than for food, a shift that has helped lead to global food shortages.
- Current policies should be 'urgently reviewed in order to preserve the goal of world food security, protect poor farmers, promote broad-based rural development and ensure environmental sustainability'.
- The United Nations joined a number of environmental groups and prominent international specialists who have called for an end to, or at least an overhaul of, subsidies to biofuels.
- Biofuels are cleaner, plant-based fuels that can sometimes be substituted for oil and gas. In a highly critical assessment, the Organization for Economic Cooperation and Development (OECD) concluded that the government support of biofuel production in member countries was possibly mistaken and that it 'had a limited impact on reducing greenhouse gases and improving energy security'.
- However, the biofuel policy did have 'a significant impact on world crop prices' by triggering and fuelling food price inflation. The organisation includes European countries, the United States, Canada, Japan and Australia.
- In the past eight years, as oil prices and concerns about carbon emissions have increased, a number of countries, including the United States, and the European Union have created incentives and offered subsidies to energise the fledgling biofuel industry.
- As a result, the production of biofuels made from crops that could also be used for food increased more than three-fold from 2000 to 2007 as per the estimate of the Food and Agriculture Organization.
- Support to encourage biofuel production in OECD countries amounted to more than $10 billion in 2006, which is a whopping budget especially in the background of $200 million US aid committed by the Bush government to help the poor tide over the impending food shortages.

But a host of studies in the past year concluded that the rush to biofuels had some disastrous, if unintended, consequences for food security and the environment. Less food is available in the regional markets of poor countries, global grain prices have skyrocketed and invaluable forests disappeared off the face of the earth as farmers have created fields to jump the bandwagon of the biofuel boom. There is one more problem with the policy, as many specialists stress, since so much energy is required to convert many plants into fuel that the process does not result in a savings of carbon emissions. The OECD report said only two food-based fuels were clearly environmentally better than fossil fuels when considering the entire 'life cycle' of their production: used cooking oil and sugar cane from Brazil. Sugar cane is far easier to convert to biofuel than most other crops. Already this year, the European Union has stepped back from its target of having 10% of Europe's fuel for transportation that come from biofuel or other renewable sources by 2020. Last month, the European parliament suggested that only 5% come from renewable sources by 2015, and that 20% come from new alternatives 'that do not compete with food production'.

There are important spin-offs in the developing world as the biofuel boom continues. As examples, even as it receives a billion pounds of free food from international donors, Sudan is growing and selling vast quantities of its own crops to other countries, capitalising on high global food prices at a time when millions of people in its war-riddled region of Darfur barely have enough to eat. Somalia, Ethiopia, Niger and Zimbabwe are all recent examples of how war, natural disasters or gross mismanagement can cause significant decline in food availability that can push millions of people to the inevitable of starvation. In Sudan, there is a clear emphasis on food exports. The country is already farming wheat for Saudi Arabia, sorghum for camels in the United Arab Emirates and tomatoes for the Jordanian Army. The national government intends to invest $5 billion into new agribusiness projects, many of them to produce food for export and biofuels.

7.4.2. Discussion on Speculation and Food Markets

According to the World Bank report, global food prices have increased by 83% during 2005–2008. Rice, a staple food for nearly half of the world's population, has been a particular focus of concern in 2007–2008, with spiralling prices prompting several countries like India to impose bans on exports as they try to protect domestic consumers. While grocery prices in

the United States increased about 5–10% overall in 2007–2008, some essential items like eggs and milk have jumped far more.

A simple incident can provide a graphic picture about the situation, as President Rene Preval of Haiti questioned the genuineness of the food crisis. He argued if Haitians can afford cell phones, they should be able to feed their families. President Preval interpreted the storm of protest as some sort of minor political demonstration, which angered the common people who filled the boundary walls of the Presidential palace while the Presidential guard quickly withdrew and the UN peacekeepers were called in to keep the protesters at bay. As a consequence, heads started rolling: within days, opposition lawmakers had voted out the prime minister, Jacques-Édouard Alexis, forcing President Preval to reconstitute his government. In Haiti, three-quarters of the population have earnings less than $2 a day and one in five children is chronically malnourished. Amidst such poverty and destitution, there is one business that started booming: the selling of patties made of mud, oil and sugar, typically consumed only by the most destitute. This gives a clear indication of the state of affairs in Haiti.

A national government's ability to address the crisis is limited, however. Most national governments spend more on subsidies, including gasoline and bread, than on education and health combined. It is thus an insurmountable problem that prompted many governments to send riot police to starving and protesting masses.

In India, food prices increased manifolds during 2007 and 2008, which forced people to limit their food intakes. In Egypt, during the first half of 2008, food prices doubled. Thailand, which produces 10 million more tons of rice than it consumes, is the world's largest rice exporter; food rations and purchase limits on rice were introduced during 2007–2008. Governments in other nations, in difficult years with global financial crisis and the looming recession, will struggle to subsidise food production and consumption. In the pithy words of the President of El Salvador at the World Economic Forum on Latin America in Cancún, Mexico:

> How long can we withstand the situation? We have to feed our people, and commodities are becoming scarce. This scandalous storm might become a hurricane that could upset not only our economies but also the stability of our countries.

In South East Asia, severe political storm gathered momentum in 2008 over food price inflation: Prime Minister Abdullah Ahmad Badawi of Malaysia was forced to step down for failing to curb fuel and food price inflation. In Indonesia, fearing serious riots and protests, the government revised its 2008 budget, increasing the amount it will spend on food

subsidies by about $280 million. Politicians and governments are all alarmed by the alacrity of small but widespread protests against food price inflation in Indonesia, as in January 2008, public anger was vented against the government for letting soybean prices to rise in Indonesia.

A classic example is Senegal that has been one of Africa's oldest and most stable democracies:

- Police in riot gear beat and used tear gas against people protesting high food prices
- Protesters raided a television station that broadcast images of the event.
- Many Senegalese have expressed anger at President Abdoulaye Wade for expending government resources on roads and five-star hotels for an Islamic summit meeting in 2008 while many people are unable to afford rice or fish.

According to experts from World Food Program, the fear and the drive for survival have been responsible for the food crisis in the less developed world:

> The human instinct is to survive, and people are going to do no matter what to survive. And if you're hungry you get angry quicker.

Niger does present another interesting case from the filing cabinet of our common history: the first post-colonial president of Niger, Hamani Diori, was toppled amid allegations of rampant corruption in 1974 as millions starved during a drought. In 2005, mass protests in Niamey, the Nigerien capital, rocked the government to realise the suffering of people from the looming food crisis, which was caused by a complex mix of poor rains, locust infestation and market manipulation by traders. In response to the public outcry, the government chose an effective strategy of repealing tariffs on staple food items to balance demand and supply of food grains. The idea of turning farms into fuel plants seemed, for a time, like one of the answers to high global oil prices and supply worries. That strategy seemed to reach a high point last year when Congress mandated a five-fold increase in the use of biofuels.

7.4.3. Food versus Biofuel: Is it a Bugbear?

The biofuel policy of the United States and European governments seemed to have diverted food crops for fuel. In the fall of 2007, the grocery and

livestock industries in the United States vehemently opposed an energy bill, which was meant to increase costs of production of farmers.

How serious is the diversion of crops from the food sector to the fuel sector? It is a question that will take the centre stage in future years. Some important observations are in order:

- A fifth of the United States' corn crop is currently used to brew ethanol for motor fuel,
- In response to the public policy on biofuels, farmers have planted more corn by compromising the acreage of other crops, particularly soybeans.
- The decline in soybeans, in turn, has contributed to a global shortfall of cooking oil.
- A powerful scientific body of Europe, the European environment advisory panel, urged the European Union to suspend its goal of having 10% of transportation fuel made from biofuels by 2020.
- Europe's somewhat naïve but well-meaning push for biofuels, the scientists argued, had created more problems through a variety of harmful ripple effects like food price inflation and deforestation in various parts of our globe.

A strong reaction is building up against the energy policies in the United States and Europe that had promoted ethanol and similar fuels. Political leaders from poor countries put forward the argument that these fuels are driving up food prices and thereby pushing billions towards starvation and ultimate annihilation. Biofuels are fast becoming a new flashpoint in global diplomacy, which can proselytise the globe and cause serious conflicts and tensions. Western politicians are not convinced that biofuels are the only one factor in the seemingly inexorable rise in food prices. The issues are extremely muddy at the current state. In 2008, at a conference in Washington, representatives of poor countries that have been hit hard by rising food prices called for urgent action to deal with the price spikes. Several of them demanded a reconsideration of biofuel policies adopted recently in the West. It is hard to judge whether this is simply a political buck passing at this stage. Let us have a quick run through the main points:

- Many specialists in food policy consider policies on biofuels to be ill advised.
- The policy induces a diversion of crops like corn from food markets into fuel production has contributed to their higher prices.
- There are factors as well including droughts that have limited output.

- Rapid global economic growth that has created higher demand for food.
- As a result, the gap between demand for and supply of foods has widened in recent years.
- Global economic growth, much faster over the last five years than the previous historical record, has been lifting millions of people from the wombs of poverty and destitution who now have better access to food markets. At the same time, growth in agriculture has been sluggish. As a result, farmers are struggling to keep abreast with the surge in demand.

Thus, it is true that there is convergence on the view that the growth of biofuels has partly contributed to higher food prices, the importance of biofuel policy is still disputed as there are other significant factors. As examples, soaring energy costs and rising demand for meat in developing countries also put upward pressures on food prices. One important point is that biofuel production possibly accounts for a quarter to a third of the recent increase in global commodity prices. There is a fear propounded by FAO, under the UN auspices, that biofuel production, assuming the continuation of the current policy, would increase food costs by 10–15% in 2009–1010. The drought in Australia and the rising income levels and consumption in India and China are also important factors. Representative Jim McGovern, Democrat of Massachusetts, is usually quoted by media that the US Congress made a mistake in backing biofuels, as the Congress did not anticipate the full impact of biofuels on food markets.

> If there was a secret vote, there is a pretty large number of people who would like to reassess what we are doing. Senator McGovern is credited with this assertion.

Some experts tend to argue that the biofuel policy is one area where a reversal of government policy could help take pressure off food prices, which seems to be the only control, variable in the hands of governments in the Western democracies. However, there are deep-rooted problems as the development agencies like the World Bank and the IMF and scores of national governments actively pursued industrial development as the panacea for economic progress and thereby compromised the development of agriculture. As an example, in most developing nations, social unrest has been fomenting on prices of rice and wheat, neither of which is used as a biofuel. For both these crops, global demand has soared at the same time that droughts drastically reduced output from farms while the long-term productivity for these products registered significant decline.

7.4.4. Market Manipulation and Food Prices

Some observers maintain a possibility of market manipulation that is manifested in a bizarre picture of dual prices for grains. It is a common argument in economics that there should not be two prices for one thing at the same place and time, since arbitrage and speculation will cause convergence of dual or multiple prices. In reality, we see the emergence of multiple prices for corn, wheat and soybeans in the US markets, which are incidentally the three biggest crops in the United States. This observation has mystified the profession. For reasons beyond economic theory, the price for a bushel of grain set in the derivatives markets has been substantially higher than the simultaneous price in the cash market. As a result, no one knows which one is the correct price while the market signalling seems to fail to allocate resources.

Market regulators have ruled out deliberate market manipulation. But they, too, are baffled. The anomalies recur between the price of a bushel of grain in the cash market and the price of that same bushel of grain in the derivatives markets, as determined by the expiration price of a futures contract traded in Chicago. A futures contract is an agreement to deliver a specific amount of a commodity on a certain date in the future. Such contracts are important hedging tools for farmers, grain elevators, commodity processors and anyone with a stake in future grain prices. A futures contract that calls for delivery of wheat in December 2009 may trade for more or less for each bushel than today's cash market price. But as each day goes by, its price should converge closer to that day's cash price as profit-seekers take their positions in the market. On the final day, that is the expiration day of the contract, when the bushels of wheat covered by that futures contract are due for delivery, their price should be close to the price in the cash market, allowing for a little market friction or major delivery disruptions like major weather disruptions. But on numerous occasions since early 2006, the futures contracts for corn, wheat and soybeans have expired at a price that was much higher than that day's cash price for those grains.

7.4.4.1. Some Examples
- For example, soybean futures contracts expired in July 2007 at a price of $9.13 a bushel, which was 80 cents higher than the cash price that day.
- In August 2007, the futures expired at $8.62, or 68 cents above the cash price.

- In September 2007, the expiration price was $9.43, or 78 cents above the cash price.
- The corn market showed similar anomaly: futures contract expired September 2007 at $3.36, which was a remarkable 55 cents above the cash price.
- The contract that expired in March 2007 was roughly even with the cash price.
- Wheat futures had been especially prone to this phenomenon, going back several years.
- Wheat price distortions are a major concern as they render the fundamentals useless in determining prices.
- It is true that the anomalies might be a temporary result of 'a lot of shocks to the system', including sharp increases in worldwide food demand, uncertainty about supplies and surging commodity investments.
- The new arrivals in the commodities markets – hedge funds, pension funds and index funds – could be a serious problem.
- These investors and speculators distort futures prices by pouring in so much money without regard to market fundamentals.
- The market sends a sell signal, but relevant players do not sell. So the markets are not behaving the way they otherwise do. The pricing formula for the industry is not understood and less efficient. Market participants are failing to discover prices and also not capitalising on arbitrage opportunities.
- Some experienced commodity analysts think that the flaw may be in the design of the contracts, if futures were settled based on a cash index, it would eliminate these odd disparities. Finding an appropriate cash index can be a serious problem.

7.4.5. Speculation and Famines

- Decline in aggregate food availability is neither a necessary nor a sufficient condition for famines to wreck havocs in a society.
- Mortality never exceeds 3–5% of the total population that implies concentration of the problems in specific geographic regions due to distribution problems.
- Famines can be devastating if the rising food prices force people from purchasing the minimum bundle of food items.

Let us cast a quick look at the major famines of the human civilisation in Table 7.1, about 18 of them were caused by weather conditions and 21 by conflicts and government failures.

Table 7.1. Snapshots of Famines.

Year	Country	Mortality	Trigger Factors
1903–1906	Nigeria	5,000	Drought
1906–1907	Tanzania	37,000	Conflict
1916–1917	Tanzania	30,000	Conflict and drought
1920	China	500,000	Drought
1921–1922	Soviet Union	9,000,000	Conflict and drought
1927	China	6,000,000	Natural disasters
1929	China (Hunan)	2,000,000	Conflict and drought
1932–1934	Ukraine	8,000,000	Government policy
1943	China (Henan)	5,000,000	Conflict
1943	India (Bengal)	3,000,000	Conflict
1943–1944	Rwanda	300,000	Conflict and drought
1946–1947	Soviet Union	200,000,00	Government policy
1958–1962	China	33,000,000	Government policy
1968–1970	Nigeria (Biafra)	1,000,000	Conflict
1972–1975	Ethiopia	500,000	Drought
1974	Bangladesh	1,500,000	Flood and market
1979	Cambodia	2,000,000	Conflict
1983–1985	Ethiopia	1,000,000	Conflict and drought
1983–1988	Sudan	500,000	Conflict and drought
1991–1993	Somalia	300,000	Conflict and drought
1995–1999	North Korea	3,500,000	Flood and government

Source: FAO.

Table 7.2. Distribution of Famine Mortality from 1900 to 1999.

East Asia	Europe	South East Asia	South Asia	Africa	Total
43 m	18 m	4.9 m	4.2 m	4.2 m	75 m

Source: FAO.

The geographic distribution of famines-related mortality is given in Table 7.2.

7.5. FOOD CROPS VERSUS BIOFUELS: A SIMPLE MODEL

In recent times, both developed and developing worlds have been hit hard by spiralling food prices, which led to violent food riots, starvation and deep

crises in poorer regions in many developing nations like Haiti, Indonesia, Ethiopia and the Philippines and the list goes on. Global food prices have risen significantly during the last three years, which the world has not witnessed in the last 30 years: during 2008, the average food price has risen by 56% while the rice price rose by 96% and the wheat price by 92% that can easily lead to a severe food crisis and famines in various parts of our world. Very little attention has been given to the modelling of food crises in recent years, though there is an early and compelling literature on famines and food crises (Sen, 1983). Sen (1983) established how starvation and famines can take place due to a failure of exchange entitlement for which an overall decline in per capita food availability is not a necessary condition. On the contrary, our model intends to explain how food supply can alarmingly decline due to conscious choices of farmers and not due to any vagaries of nature or markets. In what follows we develop a simple model that can explain why in some regions of a developing country, food shortages and crises can persist as an equilibrium phenomenon. In the section, we provide the basic model.

7.5.1. Choice between Biofuel and Food crops

The model is based on three simple intuitions: first and foremost, due to the ongoing Iraq crisis, climate change threats and actual and anticipated oil price hikes, there is a global search for an alternative to fossil fuels that has resulted in a significant switch to the production of biofuels at the expense of food crops: as an example, this has caused over 20% of corn and rapeseed production in developed countries to be diverted away from food. Secondly, many food exporting nations like Argentina and India have placed restrictions on food exports to avoid severe food crises at local levels, which can give further incentives to local farmers to switch to the production and exports of biofuels in developing nations. Thirdly, in many developing nations, farmers sell their food crops to governments at a support/procurement price that is excessively high – or even higher than the market price, which acts as a subsidy to food producers. As a result, farmer's lobbies (or rich farmers) use agricultural exports as a bargaining chip in securing and seeking subsidised agricultural infrastructure, rural local goods and irrigation water. In the wake of the crisis, as many national governments from the developing world impose bans on food exports, there is an incentive for farmers to switch to the production of biofuel in order to enhance their bargaining power in rent-seeking activities. Therefore, farmers

from these developing nations can use exports of biofuels as a rent-seeking instrument. A significant switch to biofuels can therefore give rise to serious regional food shortage. We provide a baseline model in what follows.

7.5.2. A Baseline Model of Rent-Seeking and Biofuels

Suppose there are a finite number of farmers in a regional economy. Each farmer has a finite vector/package of inputs/resources that the farmer chooses to divide between the production of biofuels and food crops. Note that the vector has several inputs ranging from land, labour, seeds, fertiliser, pesticide and water, and we hold their relative prices unchanged so that we can treat this package of inputs as a composite commodity. For farmer i ($i \nabla$ 1 to n), the production of food (K_i) is given by the following production function of the composite input H_i:

$$K_i = MH_i^{\alpha} \tag{6a}$$

We assume that the production of biofuels needs both the composite input (h_i) and the food crop (K_i). For simplification, we assume that the biofuel output Q_i is characterised by the Cobb–Douglas production function as the following:

$$Q_i = NK_i^{1-\beta}h_i^{\beta} \tag{6b}$$

Note that the resource constraint implies

$$H_i + h_i = \text{constant} \tag{6c}$$

Expressing (6a) and (6b) in logarithm will give us

$$k_i = m + \alpha \log h_i \tag{7a}$$

where $k = \log K$, $m = \log M$.

$$q_i = n + \beta \log h_i + (1 - \beta)m\alpha \log H_i \tag{7b}$$

where $q = \log Q$, $n = \log N$.

Postulate 1. Our model is best understood in terms of two dates t and $t+1$. At date t, there is a dividend, or return, to a farmer i from committing the production and export of biofuel Q_i. We assume that there is no additional price gain from switching from food crops to biofuels. We call this dividend at date t as X_i for farmer i.

The dividend is an additional return to farmer i from the distribution of public resources to the local irrigation system, rural infrastructure like transportation and storage facilities. We assume that the distribution of local public resources is determined in a contest between farmers and the dividend is a return from this contest.

Postulate 2. At date $t+1$, the production activities bear fruits, and outputs are given by Eqs. (6a) and (6b). The discount rate for each farmer is a common interest rate. In order to keep the model tractable, the return from biofuels is not explicitly separated from the dividend X_i. The return to farmer i is R_i:

$$R_i = X_i + \left(\frac{\log K_i}{1 + r}\right) \tag{7c}$$

where X_i is the dividend at date t from biofuels, K_i the output of food crop, r the interest rate which is used as the discount rate.

Postulate 3. The dividend from biofuel is defined as the following:

$$X_i = B_1 + P_i B \tag{7d}$$

The dividend has two components, 'B_1' and 'B', where 'B_1'is a fixed return from selling biofuels in the global market and we assume $B_1 = 0$, which does not affect our results; B the pecuniary benefit from the contest in the distribution of local public goods. We call P_i as the probability of securing this pecuniary benefit B, or a contest success function. We express the dividend function of farmer i from producing biofuels as

$$X_i = P_i B \tag{8a$'$}$$

Postulate 4. The contest success function is given by P_i. We assume that rival farmers have a common opinion, q^A, about the biofuel output q_i that is necessary to secure the rent. It is important to note, for our model, that q^A is some sort of an average output that rivals assume necessary to be successful in a contest. We express P_i as the following:

$$P_i = q_i + q_i(q_i - q^A) \tag{8a$''$}$$

Eq. (8a$''$) incorporates the rat race model: the probability of success in a contest depends on a rival's own biofuel output q_i and also on

the relative output $(q_i - q^A)$ against the average output in the relevant region.

7.5.3. Interdependency in Allocation of Efforts and the Cournot–Nash Characterisation

Farmer i expends input h_i to obtain the biofuel output q_i. What is important is that the optimal use of h_i depends on the average opinion q^A. Thus, there is interdependency in the allocation of efforts between farmers: if farmer j increases his h_j, then q^A goes up that will, in turn, increase the optimal effort of farmer i, h_i. Hence, as in the rat race, each farmer i is driven by the knowledge that for lower q_i, one must share a lower probability, P_i, of receiving a dividend with less able rivals. Similarly, one is aware that for higher q_i, one will enjoy a higher probability that one will share with rivals of higher ability. Why does not farmer raise the q_i to the maximum feasible level? In our model, the formation of biofuel output is costly because it reduces the input to produce the food crop output.

Different farmers have different costs, and the optimal biofuel outputs arise from these costs. If all farmers behave in this fashion then the equilibrium production of biofuel depends on the expectations of each farmer about the efforts of other farmers. We summarise these expectations as q^A that, which may be argued, is kind of an average opinion. In the Cournot–Nash characterisation, we assume that each farmer assumes that as one changes one's input and inputs of others, and hence q^A will remain unchanged. This is a well-known assumption of Cournot models. Note that the reaction function of farmer i in allocating one's input h_i, given the efforts of h_j by the other rivals. Based on the reaction functions, we shall derive the Cournot–Nash equilibrium in the allocation of the input package. The Cournot–Nash equilibrium is such that once reached, no farmer has any incentive to unilaterally deviate from the equilibrium allocation of efforts.

7.5.4. The Cournot–Nash Equilibrium, Fragility and Herd-Like Behaviour: Duopoly Case

In what follows we consider a simple duopoly, or two farmers. Our results will hold for finitely many farmers. In order to derive the Cournot–Nash

equilibrium allocation, we follow two steps. In Step 1, we derive the reaction functions of the two farmers. In Step 2, we derive the optimum allocation of inputs of these farmers from the equilibrium. To simplify further, we express their beliefs about the average opinion in the following postulate:

Postulate 5. We define $E_i(q^A)$ as the subjective estimate/belief of farmer i about the average opinion q^A. We express this as

$$E_i(q^A) = 2\Psi_i q_j + \eta q_i \qquad (9a)$$

We set $\eta = 0$ to simplify calculations.

However, there is a twist here: the main intuition is that farmer i expects/believes that farmer j has a stronger influence on the average opinion. We establish the result with the assumption that farmer i thinks s/he has no influence on the average opinion. Thus,

$$E_i(q^A) = 2\Psi_i q_j \qquad (9b)$$

Step 1. Farmer i's optimal choice involves the following:

$$\underset{\{qi\}}{\text{Maximise }} R_i = P_i B + \left(\frac{\log K_i}{(1+r)}\right)$$

Subject to

$$k_i = m + \alpha \log h_i \qquad (7a)$$

$$q_i = n + \beta \log h_i + (1-\beta)m\alpha \log H_i \qquad (7b)$$

$$P_i = q_i + q_i(q_i - q^A) \qquad (5a')$$

$$E_i(q^A) = 2\Psi_i q_j \qquad (9b)$$

$$\log H_i + \log h_i = \log \text{ constant} = 0 \qquad (9b')$$

The reaction function of farmer i is

$$q_i = \Psi_i q_j + V \qquad (9c)$$

where

$$V = \frac{\alpha}{2(1+r)B(\beta - \alpha)(1-\beta)} \qquad (9c')$$

Step 2. The Cournot–Nash equilibrium is given by the consistency condition and, hence, the solution to the simultaneous equation system (9c). This will give us the equilibrium output of biofuel of farmer i q_i^e:

$$q_1^e = \frac{V(1 + \Psi_2)}{1 - \Psi_1 \Psi_2} \tag{9d}$$

$$q_2^e = \frac{V(1 + \Psi_1)}{1 - \Psi_1 \Psi_2} \tag{9e}$$

In Diagram 7.5, T_1 and T_2 are, respectively, the reaction functions of farmer 1 and farmer 2, and NE represents the Nash equilibrium where T_1 and T_2 intersect. The existence of equilibrium is guaranteed if $[1 - \Psi_1 \Psi_2] > 0$, Then the Nash equilibrium will be as follows

$$\text{Log } H_1^e = \frac{[q_i^e - n - (1 - \beta)k_1]}{b} \tag{10a}$$

$$\text{Log } h_1^e = \frac{[-q_i^e + n + (1 - \beta)k_1]}{\beta} \tag{10b}$$

One can detect herd-like behaviour in this context by looking at the comparative-static properties of the Nash equilibrium:

$$\frac{\partial q_i^e}{\partial \Psi_i} = \frac{V(1 + \Psi_j)}{(1 - \Psi_i \Psi_j)^2} > 0 \tag{10c}$$
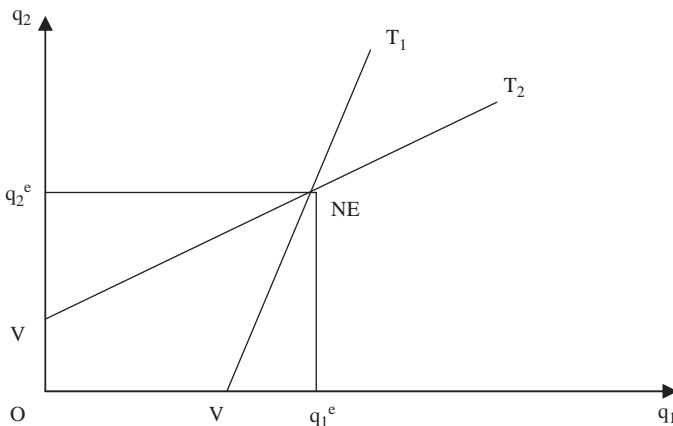
Diagram 7.5. The Cournot–Nash Equilibrium Biofuel Output with Two Rival Farmers.

$$\frac{\partial q_i^e}{\partial \Psi_j} = \frac{V(1 + \Psi_j)\Psi_i + (1 - \Psi_i\Psi_j)V}{(1 - \Psi_i\Psi_j)^2} > 0 \qquad (10d)$$

$$\frac{\partial H_i^e}{\partial \Psi_i} = \frac{V(1 + \Psi_j)}{\beta(1 - \Psi_i\Psi_j)^2} > 0 \qquad (10e)$$

$$\frac{\partial H_i^e}{\partial \Psi_j} = \frac{V(1 + \Psi_j)\Psi_i + (1 - \Psi_i\Psi_j)V}{\beta(1 - \Psi_i\Psi_j)^2} > 0 \qquad (10f)$$

$$\frac{\partial h_i^e}{\partial \Psi_i} = -\frac{V(1 + \Psi_j)}{\beta(1 - \Psi_i\Psi_j)^2} < 0 \qquad (10g)$$

$$\frac{\partial h_i^e}{\partial \Psi_j} = -\frac{V(1 + \Psi_j)\Psi_i + (1 - \Psi_i\Psi_j)V}{\beta(1 - \Psi_i\Psi_j)^2} < 0 \qquad (10h)$$

First and foremost, we can see from the reaction functions that q_1 and q_2 are strategic complements. Hence, the decision by one farmer to increase (reduce) their inputs to produce biofuel output will prompt the other to increase (decrease) their inputs in the production of biofuels. The reason is that an initial shift in inputs for biofuels by one farmer can expose the other farmer as under/over investing for producing biofuels. This induces the other farmers to respond by moving in the same direction.

Secondly, decisions concerning producing biofuels are significantly influenced by herd instincts: subjective variations in beliefs of a group (changes in Ψ_1 or Ψ_2) can induce all to change their allocation of their inputs to biofuels. One may say that these changes are not triggered by changes in the objective world as these changes take place in the subjective realm of a farmer. The other farmer though has unchanged subjective beliefs, yet they decide to go with the flow (herding) in their allocation of efforts to conflicts (see Palley, 1995 for details). This dependence of the Cournot–Nash equilibrium on the subjective elements makes this equilibrium highly fragile. Simple fluctuations in subjective elements can have far-reaching impacts on the optimal efforts in producing biofuels. It is recognised that in games involving complementarities, consequences of idiosyncratic shocks get amplified through what is called a *multiplier effect* (see Vives, 1985, 2005).

7.6. CONCLUDING COMMENTS

We examine the strategic aspects of 'shortages' created by speculative stockholdings of food items in developing nations. Speculators can affect the future food prices by withholding supply of current period. As a result, speculators increase current profit by reducing current supply and, thereby, increase current price. Against this gain, the speculators make a loss by reducing the future price by increasing the stock that embodies future supply. Thus, there exists an optimal stock that achieves the optimal relative price (future price and current price ratio) that maximises the intertemporal profits of the speculators. Thus, if the market is unhindered, the speculators may significantly warp market prices to augment their profits by extracting larger consumer surplus. In protecting mainly the poor consumers from such intertemporal price discrimination, the governments in developing nations take active role in such markets. The governments attempt to engender a '*just price*' by manipulating market supplies through hoarding and dishording of stocks of food and imports of food. Thus, such a market is characterised by *circular interdependence* between the speculators and the government. The precise contribution of this chapter is to develop a game to endogenously determine the optimum level of speculative stock holdings as the equilibrium outcome of strategic interactions between speculators and a government.

We model the equilibrium outcome of the food market in which the farmer–traders strategically hold stocks to distort market prices in their favour, while the government manipulates its own stocks and imports to keep the food price close to the 'desired level'. The equilibrium is characterised as a perfect Nash equilibrium of the proposed sequential game.

This chapter establishes that such a market will be characterised by one of the four possibilities: in Case 1, there exist two equilibria – low-speculation and high-speculation equilibria. The low-speculation equilibrium is unstable while the high-speculation equilibrium is stable. Thus, the government can only goad the market to the high-speculation equilibrium. Also note that there is nothing sacrosanct about the stability of the high-speculation equilibrium, since it depends on the relative steepness of the slopes of the reaction functions. This case is described in Diagram 7.1. In Case 2, the possibility of a unique and stable equilibrium is the best that the government can aspire to achieve. Case 3 highlights the possibility and consequent instability of the non-existence of a pure-strategy equilibrium. Case 4 highlights the possibility of three equilibria – two stable equilibria separated by an unstable one. In this case, any momentary deviation of speculation

beyond the critical level will have a lasting impact on the food prices, levels of speculation and on the economy. Government mismanagement will also have similar deleterious long-run impact on the market and the economy. This chapter also establishes that the selection of equilibrium in such markets is hinged either on the expectations or the history. The government plays a crucial role in stabilising volatile expectations and burst of speculative activities through its hoarding and dishoarding of food.

CHAPTER 8

COSTLY PEACE: A STUDY OF THE DYNAMICS OF NEGOTIATIONS FOR PEACE AND DISARMAMENT

8.1. GOVERNANCE AND ENFORCEMENT OF PEACE AS A CONTRACT

The main thesis of the chapter is to introduce a new idea to the field of peace negotiations, which will require the development of a new model of negotiations to enforce peace. The existing models of peace negotiations highlight the existence of a positive peace dividend to parties involved in conflicts and peace negotiation. They, hence, usually highlight a gradual and dynamic adjustment, or movement, away from a conflict-ridden outcome towards a peaceful outcome that offers a positive peace dividend to all relevant stakeholders. In comparison with the status quo, peace brings additional economic returns and peace therefore offers a win–win situation. Despite the fact that a win–win situation does not ensure the enforcement of peace, as agents can easily get locked into what is commonly known as the prisoners' dilemma – yet the possibility of Pareto improvement makes negotiations for peace somewhat artificial. At least in the short run all agents involved in active conflicts are apprehensive of peace as they expect immediate (expected) returns from making peace can outweigh the expected returns from conflicts. An important work that sidesteps the win–win situation of peace dividends is by Isard and Azis (1999) who introduced the possibility of an immediate loss of economic returns from the peace process in their conflict management procedure (CMP). However, in the existing work on CMP, the long-run returns from peace outweigh that from conflicts. One therefore presumes that peace brings economic benefits to all. The existing CMPs therefore assume away any possibility of lower economic returns from peace. There are some important models in which peace negotiations are also modelled as a zero-sum game in which the gain of a

party represents a loss to others, which is known as win–lose negotiations. In this work we introduce the possibility of bargaining and negotiations against the backdrop of potential immediate losses while peace is favoured simply for its intrinsic value and not for pecuniary returns. In the real world, there is evidence to believe that agents involved in conflicts are painfully aware of two things: first, the decision-making agents who choose between conflicts vis-à-vis peace are the leaders who get rarely affected by economic returns from conflicts or peace. It is usually the foot soldiers who bear the brunt of costly conflicts and can benefit from peace. Secondly, most people value peace for the sake of it as peace has an intrinsic value that ensures the protection of rights and their lives and protection from violence. Thus, peace is a collective good that provides little extra economic returns to actual decision-makers who choose between courses of conflicts or peace.

In this work, we offer a comprehensive treatment of peace as a collective good and thereby explain the negotiation process in which peace does not offer a win–win situation. Our work will lay down the principles and the precise path that can ensure peace among conflicting agents when peace is valued for its own sake and not for extra pecuniary returns for decision-makers. We hence call peace 'costly' peace in this chapter. The relevant question for us is how we can ensure the establishment of costly peace to protect property rights and lives of humans by a clever choice of suitable economic governance. Let us have a cursory look at the emerging strand of thoughts on economic governance.

Williamson (2005) explains economic governance as the 'study of good order and workable arrangements'. Good governances hence presupposes the existence and the efficacy of the institutions and organisations that support economic transactions by protecting property rights, enforcing contracts and organising collective actions. Economic governance therefore lays down the foundation of rules, artefacts of regulations and channels of information that are a pre-condition for carrying out interactions among economic agents, economic and social groups and corporate (Dixit, 2004). It is important to note that these institutions are neither static nor ubiquitous. Our societies have innovated institutions to perform the functions to create a level-playing field within which economic transactions take place. These institutions die and take new forms over time as the necessity arises. The new field of economic governance examines different institutions by developing appropriate theoretical and empirical models. Economic governance therefore studies the 'processes that support economic activity and economic transactions by protecting property rights, enforcing contracts, and taking collective action to provide appropriate physical and

organizational infrastructure' (Dixit, 2004). Economic governance thus embodies processes that are carried out within formal and informal institutions. The field of economic governance studies and compares the performance of different institutions under different conditions. The field pays a riveting attention to the evolution of these institutions, and the transitions from one set of institutions to another.

It is important to underline the purpose of these institutions. First and foremost, the most important role of an effective institution is to enforce property rights of economic agents against theft by other individuals and expropriation by the state, which will lead to enforcement of voluntary contracts among individuals. It is important to note that the right to safety and protection against violence constitutes the basic rights of a citizen in a civil society. It is the role of economic and political governance to enforce the right. Secondly, the role of an institution is to build an appropriate regulatory framework to protect the vulnerable from the powerful. Finally, it is also important to note that good governance must keep social and economic cleavages and chasms within reasonable bounds so that costly conflicts can be avoided, as articulated in Chapter 2 in the context of ethnic cleavages in a society. It is of considerable importance to note that the nature of institutions takes three possible forms: first, the state institutions are of significance as they provide the legal and regulatory infrastructure. Secondly, there are private organisations that aid the transmission of relevant information without which economic rights of citizens cannot be protected. Finally, there are social norms that enforce desirable individual and group behaviour.

8.1.1. Basic Tenets before Negotiations for Peace: Quality of Governance and Formal Institutions

That the quality of institutions of governance significantly impinges on economic outcomes is widely recognised (Persson, 2005). The lack of adequate mechanisms to protect property rights and stave of predatory behaviour can only give rise to a negative externality that, in turn, lowers investment and thereby lowers economic growth. But economists are uncertain of several related issues: first, economists have expressed serious disputes about the precise measures of quality of institutions. It is virtually impossible to pin down a set of institutional features that are universally acclaimed as an integral part of good governance. Secondly, controversies still persist on defining and isolating the precise mechanisms that allow

formal institutions to determine economic outcomes. In some sense, the second drawback is a product of the first drawback as we simply do not know the desirable properties of various institutions.

At the core of the problem lies a simple dichotomy between democracy and authoritarianism. Let us take an example from the well-debated issue concerning democracy and economic growth. Democracy has many normative virtues but its worth in economic governance and economic growth is less clear. Barro's work (1999, p. 61) highlighted an inverse U-shaped relationship between economic growth and a continuous measure of democracy. Barro stated 'more democracy raises growth when political freedoms are weak, but depresses growth when a moderate amount of freedom is already established'. The economic data did not corroborate Barro's findings as the fit was relatively poor. Persson (2005), using cross-sectional and panel data, shows that the distinction between democratic and non-democratic forms of government is not enough. As highlighted before, the precise form of democracy matters for policy design and economic outcomes. The economic success of political institutions is somewhat buried in the details pertaining to structural aspects of political rules and organisational organisations (see Keefer, 2004). Democracy is important for governance of peace and protection of people from conflicts because democracy relies on rules and procedures and provides citizens with protection against violence. The elite representing decision-makers, which might otherwise prefer to rule unconstrained, may find it in its own interest to make a credible commitment not to violate citizens by creating and fostering democracy as highlighted by Acemoglu (2003) and Acemoglu and Robinson (2005). Following the work of World Bank researchers one can rely on six basic rules that are necessary for mitigating conflicts by improving economic governance:

- Voice and accountability ensuring enforcement of political, civil and human rights;
- Reducing political instability and violence measuring the likelihood of violent threats to, or changes in, government, including terrorism;
- Enhancing government effectiveness by enhancing the competence of the bureaucracy and the quality of public service delivery;
- Reducing regulatory burden by reducing the incidence of market-unfriendly policies;
- Enforcing rule of law that enhances the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence;

- Control of corruption that reduces the exercise of public power for private gain, including both petty and grand corruption and state capture.

8.1.2. Private Institutions and Negotiations for Peace

It is usual to assume that nation states and their constituents in the vertical governmental structure offer the policing functions for safety of citizens from violence and property right protection. These services are increasingly supplemented by private security systems that serve specific clients and purposes.

- Firms and rich people employ or hire security personnel.
- Gated communities and exclusive neighbourhoods have private patrols.

It is usually assumed that these private measures supplement the functions of the police for their specific context and work cooperatively with the law enforcement, but these two may clash if the private security system goes beyond its permissible functions. In the current context, it is very difficult to define the boundaries of public and private institutions. What is more important is the problem of enforcement of public and private rules due to economic opportunism and potential for corruption, which can unleash a serious conflict of interests.

If the state is unwilling, or unable, to protect its citizens, defend certain kinds of property or enforce certain kinds of contracts or is itself predatory, then private institutions can emerge to perform these functions for a profit. Organised crime is an example that private agents do in fields left by the state. As examples, Gambetta (1993) and Bandiera (2003) argued that the Mafia emerged in Sicily to fill the vacuum of protection in the late 19th century. The landed aristocracy hired guards of former feudal lords and bandits to protect their properties. Gambetta explained how the Mafia's role gradually developed to enforce private contracts in illegal activities and in grey markets. From the Asian experience we also know, the Japanese Yakuza was instrumental in organising markets at the end of the Second World War in Japan. In a similar vein, history tells us how Mafias gained a labyrinth of business and corporate and social controls in Russia after the collapse of the Soviet regime. Chapter 1 of the book provides a detailed account of this set of issues under the notion of clientilisation.

Any institution of contract enforcement must solve four key problems:

- devise contractually stipulated behaviour of agents,
- detect opportunistic deviations from the contractually stipulated behaviour,

- store and transmit information about the histories of the participants' behaviour,
- devise and enforce appropriate punishments to deviants.

Formal state institutions of governance resolve these problems by its legal mandate; the legal system of a nation force agents to commit to good behaviour by subjecting them to detection and punishment if they deviate. A third-party supplier of information or enforcement serves similar functions.

An alternative to the formal state institution is the institution of social networks and norms, which can ideally solve the problems of information and punishment in a decentralised manner. Each participant can transmit information about his or her current exchange partner's behaviour to others in the group to whom he or she is linked. And each can play his or her assigned part in punishment, typically by refusing to take part in an exchange, if he or she gets matched with a potential partner who is known to have bad history in past dealings with others in the group.

Incentives to convey information or refuse potentially beneficial trades can be established by a *norm* that regards refusal to do so as itself a punishable offence, as in Abreu's (1986) penal codes for repeated games. External incentives and coercion will be unnecessary if people have moral sentiments towards cheating. Greif's (1993) historical analysis of Maghribi traders' system of communication and collective punishment is valuable in this context. Ostrom's (1990) synthesis of the evidence on common pool resource management provides another important example. Ostrom emphasised the importance of local knowledge and communication, of appropriately designed punishment strategies and of incentives for individuals to perform their assigned roles and actions in the system. Fafchamps (2004) examined many different market institutions in Africa; his work stressed the importance of designing systems appropriate to the conditions of each country or group.

What determines the effectiveness of norms and customs? In an important work Li (2003) established a difference between the costs of operating a norm-driven system and those of formal governance. A relation-based system of networks and norms has low fixed costs to set it up. It however has high and rising marginal costs. Exchange on a small scale starts among the most closely connected people who have a strong information-sharing mechanism and group loyalty to sustain honesty. No fixed costs are there to establish any formal rules or mechanisms of enforcement in small groups of well-connected people. But as trade expands, potential partners added at the

margin are less well connected, making it harder to apply the same information-sharing mechanism to ensure their participation in any punishments. On the other hand, formal or rule-based governance has high fixed costs of setting up the legal system and the information mechanism, but once these are incurred, marginal costs of dealing with strangers are low. Therefore, norm-based governance is better for small groups and rule-based governance better for large groups. Greif's (1994) comparison between the relation-based system of Maghribi traders and the formal institutions of Genoese traders supports this theory.

8.1.3. Introduction to Principles of Negotiations: Modelling Costly Peace Process

The point of departure of this chapter is to explain civil conflicts and how negotiations can take a conflict-ridden system to a peaceful state. Civil conflict is usually defined as a breach of a social contract between local groups within a standard set-up in which more than two parties seek to maximise their expected returns/utilities from states of war and peace. Thus, there are two strategies available to each party – either to live and die by the gun or to throw away the arms and come to a negotiation table for a mutually agreeable resolution. Either strategy (war and peace) has costs for each player, whose strategy is also motivated by greed and grievances. Let us take stock of some concrete examples from the run of history.

Before the 1973 Arab–Israeli war, peace negotiations between the Arabs and the Israelis were minimal and negligible. After this crucial war, things have started changing since both parties seemingly showed interests to resolve various issues and thereby reach a signed peace.[1] Egypt was the first to sign a peace agreement with Israel on 26 March 1979 and followed by Jordan on 26 October 1994. For the Palestinians, there appeared numerous peace plans to settle the Israeli–Palestinian conflict. Most of the plans discuss and focus upon major issues such as Jerusalem, the right of return for Palestinian refugees, the borders and the Israeli settlements. Most of these plans were rarely successful. Yet these are the initial steps to move away from violence and conflicts towards a pathway to peace.

On 11 March 2004, India's cricketers made a historic 40-day tour of Pakistan for the first time in 14 years. About 8,000 Indian fans travelled to Pakistan to watch the event. These Indian fans were warmly received by the common people of Pakistan and a rare sight of brotherhood replaced the

usual hostility between Indians and Pakistanis. This step is considered by many as a significant step towards strengthening the fragile peace between these two countries. On 7 April 2005, two busses crossed the border between these two nations; a day on which a small – but 'mutual improvement in joint action' – step was taken. The main purpose of this type of joint action is to break the ice between parties in conflict and jumpstart the peace process that can take an irreversible course.

Another important example of a conflict where the strategy of peace process has been immensely successful is in the context of centuries of violent conflict between Germany and France. After the Second World War, all efforts have failed to achieve a united Europe to minimise, or lessen, the likelihood of a Third World War. A person, famously known as Jean Monnet, looked for some joint policy between France and Germany to promote their coal and steel industries. After an initial success of this policy other European nations joined the group such as Belgium, Italy, Luxembourg that led to the establishment of the High Authority of the European Coal and Steel Community. This first step of joint action was followed by a series of other steps leading to the formation of the European Union in 1993, which virtually ended a long-lasting conflict between France (and its allies) and Germany (and its allies).

8.1.4. Theoretical Foundation of Step-Wise Dynamics of Peace Processes

A peace process embodies a series of joint activities, or actions, taken by agents embroiled in conflicts. The purpose of joint actions aims at achieving stability. In this context we know two concepts of stability and let us briefly dwell on them. The global stability is a long-run position that is reached when all issues between conflicting parties are resolved peacefully and the probability of conflicts/war between them is so minor that it does not enter in the economic calculus of the relevant decision-makers. See Fig. 8.1 which highlights the globally stable system in the first panel such that the ball remains at the bottom always if an adjustment process is allowed. The upshot is that there is a natural tendency for the ball in a globally stable system to reach the pit – an example from the physical world is the law of gravity.

The local stability represents a much tenuous and fragile system: it is a state of affairs where a small perturbation of the system does not change the status quo position nor there is any automatic adjustment to a specific equilibrium from an arbitrary starting point. It is important to note that a
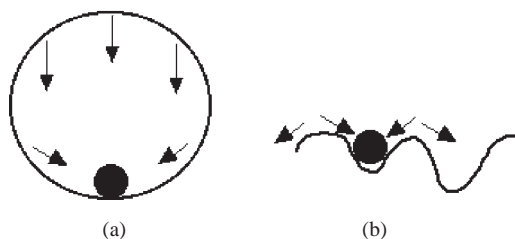
Fig. 8.1. Global vis-à-vis Local Stability. (a) Global Stability. (b) Local Stability. *Source:* Isard and Azis (1999).

critical perturbation can cause serious changes that are commonly known as regime switches/shifts, which can move the balance from one point of local stability to another point as highlighted in the second panel of Fig. 8.1 created by Isard and Azis (1999). We know the problems of local stability in the context of violent conflicts between belligerent groups can deter the negotiation process unless a critical minimum effort is applied to dislodge a locally stable and conflict-ridden outcome (Axelrod, 1990; Newman, 1961). See Panel b of Fig. 8.1 that indicates that small perturbations cannot move the ball to a different hole, however a stronger perturbation can achieve a move. The role of negotiations is usually held to create a sufficient perturbation to take the system from one locally stable point to another. We will explain the details in the next sub-section.

8.1.5. Conflict Management Procedures: Important Models Replicating the Dynamics from Locally Stable Equilibrium to Another

In order to shed critical light on the issue of transition from conflicts to peace, the CMP combines three important theoretical tools:

- First and foremost, existing models apply the prospect theory that was developed by two famous researchers in psychology namely Kahneman and Tversky (1979).
- Secondly, existing models also apply the related intertemporal choice theory that was developed by Ainslie and Herrnstein.
- Finally, an application of analytical hierarchy process (AHP) and procedures is a usual practice, while the AHP was developed by Thomas Saaty (1990) and Isard and Azis (1999).

The CMP is based on three interlinked stages:

- First, researchers highlight the elicitation and conflict analysis. In the elicitation and conflict analysis, they identify the crucial actors and critical policy objectives relevant for the actors engaged in conflicts. At this stage researchers also elicit the relative importance of each policy objective for each actor the relevant sensitivity factors.
- Secondly, researchers spend significant efforts in detecting stable neighbourhood positions, which are in some sense similar to the locally stable equilibrium positions as discussed in the previous sub-section.
- Finally, researchers enter the deliberation process that involves consultation with the concerned groups regarding what kind of joint project/s would be rational and consonant with the discovered satisfying position. In order to achieve this, researchers combine the AHP-procedure with the sensitivity analysis to estimate the preference step-function for all actors and for their objectives. The step-function offers the adjustment path from conflicts to peace as a transition from one locally stable equilibrium to another. In a path-breaking analysis, Isard and Chung (2000) developed and applied the methodology in their paper entitled 'A proposal for North/South Korea cooperation that proved effective: A plea for more multi-analytic approaches in conflict management'.

Kahneman and Tversky (1979) have explored how people take decision in states of affairs involving uncertainty about outcomes. They have found that there is little empirical support for using rational analysis and consequent prescriptions when decision-makers face uncertainty. Important points are in order:

- For example, in simple situations (like lottery where there is uncertainty about the result), they have noted that people think of consequences as increments to, or decrements from, current wealth while the current wealth serves as a reference points from which changes are made.
- In addition, when people relate their subjective values with improvements these values decline with the size of improvements. As an example, the subjective difference between a gain of $100 from a reference point of $100 is greater than the subjective difference between a gain of $100 from $1,100 to $1,200. The same concept works on loss, where the subjective difference between a loss of $100 and a loss of $200 is greater than the subjective difference between a loss of $1,100 and $1,200.

8.1.6. Main Departures of Our Model

The proposed model in the next section expands the micro-foundations of conflict and its persistence within the traditional set-up of greed and grievances. One may construe thus as a contest between an incumbent government and rebel leaders and international mediator. We make some important assumptions to derive the results:

- First, we allow for the substitutive reactions by each decision-maker in a non-cooperative negotiation game. As a result, one may like to think of the model involving three crucial players: rebels, government and mediator choose their responses to pro-peace moves by choosing their appropriate strategies.
- Secondly, one can also introduce the possibility of financial transfers by diasporas either to rebel groups, or government, or mediator. We do not take into account such transfers as outside options. Interestingly, these transfers can introduce a trade-off in the gains associated with peace vis-à-vis conflict/war, which we do not take into account.
- Thirdly, one can characterise international mediation/interventions into two types: direct (and often fungible) resources to governments to buy peace in the form of money, development assistance, power sharing or inclusion measures. Secondly, one can consider mechanisms that induce behavioural change towards peace, such as conditional aid, sanctions, military peacekeeping. It is possible to develop a principal-agent model to explore the inefficacy of the proposed mechanism. We do not entertain the agency problem in our framework. At the outset, it is important to realise that the agency problem can effectively deter the peace process.

8.2. THE COASE THEOREM AND COALITIONAL ISSUES: MULTI-PARTY CONFLICT AND TENSIONS BETWEEN GRAND COALITION VIS-À-VIS SUB-COALITIONS

Let us consider a multi-party conflict and potentials for negotiations and bargaining among three groups of decision-makers. For the sake of tractability, we reduce the problem into a tripartite decision-making. In this context of multilateral bargaining two important models are the Coase theorem and the bargaining set stability. The Coase theorem[2] is argued to be incompatible with bargaining set stability (see Aivazian, Callen, & Lipnowski,

1987). The strategic coalitional behaviour, in a set-up of more than two agents, would make every coalitional structure potentially stable (Peleg, 1963) which jeopardises the attainment of the grand coalition, which involves all parties involved in a conflict. Even when the grand coalitional outcome is Pareto optimal, stable sub-coalitions can engender Pareto sub-optimal allocation of resources. This is akin to the concept of locally stable equilibrium as highlighted by the CMP of the previous section. As a consequence, the Coase theorem and bargaining set stability appear to be irreconcilable, which acts as a deterrence for achieving a peaceful outcome through negotiations.

This is a well-known problem in the literature on game theory. The crux of the theoretical problem, as expounded by Aivazian et al. (1987), lies in a tension between the grand coalition and the sub-coalitions. If a subset of agents can secure a higher joint payoff than their joint payoff in the grand coalition, then these agents do not have any incentive to be a party to the grand coalition. Hence the grand coalitional outcome may not be feasible and the excluded agent has an incentive to continue with violent conflicts and the peace process crumbles down. In other words if agents involved in a multi-agent conflict can form sub-coalitions, they will have no incentives to establish a group norm in enforcing a collective peace contract.

At the technical level, our work addresses this specific tension to examine whether the agents can form the grand coalition and attain a unanimity concerning the enforcement of the peace contract. We demonstrate in a stylised model that the grand coalition will form and home in on an outcome when each agent makes an equal relative concession/sacrifice. To our understanding, this is the first work that establishes the condition so that the grand coalition of multiple agents will form and peace will be enforced like any other contracts. In order to achieve this we will explore the rational underpinning for the principle of equal relative concession in the peace process.

8.3. THE BASELINE MODEL OF NEGOTIATIONS IN MULTI-PARTY CONFLICTS

In this section we consider decision-making by multiple stakeholders (possibly nations) who are led by multiple decision-makers. To keep our arguments tractable, we will consider three decision-making units and reduce them to three agents as the leaders of these three stakeholders. Our

model can be extended for any finite number of decision-makers. We simply call the decision-makers as agents. So let us consider three agents A, B and C whose payoffs/utilities are as follows[3]: $U_A = -|X-a|$, $U_B = -|X-b|$, $U_C = -|X-c|$. Where $|\cdot|$ is the Euclidean distance[4] and X the return from the multidimensional public goods from peace. Thus, the public goods include the peace dividend purely in economic terms and also in non-pecuniary terms – like that of the intrinsic value of peace. The numbers a, b and c represent the multidimensional returns from conflicts for agents A, B and C respectively, which are similar to the *ideal payoffs* of Kalai-Smorodinsky (1975). The underlying idea is that each agent derives some benefit from conflicts and the maximum possible benefit from conflicts derives from their ideal points.

In the simplest version, one may like to consider X as the division/allocation of national product (GDP) into defence expenditure, consumption expenditure and investment expenditure. Given the ideal allocation for each agent the benefit declines as the actual allocation deviates from the ideal one. These utility indexes are introduced to capture the basic message that the peace dividend is less than the economic returns from conflicts. Thus, by choosing peace each agent makes a pecuniary loss and not a gain. Can one have peace in such a scenario when peace is valued for its intrinsic quality?

Let us have a look at the existing literature on game theory here. Each agent prefers his ideal allocation but is aware of Aumann–Maschler bargaining set (1964) formed by other agents. Hence each agent would like to be a party to a coalition in order to avoid the dominance, or exploitation, by Aumann–Maschler bargaining set (1964) formed by other agents. If this is the case, our results concerning the dynamics of negotiation for peace will be established. The sub-coalition acts as a threat point, which forces agents to come to an agreement about peace. For any grand coalitional outcome, it can be shown that there exists another outcome which is preferred by a majority while such a tension can be modelled as the Condorcet paradox (see Guth & Selten, 1991). This tension between sub-coalitions and grand coalition is the corner-stone of the model of Aivazian et al. (1987).

Each agent fears that if he does not grant a concession during negotiations, then a disagreement will ensue that may trigger a coalition of other two agents. This disagreement outcome acts as a potential threat on each agent which prompts them to come to an agreement during formal negotiations. This is similar to the argument articulated by Friedman (1991) in the context of the '*Folk*' theorem. In a multi-party conflict, agent A fears that other agents would '*gang up*' against him and everyone thinks in an

identical manner. In the standard literature all agents have perfect knowledge concerning the payoffs under different coalitional regimes (see Aivazian et al., 1987). In this work we bypass this simplification and introduce incomplete information concerning coalitional outcomes.

The rationale for so doing is as follows: the three-person negotiation problem, with the postulated utility functions, may easily be reduced to a non-cooperative game version of the Condorcet paradox if the allocation involves more than one issue (see Enelow & Hinich, 1984, pp. 22–23). Such a non-cooperative game is shown to have infinitely many equilibrium points (Guth & Selten, 1991), which engenders an uncertainty concerning actual outcomes. This raises a problem of outcome selection. An outcome, hence, gets intertwined with the expectations of agents concerning the coalitional payoffs. We, therefore, examine the expectation formation of agents in the following lemma.

Postulate 1. Agent A believes that the disagreement outcome would be the sub-coalitional outcome which is agreed between agents B and C in a pair-wise, cooperative bargaining scheme. Agent A believes that agents B and C have identical bargaining strengths. We label this perceived disagreement outcome as $X^*(B,C)$.

Lemma 1. Under the proposed belief structure as outlined in Postulate 1, $X^*(B,C)$ is given by the following:

$$X^*(B,C) = \frac{b+c}{2} \tag{1a}$$

Proof. The latent idea behind a cooperative bargaining solution, as Roth (1979) argues, is the maximisation of the weighted average of the payoffs of B and C. This maximisation is equivalent to minimisation of their concessions/sacrifices in our proposed model. Hence[5]

$$X^*(B,C) = \underset{X}{\arg\ \min}(mU_C + nU_B) \tag{1b}$$

where m and n are the weights which hinge on the bargaining strengths of B and C. The minimisation of this weighted average yields the following:

$$m\frac{dU_C}{dX} + n\frac{dU_B}{dX} = 0 \tag{1c}$$

It is evident that the knowledge of m and n would make Eq. (1c) determinate. Assuming that both parties make concessions proportional

to their bargaining strengths we yield the following:

$$m\frac{\mathrm{d}U_C}{\mathrm{d}X} = n\frac{\mathrm{d}U_B}{\mathrm{d}X} \tag{2}$$

Substituting (2) in (1c) and after minor manipulations we get the following:

$$\frac{\mathrm{d}U_B}{\mathrm{d}X}U_C + \frac{\mathrm{d}U_C}{\mathrm{d}X}U_B = 0 \tag{3}$$

Hence

$$X^*(\mathrm{B,C}) = \arg\min_X(U_B U_C) \tag{3a}$$

The minimisation of the product of sacrifices yields the following:

$$\frac{U_C}{U_B}(X - b) + \frac{U_B}{U_C}(X - c) = 0 \tag{3b}$$

or

$$\frac{X - c}{X - b} = -\frac{U_C^2}{U_B^2} \tag{3c}$$

Assuming equal bargaining strengths the right-hand side reduces to -1 which implies that both B and C suffer identical loss in reference to their maximal expectations. What is the rational behind this equal bargaining strengths? Note that the pair-wise bargaining is merely a mental calculation of A. Since A does not know the actual bargaining strengths of B and C in a pair-wise contest, he believes a 'fifty–fifty division' would be the outcome. This equal sharing is a manifestation of equal bargaining strengths. Young (1993) articulated such a division as a custom. He reports that even in laboratory settings such a 'fifty–fifty division', or equal bargaining strengths, is quite customary even when agents are in asymmetric positions. Hence it follows

$$X^*(\mathrm{B,C}) = \frac{b + c}{2} = d \tag{3d}$$

Similarly we derive $X^*(\mathrm{A,B}) = (a+b)/2 = f$ and $X^*(\mathrm{A,C}) = (a+c)/2 = e$ (Q.E.D.).[6]

Definition 1. The payoffs d, e and f are the minimal points of agents A, B and C respectively (see Friedman, 1986).

Theorem 1. The minimal points act as potential threats which constrain the agents to come to an agreement wherefrom the grand coalition will form on the basis of equal relative sacrifice. The grand coalition will home in on the allocation G and to achieve G each agent grants equal relative concession.

Proof. We follow Zeuthen (see Friedman, 1986) to delineate a unanimous allocation. Consider agent A who holds a subjective probability p as the chance that other agents would refuse to implement his ideal point 'a' as the allocation. He, therefore, anticipates a conflict with probability p which would establish 'd' as the negotiated outcome of B and C. Thus his expected return based on the probability estimate 'p' is

$$E(a, p) = pd + (1 - p)a \qquad (4a)$$

Rational agent A would grant a concession $X(A)$ such that

$$X(A) \geq (1 - p)a + pd \qquad (4b)$$

or

$$p \leq \frac{2(X(A) - a)}{b + c - 2a} \qquad (5)$$

Similarly we define q and r for agent B and C which yield the following:

$$q \leq \frac{2(X(B) - b)}{a + c - 2b} \qquad (6)$$

$$r \leq \frac{2(X(C) - c)}{a + b - 2c} \qquad (7)$$

The upper bounds of p, q and r are the highest probability of a conflict that agents A, B and C fear respectively. These are called the risk limits while Zeuthen (see Friedman, 1986) proposed that for a complete agreement it is mandatory that

$$p = q = r \qquad (8)$$

On the other hand a feasible allocation implies the following since X is a public good

$$X(A) = X(B) = X(C) = G \qquad (9)$$

Inequalities (5), (6) and (7) under the conditions (8) and (9) yield the following:

$$G = \frac{a + b + c}{3} \qquad (10)$$

such that

$$\frac{U_A(G)}{U_A(d)} = \frac{U_b(G)}{U_B(e)} = \frac{U_C(G)}{U_C(f)} = \frac{2}{3} \qquad (11)$$

Hence allocation G induces an equal relative sacrifice for each agent (Q.E.D.).

8.4. DYNAMICS OF NEGOTIATIONS IN MULTI-PARTY CONFLICTS: THE RATIONAL UNDERPINNING FOR THE PRINCIPLE OF EQUAL RELATIVE CONCESSION

We apply the famed solution method of Rubinstein (1982) in order to provide rational underpinning to the principle of equal relative concession. We adopt a bargaining model which is similar in spirits to Zeuthen–Harsanyi model (see Friedman, 1986). Suppose the game starts unfolding at time $t = 1$ during which negotiations take place regarding coalition formation. If no agreement is reached, the game moves to $t = 2$ during which fresh negotiations are undertaken. If no agreement is reached, the game unfolds its stage $t = 3$. Suppose at stage $t = n$, all the agents come to share common knowledge about the unique estimate (Δ) of concession and the common probability π of its collective acceptance. This follows from the Harsanyi–Aumann doctrine.[7] Now we apply the logic of backward induction to trace back from $t = n$ to $t = 1$. Thus, there are n periods and, hence, t ranges from $1, 2, \ldots, n$. Suppose, for simplification, δ is the common discount rate for each agent such that $0 < \delta < 1$. We start at

Table 8.1.   Application of Backward Induction.

At date $t = n$, the expected loss of agent A from the common concession Δ is $U_A(\Delta)\pi$
At date $t = n-1$, A's discounted value of the loss from concession Δ is $\delta U_A(\Delta)\pi$
At date $t = n-2$, A's discounted value of the loss from concession Δ is $\delta^2 U_A(\Delta)\pi$

...

At date $t = 1$, A's discounted value of the loss from concession Δ is $\delta^{n-1} U_A(\Delta)\pi$

$t = n$ and trace back to $t = 1$ to find out the acceptable concession at $t = 1$ (Table 8.1).

Lemma 2. It is rational for agent A to adopt the principle of equal relative concession and to allow a concession G at date $t = 1$ if the following condition is satisfied:

$$\Delta \leq \frac{(\delta^{n-1}\pi - 1)}{\delta^{n-1}\pi}a + \frac{G}{\delta^{n-1}\pi} \tag{12a}$$

Proof. The allocation G is rationally chosen by agent A if

$$|U_A(G)| \geq \delta^{n-1} U_A(\Delta)\pi| \tag{12b}$$

where $|\cdot|$ is the absolute value norm. Simplification of (12b) yields:

$$\delta^{n-1}(a - \Delta)\pi \geq a - G \tag{12c}$$

or

$$\Delta \leq \frac{(\delta^{n-1}\pi - 1)}{\delta^{n-1}\pi}a + \frac{G}{\delta^{n-1}\pi} \tag{12d}$$

Similarly, for other two agents, the principle of equal relative concession is a rational act if

$$\Delta \leq \frac{(\delta^{n-1}\pi - 1)}{\delta^{n-1}\pi}b + \frac{G}{\delta^{n-1}\pi} \tag{12e}$$

$$\Delta \leq \frac{(\delta^{n-1}\pi - 1)}{\delta^{n-1}\pi}c + \frac{G}{\delta^{n-1}\pi} \tag{12f}$$

Q.E.D.

Thus, for given Δ, δ, n and π, if conditions (12d), (12e) and (12f) are satisfied then it is rational for each agent to choose the principle of equal relative concession.[8]

8.5. NEGOTIATIONS FOR PEACE AND FORMATION OF A GRAND COALITION: A BRIEF HISTORY OF ECONOMIC THOUGHTS ON DISARMAMENT AND PEACE

The above model of coalition formation has several probable applications in the context of peace economics. The most important field is the context of disarmament, which presupposes the gradual disarming of parties in actual or potential conflicts. As one party reduces its conflict capability (or arms), this party enhances its vulnerability from conflicts with others. In this sense, unilateral disarmament can fail to instantly achieve a win–win situation, unless a coalition is formed along the line of our suggestion. In an extension of this idea, if a group of nations form a coalition to negotiate in reducing their conflict capabilities, a successful negotiation increases their vulnerability from outsiders. This potential conflict between insiders and outsiders poses a serious concern for unilateral reduction in strategic arms and still remains a stumbling block to achieve disarmament. In order to establish the relevance of our models, we take a cursory look at the issues concerning armament and disarmament.

Vilfredo Pareto (1887) is one of the first few to argue that the modern parliamentary system is inadequate for establishing peace. He did not suggest any mechanism, but subsequent thinkers like Veblen and Wicksell recommended a clear institutional structure to achieve peace and permanently banish war, which are similar in spirits to our game-theoretic modelling. Pareto articulated that war is an obsolete politics in modern societies, which is driven mainly by the militaristic urges of European governments. It is important to highlight that Pareto argued that these military urges are a product of generalised decadence of Western civilisation. Popular democracy, in his view, will favour increases in military expenditure and engage in wars. Only deep political reform, notably the abandonment of the parliamentary system, would lead to disarmament.

At the conclusion of World War II, as discussed in Chapter 6, a bipolar view emerged on disarmament. As per the less dominant strand of thoughts, disarmament has a strong economic desirability due to the creation of the

peace dividend from disarmament. Since disarmament causes economic development that further lays the foundation for peace, negotiated disarmament can have a strong economic impact on relevant decision-makers. As per the other strand, disarmament is unwanted as disarmament reduces the capability of successful conflicts of insiders against outsiders.

According to the core of the first strand of thoughts, the issues pertaining to disarmament revolve around a few important themes that are in currency for a very long time. There are several presuppositions and value judgments that are relied on for supporting disarmament:

- Armament is for inflicting violence on the society
- Armament thereby retards human progress
- Armament is driven by the political agenda of the dominant social class in a society.

Disarmament is a departure from the unnecessary and costly act of human societies and therefore represents a core of a modern and progressive society. Thorstein Veblen remains the most powerful architect of this strand of thoughts that values disarmament per se. Veblen (1915, 1917) applied the Darwinian concept of evolution to the evolution of societies as he presumes that societies evolve over time from warlike and rudimentary states to more peaceful ones. In his dynastic state that is driven by a military spirit and antagonistic relations, peace is a temporary punctuation in the continuing chain of conflicts and a mere prelude to war. Disarmament is destined to be a failure. But the critical question for social scientists is whether the arrow of evolution is deterministic and driven by the internal dynamics of a society. Veblen categorically rejected the idea of determinism: there is nothing automatic in a state that leads to an eventual domination of the spirit of economic advancement over the militaristic and bellicose sentiments. The eventual establishment of a peaceful society in his models derives from a social tension between two opposing classes: the class of enlightened elite seeks to establish the dominance of the spirit of economic development while the military–imperial clique seeks to continue with the strategy of conflicts. The balance of power between these two opposing interest groups is believed to drive the dynamics either to armament and conflicts or to disarmament and peace. This is exactly what we modelled in Chapter 3. Peace can only last as long as the military–imperial clique is kept at bay to take over the control of a nation state. Veblen advocated the formation of a group as our model highlights. His

idea was to form a 'league of neutrals'. The main principles to form this group are

- Non-discriminatory commercial practices
- Elimination of preferential tariffs within groups
- Liberalisation of industry and trade.

If a relevant group of nations can create a league of neutrals, Veblen relied on the (marginal) cost of war as deterrence for armament. Disarmament follows from a successful formation of a league that can successfully win the class struggle or a conflict of interests between the enlightened elite and the imperial clique.

In his powerful work Knut Wicksell (1919) recommends peace and disarmament through cooperation driven by the formation of coalition of nation states. In his case, the inter-country cooperation has both economic and political elements. He called forth the creation of a 'society of nations', which is similar to our grand coalition. At the same time he asked for a simultaneous and global shrinking of military budgets and the development of interstate economic cooperation agreements. Our model thus bears remarkable semblance of the initial ideas of Wicksell. Our penalty mechanism (anticipated or real) is also based on the Wicksellian idea of international sanctions to form the core group for achieving peace. Wicksell was suspicious whether the penalty mechanism can work and instead relied on international trade and demographic factors to reduce the risk of armament. Ours is the first work to establish a set of conditions and bargaining and negotiating rules under which the penalty mechanism works and a grand coalition forms to achieve a successful disarmament.

For British thinkers led by Arthur C. Pigou, *excessive* armament is a serious problem, but so might disarmament. It is similar to our notion of conflicts between insiders and outsiders of a coalition. Complete disarmament within a coalition of nations can act as a juicy invitation for a costly war with outsiders that one usually seeks to avoid. Thus, the British view has been that of moderation and of a balancing act that armament plays in avoiding uninvited wars.

John M. Keynes was also antagonistic to the idea of absolute pacifism. It is Keynes who effectively argued in favour of the roles of economic sanctions and formation of military coalitions and alliances, which can play a central role in creating a peaceful society. However, the Keynesian ideas received a tough and resilient resistance from the earlier work of Pigou (1921) and the subsequent work of Lionel Robbins (1939). In some sense one may like to

argue that the failure of Keynes to value pacifism can have its roots in the overall Keynesian attack on his former teacher Pigou. It is imperative to learn that both Pigou and Robbins took a well-argued stance against the risk of over-arming. As our Chapter 3 offers a constructive model, Pigou (1921) was the first to raise a question whether conflicts are driven by purely irrational sentiments: he argued (armed) conflicts are partly the product of irrational desire among states to dominate and subjugate each other. It is instructive to look at some of the salient features of his ideas:

- The prevailing idea that equates economic development with international peace was rejected by Pigou
- Pigou advocated for free trade and increases in mutual foreign investment as a precursor for peace
- Pigou stressed the role of national defence as a priority for states
- National defence, similar to the thoughts of modern thinkers like Jack Hirshleifer and Grossman, is to guarantee the protection of national wealth
- Disarmament is not desirable if it encourages war between insiders and outsiders
- Disarmament is desirable if it is the result of negotiated agreements among nation states that can effectively deter attacks by outsiders.

In some important sense, the most mature views were expressed by Lionel Robbins. He argued that the existing analyses of imperialism were partly flawed (Robbins, 1939). He though agreed that international relations are partly determined by power struggles to which economic factors are also central. But he did not want to focus exclusively upon economic interpretation. Robbins blamed some capitalists for brining wars and conflicts but did not share the idea that the capitalist class as a whole was responsible for imperialism and conflicts. The most important contribution of Robbins is his articulation that international relations are determined by control over scarce resources and of the means of communication. From that vantage point, Robbins argued that peace can coexist with armament, a very different view from the one that most observers have taken. Robbins argument is similar to the Kantian notion of ethics as he sought to two important conditions that can proffer peace:

- A decreased emphasis on national sovereignty and national sentiments. Robbins argued that nationalism is not enough, which is the most potent argument in favour of global peace today.
- To promote lasting peace, secondly, he advocates the creation of a United States of Europe.

It is important for us to examine the Marxist and neo-Marxist ideas on conflicts, imperialism and capitalism. Disarmament is a purely political concept in the context of Marxism. It does not make a great economic sense. This is so since mutual disarmament is a transitory phenomenon without any streak of permanence in the capitalist world. Wars and conflicts are a product of petty quarrels among capitalist nations over markets. Disarmament does not accord with the internal dynamics of a capitalist society. Disarmament is viewed as a short-run aberration from the long-run equilibria or inherent capitalist tendencies. At the best, it is the characteristic of a stationary economy.

The Marxist ideas are rooted in the theories of imperialism and class conflicts. In the context of imperialism, the arms race is an instrument for furthering imperialistic interests. As a result, internal and external wars are inherent in capitalism. For example, the long-run steady state is pivoted on the laws of the equalisation of profits and a gradual decline in profit rates. The inevitable crisis of declining profit rates intensifies rivalry among capitalists to invade and capture larger and larger of markets, which was successfully modelled in Chapter 3 of our book. The competition for markets share and capital exports are characters of capitalist systems, according to the Marxist views. That rivalry will trigger colonisation of foreign markets. The Marxist notion of class conflicts/war is construed as internal civil wars within a society between the capitalist class and the proletariat, which can easily spin off to an external conflict between nations as highlighted in Chapter 6 of the book.

Some form of armed violence and conflicts accompany a capitalist system due to the class war. Logically, disarmament can take place provided there is no conflict of interests between the capitalist and the proletariat. Thus, disarmament is feasible if and only if the end state of the capitalist system is established, not otherwise. In the international context the role of the state is important. The role of the state is to promote the nation's interest abroad while the national defence force establishes the national interests on overseas soils mainly to serve the partisan interests of multinational firms. It is the much debated idea of Rosa Luxemburg that a natural hostility between nation states will emerge from the inherent hostilities of imperialist powers trying to grab markets for their economic survival. Disarmament can take place at the end stage of capitalism only when socialism takes a formal shape. Similar ideas were spelled out by Lenin in 1916 as World War I is argued to be a direct consequence of the rise of German power along with the decline of British and French capitalism.

It is appropriate to bring the oft-repeated arguments of Keynes against the Marxist school of thoughts. Keynes (1934) regarded communism 'an insult to our intelligence'. Keynes argued the following important points for peace:

- During wars and economic crisis political decisions modify the course of history.
- Scientific knowledge of the economy can help modify our collective history.
- Peace is ultimately a pre-condition for economic development.
- Lasting peace is feasible if and only if peace treaties are fair.
- Otherwise, peace will be replaced by renewed and armed conflicts.

To create the peace dividend by improving the economic situation, Keynes recommended a reduced military spending along with arms limitations (see Keynes, 1921). Keynes dichotomised time into the short run and the long run. In the short run, military spending will create its usual multiplier dynamics to give a boost to the economy and thus a great economic asset. The same asset turns into a disaster in the long run since the military spending imposes a burden on the society as the spending is unproductive. Armament has a huge opportunity cost in the long run. Keynes believed security is delicately predicated on economic strengths for two sets of reasons that drove the research agenda of Chapter 6 of this book:

- A lack of economic strengths and consequent crises can lead to the downfall of democracies.
- Poor economic conditions invite the threat of outsiders to rule, in the Keynesian thoughts economic crisis can only invite communism to capitalist systems.

Thus, one of the major deterrence for peace and disarmament is economic sluggishness of various nations and regions within a nation. The Keynesian recipe for lasting peace and disarmament calls forth an international economic forum and solidarity and harmonisation of national and international economic interests. Our findings in this chapter are very significant for re-establishing the initial intuitions, ideas and ideologies of Keynes: the issue of international security must be multilateral and ought to be shared. How to pave the way for disarmament and peace? The Keynesian proposal is immensely valuable for the modern world and akin to our theoretical model:

- In 1929 Keynes called for an extensive financial support to establish a Society of Nations,
- Membership in this Society should be limited to peaceful states,

- The Society should be granted relevant powers to institute a penalty mechanism for non-peaceful states,
- In 1937 he recommended economic sanctions against Italy and Japan,
- In 1938, he asked for a European defence and conflict prevention pact, in essence a bloc of countries forming a military coalition, or alliance as in our theoretical model.

The most powerful observation of Keynes is the potential role of prisoners' dilemma setting the forces for an over-arming by individual nations since each individual decision is correctly based on individual rationality, which unfortunately brings the collective disaster of an excessively armed world. The over-arming only hurts us by reducing our economic well-being, which clears the way for a violent conflict. How do we get out of this collective mess? Keynes suggested the role of negotiation, arbitration and coalition formation and application of moral ethics and penalty mechanism to break the tyranny of the prisoners' dilemma – a strategic concept unknown to Keynes.

In this context, the most important theoretical construct came from Richardson (1919). Richardson examined the possibility of peace in the context of a dynamic decision-making model involving two differential equations. These two differential equations try to capture an arms race as a purely action–reaction process, popularly given by the following equations in the literature

$$\frac{\mathrm{d}M^{\mathrm{A}}}{\mathrm{d}t} = kM^{\mathrm{B}} - aM^{\mathrm{A}} + g \tag{13a}$$

$$\frac{\mathrm{d}M^{\mathrm{B}}}{\mathrm{d}t} = lM^{\mathrm{A}} - bM^{\mathrm{A}} + h \tag{13b}$$

M can either be defined as a stock variable (stock of weapons) or a flow variable (military expenditure). In Eq. (13a), country A's *change* of M over time (dM^{A}/dt) is positively related to some fraction, the *reaction* coefficient, of country B's stock of arms or flow of military expenditure (kM^{B}), minus a *fatigue* factor (aM^{A}) which is a fraction of A's initial stock/flow and a *grievance* factor (g) that can be positive or negative. Eq. (13b) is exactly the same for the other country. There are three critical terms of the model:

- Strategic inter-linkage (kM^{B}).
- Economic cost of conflict (aM^{A}).
- Political and social heat (grievance).

The findings are straightforward:

- The equilibrium solution for dM^i/dt is unstable if the product of the reaction coefficients outweighs the product of the fatigue coefficients (i.e. if $kl > ab$).
- The equilibrium is stable if $kl < ab$, that is when the product of the reaction coefficients is smaller than the product of the fatigue coefficients.
- Reaction coefficients of zero are to establish peace.
- Negative reaction coefficients indicate that the two countries develop links of cooperation – they trade and cooperate with each other. The characteristics of this 'cooperation race' should be symmetrical to those of the arms race.

Richardson further examined factors that can restrict the escalation of arms race, which means that it would induce governments to choose cooperation rather than strategic rivalry. Development of trade between countries contributes to the de-escalation of arms race.

Brito and Intriligator (1995) developed models to establish nuclear arms race between two countries may lead to war or to peace through deterrence. Given the reaction functions of two rival nations, the nuclear rivalry can assume a mutual destruction and thereby deter any real conflicts between these nations. Despite the end of the Cold War, the factors underlying arms races still exist.

The theory of repeated games has been utilised as a new scientific paradigm on the arms race (Brito & Intriligator, 2000). These studies look at the other side of peace that is armament and not disarmament. It is important to note that armament and disarmament are not considered as symmetrically opposite concepts in the literature on peace economics. The main weakness of the approach taken by Brito and Intriligator is that peace is viewed as a counterfactual to conflict and then extended to the case where disarmament is treated as a counterfactual to armament.

Against this backdrop, ours is the first model that is capable of modelling disarmament without any prior assumption on whether disarmament is symmetrically opposite of armament or otherwise. This in our view is a significant step forward as the literature on peace was somewhat unkind to the path-breaking contribution of Brito and Intriligator simply because of the assumed symmetric relationship.

As our work highlights that a stable equilibrium requires the control, curtailment and punishing of opportunistic behaviour. The suppression of opportunistic behaviour in the context of disarmament is a serious problem and can be enforced by joint threats against deviant agents. Our model

establishes two things: first, it highlights how a simple bargaining mechanism can achieve a gradual clipping of opportunistic behaviour in order to establish an acceptable level of disarmament that will pave the way for establishing peace. Secondly, we also provide a set of reasonable axioms that are necessary to achieve an acceptable level of disarmament and peace. It is important to note that one of our axioms requires an element of ethics without which we cannot achieve disarmament as a desirable outcome. Whether disarmament is desirable, or otherwise, has been a source of great debated between great minds like Keynes and Pigou. We here try to provide a Pigouvian rational that rationality may not be enough – we will need to have changes in behaviour of agents in order to achieve lasting peace. In our modelling, the change in behaviour is arrived at by introducing the axiom of equal relative concessions in the bargaining process.

8.6. CONCLUSION: SOME CONCRETE OBSERVATIONS

Let us start off with some recent flashpoints: the never-ending cycles of conflicts between Israel and the Palestinians has come to be viewed as a political problem requiring a political will to home in on a political solution. Historically, the strategies of peace process have dwelt on issues of land, governance and security. It is a moot point whether these political initiatives can lead to productive negotiations and a peace settlement. We posit that it would be erroneous to assume that they will establish a lasting peace.

The main obstacle to a lasting peace is inter-country inequality and the cascading grievances that flow from the inequality. In other words, the long-term peace will falter as long as there will be a mass of poor people who will scan the pomp and glory of another nation across a border. In other words, unless we are successful in creating adequate opulence among the Palestinians, the peace will always be fragile between Israel and the Palestinians.

In such a situation, what we propose is to take a set of economic measures to promote economic progress of backward regions, which can bring losses to all involved parties in the short run. However, the virtue of peace can outweigh all pecuniary losses. What we ask for is a principle of sacrifices, which will act as the *just* price of peace. In the negotiation between Israel and the Palestinians, we can now introduce a third party – the representative of the international community. Let us call the representatives of these three

groups as A, B and C. In the negotiation process, agent A representing Israel makes commitments to pump economic resources into the Palestinian regions while agent B representing the Palestinians makes commitment to reduce intensity of violence and agent C commits to a special market access to the Palestinian firms. In the short run, none makes an economic gain as each strategy is costly for each party. It is also fraught with uncertainty as they do not know what will be the real outcome despite the firm commitments. What we propose is that it is possible home in on an equilibrium choice that will equalise the relative loss to each party in the short run and can pave the way for peace and prosperity in the long run. If agents base their decisions on some reasonable axioms, the equilibrium can be easily enforced by the spontaneous formation of a grand coalition of all interested parties.

One can easily sense that what we propose has a historical precedent in the context of bloody conflicts between Japan and South Korea. Japan engendered a peaceful – mutually beneficial relationship only in the long run – with a hostile South Korea by funding its poorer neighbour's economic development. Japan's history with South Korea has been fraught with violent conflicts, which is quite reminiscent of the current flashpoints in the Middle East and the South Asian regions. In simple terms the Japanese and the Koreans have had deep, long-standing distrust and hostilities. Japan attacked and violently annexed Korea in 1910, which created simmering unrest in the occupied region. The continuing unrest prompted Japan to integrate Koreans into the Japanese culture. Towards this end Japan, in the late 1930s before the Second World War, initiated a program of cultural assimilation that lasted until Korea's liberation in 1945 by the allied troops.

This traumatic shared history could have acted as a deterrence for the peace process between Japan and Korea. Interestingly, with subsequent a turning point in 1965, Japan and Korea buried all their past animosities and re-established diplomatic relations. The peace negotiations were driven by the following strategies, which turned the tide of animosity and hostility between Japan and South Korea.

- Japan made firm commitments to provide resources and capital for the industrialisation in South Korea,
- Japan committed to increase loans, investment and trade in South Korea,
- In the next iteration, Japanese industries formally began to shift labour-intensive tasks to South Korean companies,
- South Korea agreed to participate in a division of labour and markets,
- Japan concentrated on lucrative high-tech exports, South Korea focused on labour-intensive products,

- The Western nations allowed Japanese exporters to enter the lucrative Western market for high-tech products,
- The Western nations allowed South Korea to specialise in the low and intermediate technologies and created markets for their exports to developing nations,
- Japanese commitment of technological assistance to the South Koreans' steel and shipyard industries created the industrial linkages to make the South Korean economy one of the Asian tigers.

The coalition of Japan, South Korea and the Western nations (mainly, the United States) unleashed a series of measures that erased the economic inequality off the region and gradually created an economic powerhouse in the region. A peaceful state of affairs in the region came from the initial costly steps. The main threat to such an end state of peace and shared prosperity lies in the internal dynamics that can thwart the peace process at any stage. Modern economic and game theories have offered a clear insight in the present context. On the theoretical front, the peace process faces an uphill task due to an incompatibility between the Coase theorem and the bargaining set stability, which has been modelled in terms of conflicts of interest amongst the negotiating agents. A grand coalition allocation fails to materialise if some agents receive higher joint payoffs from a sub-coalition. In such an event the formation of a sub-coalition can block the grand coalition which yields a Pareto-efficient allocation. Such a formation of sub-coalition engenders an 'insider–outsider' problem which precipitates a conflict of interests. If two agents form a sub-coalition, third agent becomes an 'outsider'. Since agents do not know which coalition would survive, each agent now faces pure uncertainty whether other agents would 'gang up' against him or not. This fear of being an 'outsider' forces the agents to negotiate to reconcile their conflicting interests. A successful grand coalition, hence, hinges upon the resolution of these conflicts. The resolution of conflicts is shown to be feasible under a set of belief structures and in a specific bargaining process. It is further shown that such a grand coalition is possible if and only if agents use the principle of equal relative sacrifice while determining the actual allocation. We also derive a set of conditions which renders the principle of equal relative concession a rational choice for each negotiating agent. The upshot is that the Coase theorem and the stable bargaining set are compatible under the principle of equal relative concession, albeit under a set of conditions, wherefrom sustainable peace can emerge. A concrete example of a negotiated peace can be gleaned from the peace dynamics between Japan and South Korea.

NOTES

1. List of Middle East proposals: 1967 United Nations Resolution 242, 1978 Camp David Accords, 1982 Reagan Plan, 1991 Madrid Conference, 1993 Oslo Declaration of Principles, 1994 Cairo Agreement, 1994 Israel-Jordan Peace Treaty, 1995 Oslo Interim Agreement, 1998 Wye River Memorandum, 1999 Sarm el Sheikh Memorandum, 2000 Camp David Proposal, 2001 Taba Talks, 2002 Arab Peace Initiative, 2003 Geneva Accord, 2003 Road Map for Peace, 2003–2004 Sharon Disengagement Plan and 2006 Franco-Italian-Spanish Middle East Peace Plan.

2. The Coase theorem contends that, with zero transactions costs and zero income effects, the unique Pareto-efficient allocation would be established independent of the initial distributions of property rights. See Aivazian et al. (1987).

3. In the appendix we present a simple setting where agents' utilities are linear in money and establish that the principle of equal relative concession will still be valid. Similar results are obtained for quadratic utility functions in the appendix. The major intuition behind the utility function is that each agent has an ideal point and deviation from the ideal point is costly for him.

4. In a multidimensional spatial model the Euclidean distance has been put to use to explain voting paradoxes (see Enelow & Hinich, 1984).

5. Since coalitions are formed to minimise the concession/sacrifice, hence B and C negotiate to minimise the weighted average of their sacrifices/concessions.

6. In the appendix we derive similar results for a linear utility/sacrifice function.

7. Harsanyi doctrine (1966) presumes that when rational agents have the same information, then they must make the same inferences and will come independently to the same conclusion. Aumann (1976) refined the argument further by suggesting that rational players will home in on the same information so that they could not 'agree to disagree'. Thus the Harsanyi–Aumann doctrine allows us a common (anticipated) concession (Δ) and its probability of occurrence π.

8. In Harsanyi (1977) the symmetry principle has a significant role in reaching the Nash solution in a bargaining game characterised by Zeuthen–Harsanyi bargaining process. This principle appears to be a mutually agreed convention that the agent with the least value of the maximum risk will concede. We are also making an implicit assumption that the bargaining outcome is characterised by the symmetry principle as Harsanyi (1977) elucidates

> You cannot choose your bargaining strategy .... on the expectation that a rational opponent ... will choose a bargaining strategy more concessive that you yourself would choose in the same situation. (p. 154)

APPENDIX

Linear and Transferable Utilities and Equal Relative Sacrifice

We express the utility function of each agent as a simple money metric or linear:

$$U_A = a - X \qquad (A.1)$$

$$U_B = b - X \tag{A.2}$$

$$U_C = c - X \tag{A.3}$$

The perceived disagreement outcome of agent A, $X^*(B,C)$ is defined as:

$$X^*(B, C) = \arg_X \min(mU_C + nU_B) \tag{A.4}$$

Following the same step as in the text we know

$$\frac{dU_C}{dX} m = n \frac{dU_B}{dX} \tag{A.5}$$

Hence

$$X^*(B, C) = \arg \min(U_B U_C) \tag{A.6}$$

$$= \arg_X \min(b - X)(c - X) \tag{A.7}$$

We define Y as

$$Y = (b - X)(c - X) = X^2 - (b + c)X + bc \tag{A.8}$$

The first-order condition yields

$$X^*(B, C) = \frac{(b + c)}{2} = d \tag{A.9}$$

Similarly

$$X^*(A, B) = \frac{(a + b)}{2} = e \tag{A.10}$$

$$X^*(A, C) = \frac{(a + c)}{2} = f \tag{A.11}$$

Eqs. (5), (6), (7) of the main text will yield, given Eqs. (8) and (9) of the main text, G:

$$G = \frac{(a + b + c)}{3} \tag{A.12}$$

Hence

$$\frac{U_A(G)}{U_A(d)} = \frac{a - ((a + b + c)/3)}{a - ((b + c)/2)} = \frac{2}{3} \tag{A.13}$$

and

$$\frac{U_B(G)}{U_B(e)} = \frac{U_C(G)}{U_C(f)} = \frac{2}{3} \tag{A.14}$$

Thus, we get the same results with the linear utility functions representing a simple money metric. The rational underpinning also applies to linear utility functions.

Quadratic Utility Functions and Equal Relative Concession

Let us consider the following quadratic utility functions:

$$U_A = -(X - a)^2 \tag{A.15}$$

$$U_B = -(X - b)^2 \tag{A.16}$$

$$U_C = -(X - c)^2 \tag{A.17}$$

We define d as $X^*(B,C)$, that is

$$d = \arg \min(X - b)^2 (X - c)^2 \tag{A.18}$$

The first order to minimise $Y = (X-b)^2 (X-c)^2$ is:

$$2(X - c)^2(X - b) + 2(X - b)^2(X - c) = 0 \tag{A.19}$$

or

$$d = X^*(B, C) = \frac{(b + c)}{2} \tag{A.20}$$

Similarly we obtain:

$$e = \frac{(c + a)}{2} \tag{A.21}$$

$$f = \frac{(a + b)}{2} \tag{A.22}$$

For agent A:

$$U_A(G) = \frac{(b + c - 2a)^2}{9} \tag{A.23}$$

$$U_A(d) = \frac{(b + c - 2a)^2}{4} \tag{A.24}$$

Hence

$$\frac{U_A(G)}{U_A(d)} = \frac{4}{9} \tag{A.25}$$

We can similarly show that

$$\frac{U_B(G)}{U_B(e)} = \frac{U_C(G)}{U_C(f)} = \frac{4}{9} \tag{A.26}$$

Hence, all the results are valid also for the quadratic utility functions.

CONCLUSION

Mao Tse Tung is reported as having said that a long march begins with a small and somewhat tentative step. It is important that our collective efforts towards peace have registered several steps – some in the right direction and some quite in the opposite direction. As positive examples, the prospect of global peace has been ably aided by the following developments: the frequency of armed conflicts fell by about 40% in the 1990s except in sub-Saharan Africa where the incidence remains high. On a global picture, genocides and politicides declined by 80%. At the same time, international arms transfers declined by 33% in value, and military spending as a percentage of GDP declined globally by 50%. Forced eviction of people fell by 45%. Battle-deaths registered a decline of 80%. These are the positive steps towards global peace.

Against this positive backdrop, terror strikes have created havocs in various parts of the world. Conflicts and terror strikes have a regional bias as most violent conflicts are located in poorer regions of our globe, which poses a serious threat to the global peace. As examples, the prospect of a lasting global peace has been threatened by some of the following developments: the major exception and continuing source of conflicts has been sub-Saharan Africa whose growth of real GDP per capita adjusted for PPP halved from the 1980s to the 1990s.The region is also known to have serious problems with fragile availability of foods and hunger. However, there are a host of other problems in these regions: since the end of the 1980s, 80% of the world's 20 poorest countries (many in the sub-Saharan region) have suffered from a major war. Military expenditure as a proportion of GDP and the number of soldiers per 1,000 people changed little in the region. Battle-deaths actually fell in sub-Saharan Africa through the 1990s (apart from an all-time high spike from 1998 to 2000 due to the Eritrean war). However, war-deaths in this region have vastly exceeded battle-deaths due to indirect deaths. The World Health Report 2004 of the World Health Organization stated that the HIV/AIDS epidemic had its 'most explosive growth' in the mid-1990s in Africa, and that by 2003, it was

'home to two-thirds of the world's population living with HIV/AIDS'. Human under/malnutrition, HIV/AIDS, onslaught and continuing human hunger and personal insecurities can turn some of the backward regions into veritable minefield wherefrom one can only expect holocaust. The persistent famines in the Horn of Africa coincided with violent conflicts within and between Ethiopia, Eritrea and Somalia in the last 15 years.

POLITICS OF INTRASTATE CONFLICTS AND PEACE

In 2006, there were 49 countries under autocratic rules and their combined population is 2.2 billion, which is about 35% of the global population (see World Bank, 2008). This simple observation has latent messages for peace science. As we noted in our work that political regimes do matter in achieving peace and resolving conflicts and crises. Due to the potential volatility of political regimes, it can be safely concluded that these 2.2 billion people will be vulnerable. They will be potential victims of state failure, as their political institutions will fail to protect them from the ravages of conflicts and violent crimes since autocracies and hybrid systems breed intrastate violence. World peace will be seriously threatened by regions of political instability. We argued:

- The fragmentation of states often leads to weak, failing or collapsed states especially in the developing world.
- Some of their governments fail in fulfilling the core of state functions.
- Besides providing territorial security, the state must have legitimacy from all constituting citizens and enforce the rule of law and provide the minimal welfare to its citizens.

Our work provides a comprehensive examination of two major issues concerning the fragmentation of state and possible state failure, which will be one of the major deterrence for achieving peace in our world. There are two important sources of conflicts – one is for the rural society and the other is relevant for the urban society. In the rural set-up, we argue that the fragmentation of markets leads to clientelism between rich farmers and their subjugated clients, small farmers. We show this as an equilibrium phenomenon in which a handful of rich and powerful players, or farmers, can effectively control millions of small farmers, which can easily challenge the authority and the mandate and the jurisdiction of a nation state. This element of clientelisation can effectively fragment the state in a developing nation.

In the urban set-up, we argue that the era of globalisation has resulted in a mild form of fragmentation, as the unbridled urbanisation has led to the formation of urban ghettos in the developing world. Urban ghettos are peopled by rural migrants who cannot pay the excessive premium for proper urban facilities in developing nations. The local and regional governments have failed to provide the basic welfare programs for the ghetto dwellers, which created several chasms in the urban society to pose an enduring threat to regional and global peace.

The first issue at hand is to explain how a handful of political and economic leaders can wield a significant control over a large number of group members, which can effectively split up a nation into rival groups that can easily precipitate violent intrastate and inter-group conflicts. This kind of clientelism lies at the heart of ethnic cleansing and violent conflicts between ethnicities. Our work in Chapter 1 is one of the very first attempts to explain the formation of clientelistic groups what is commonly known as clientelisation. By so doing, we shed new lights on the dangers of intrastate conflict and prospects for peace in fragmented states. The second issue at stake is about the inadequacy and ineffectiveness of governments in developing nation in fulfilling their minimal responsibilities, which have created huge chasms between haves and have-nots, or go-getters and no-getters. The cleavage will act as a threat to the future prosperity and peace in developing nations. We marshal evidence to argue that the era of globalisation has caused serious problems for developing nations to pursue welfare policies and thereby exacerbated the cleavages between social groups, which resulted in a mild form of fragmentation of a state that can act as a serious source of problems for peace.

GLOBAL FIRMS, ETHNICITY AND PEACE

In Chapter 2, we move from the developing world to the developed world and highlight the sources of potential problems for lasting peace. During the last three decades, globalisation has been driven by what is commonly known as global firms and their multinational teams. Global firms employ workers of different ethnicities and races and nationalities. One of the consequences of globalisation and global firm is the ethnic diversity in the urban landscape of the developed world. In Chapter 2, we examined the economic foundation of ethnic diversity. The theoretical section establishes the economic foundation of ethnic intolerance and potential dangers of violent conflicts. The empirical section shows that a global firm has an

incentive to recruit and mix employees with ethnic heterogeneity in order to exploit their human capital. Within a global firm, the economic productivity bears a positive relation with the human capital of an employee, regardless of their ethnic background. It is hence optimal for a global firm to mix employees. Within a global firm, there is some evidence to believe that there is some inter-ethnic tension as the ethnic polarisation/fragmentation reduces overall productivity within a global firm. However, the negative impact of ethnic polarisation on the productivity is compensated by the positive effect of human capital on the productivity. It is also important to note that the regional cultural variables within a global firm also play an important role in softening the adverse consequences of ethnic polarisation on the productivity.

However, the unintended consequences of the spread of the global firms across countries are the increasing ethnic fragmentation of modern societies and their consequent problems. It is important to learn that the economic foundation of mixing ethnicities within a firm is based on the usual rational foundation for the employers. However, the cost of ethnicity falls on the society while the benefits are at best spread, which in our view can rise to inter-ethnic hostility. We then rivet our attention on the economics of ethnic intolerances in modern societies dominated by global firms. It is well documented in economics that fully rational and well-informed agents may display ethnic intolerances and engage in ensuing conflict only because they prefer conflicts to peace provided the potential penalties are not too high at the margin. It is well recognised that intolerances and conflicts can also arise from the desire to build reputation and also because of imperfect information (Bowles & Gintis, 1988; Crampton, 1984; Crawford, 1982). It is also well known that multiple equilibria can be a source of conflicts (Hollis, 1987). In this work, we stress the role of an uncertainty that can accompany intolerances and conflicts. An act of intolerance by an agent may beget social censure or social approval. Approval brings a high return while censure/disapproval causes a welfare loss and hence a low return. In a static model, by imposing reasonable restrictions on these costs and benefits, we establish the multiplicity of equilibrium intolerance. We show five Pareto-ranked equilibria ranging from zero-intolerance equilibrium to severe-intolerance equilibrium. History and/or expectations play a decisive role in selecting one of them whilst momentary departure beyond a threshold can engender serious social problems. The dynamic setting highlights exogenous social interactions such that the payoff of an agent depends not only on his own decisions, but also on the decisions of other agents. Here, we introduce

a new concept that we call *anti-social capital* – a collection of attributes (vices) such as a lack of trust and commitment to members of a minority group, non-adherence to social norms and non-retributions to violators of social norms – that typically endanger social cohesion and create chinks within a social system. It is a specific type of social interaction. From these social interactions, we derive the social dynamics that are well recognised in physical and economic sciences as being the dynamics of the quadratic map. In this model of double logistic maps, one can expect interesting local and global bifurcations phenomena. We show the possibility that the level of intolerance remains bounded but never repeats exhibiting chaotic dynamical behaviour. Time profiles of intolerances and conflicts, which start very close together, will separate exponentially. The strength of Nash equilibria gets terribly emasculated, since predicting predictions of others become impossible in the context of anti-social capital. An application of standard results of chaotic behaviour can be an important step forward to the understanding of the dynamics of intolerances and conflicts. We then introduce the replicator dynamics, which examines the possibility that social behaviours can be copied, or replicated, by agents. At any point in time, we interpret the mixed strategy h as a population state in which each component h_i representing the population share of agents who are programmed to play strategy i. Agents, thus programmed to play a particular strategy, now have an incentive to update their strategies if current strategies fail to yield an average return. This leads to the possibility of self-selection of an equilibrium. From the proposed replicator dynamics, we find whether a low-intolerance, or high-intolerance, equilibrium gets established depends on the initial proportion of agents (population share) programmed to choose a low-intolerance strategy.

PEACE AND IRRATIONAL BEHAVIOUR

In order to address this important issue of irrationality and conflict, we make several departures from the dominant economic models of conflicts in Chapter 3: first, we adapt a simple of model of duopoly that allows us to depart from the dominant model of *rational* choice between production and appropriation as highlighted in the existing literature. Secondly, our model also departs from the current focus on equilibrium conflict as a contest in which the game has a unique and globally stable Nash equilibrium. Finally, the main problem with the existing line of research has been its sole reliance

on the equilibrium analysis as a tool of investigation. We, on the contrary, argue that conflict embraces a very dynamic field that, in turn, influenced by bubbles of expectations, desires for domination and a constant quest for survival. It thus seems that the equilibrium approach to modelling conflict ignores various dynamics and psychological facets of conflict. One may argue this as a general weakness of the economic approach to conflict analysis.

Economists typically focus their attention on economic models with regions of local stability on the assumption that regions of instability are of little importance and more of a pathological case (see Gangopadhyay, 2000, 2002, 2004, 2005). The main justification for using the equilibrium analysis in this context is that the research does not find exploding time paths of any significant variable. This justification is incorrect once we introduce the possibility of chaotic dynamics. The development of chaotic behaviour significantly undermines this dismissal of regions of instability that can actually generate complex, yet deterministic, dynamics within bounds. This is where we pitch our chapter to highlight the importance of chaotic behaviour in the context of conflict as highlighted in earlier work of Furth (1986), Kopel (1996) and Puu (1998). The major innovation of our work is three-fold: first, we consider the race for market domination between rivals who seek long-run survival and growth – instead of short-run profits. Secondly, we develop a simple model to capture the dynamics and fluidity associated with non-equilibrium conflict in which agents may depart from the paradigm of rational behaviour. Finally, we strain the theory of chaos to shed lights on the time profile of conflict in our simplified model.

The recent economic literature on conflict led by Hirshleifer-type models has reignited interests of researchers in conflicts over economic resources. A major weakness of Hirshleifer-type models is that they are static. In an interesting paper, Reuveny and Maxwell (2001) examine conflict dynamics over renewable resources which thereby lend a dynamic flavour to the traditional Hirshleifer-type models. Their model demonstrates how a complex nonlinear dynamics can characterise the time profile of conflicts over renewable resources. However, Reuveny and Maxwell (2001) retain the critical assumption of Hirshleifer models that relevant actors are fully rational. Conflict is therefore modelled as a rational activity. On the contrary, our model examines conflict dynamics when actors are known to deviate from the clinical paradigm of rationality. Our model demonstrates how chaotic regimes can emerge when actors are known to be imperfectly rational.

IMPLICATIONS OF ENDOGENOUS INEQUALITY
FOR PEACE

In Chapter 4, we examine the feedback mechanisms between political and economic conflicts in the simplest possible framework. The Smithian perspective on competition, or rivalry, highlights a congruence of interests of market participants: for example, a buyer wants some milk and is ready to give some money to the milkmaid for it, and the milkmaid wants money and is, therefore, ready to give a carton of milk in exchange. This exchange allows each to achieve one's goal and they, thereby, help each other. In a complex market mechanism, however, economic problems are often embedded in a conflicting situation. It is recognised that the market mechanism can easily handle congruent interests but may fail to resolve conflicts in a harmonious or fair fashion (see Sen, 1984). To redress such conflicts, the visible hand of government has usually been invoked (Ostrom, 1987). In our work, we highlight two types of conflicts – namely, market conflicts and political conflicts – and, thereby, attempt to weave them together to illuminate an important intersection between the economy and the polity. We introduce conflicts at the market level in the usual fashion as market rivalry – two prototype firms compete against each other for market shares. By applying the simple game-theoretic reasoning, we obtained the equilibrium market outcome. However, the core of the problem remains that the emerging market outcome, conduct of firms, market shares and take-home profits of these rivals and regional inequality critically depend on the choice of their strategic variable and, hence, on the nature of competition. Dixon (1986) introduced consistent conjectural variations to make the degree of competition endogenous. He established that the degree of competition is driven by investment decision of firms, since capital stocks impinge on costs of production.

We exploit this intuition of Dixon by focussing on an impact of defence spending, as opposed to private capital, on costs of production. The degree of competition in the product market is therefore driven by an allocation of defence spending. The introduction of defence spending in our model allows us to link the second type of conflict, namely, the political conflict with the first type. Since, the availability of funds for defence spending is fixed, it is modelled that there is no congruence of interests of agents coming from two distinct locations, as Hirsch (1977) noted 'what winners win, losers lose'. An allocation of defence spending will naturally entail political costs and benefits that a self-seeking government, driven by electoral motive, would try to exploit. An incumbent government will naturally choose an allocation

to maximise the probability of its re-election. Our model on probabilistic voting has antecedents in the literature: Lindbeck and Weibull (1987) and Dixit and Londregan (1994) adapted the probabilistic model to examine public policies that redistribute income to narrow groups of voters. They assume that the various groups differ in their preferences for the political parties and, thereby, identify political characteristics of a group that makes it as an ideal candidate for receiving political largesse. The upshot is that these authors mainly study the major determinants of the political success of a special interest group. On the contrary, we start off with the political characteristics of voters and then apply the probabilistic voting theorem to determine the electoral equilibrium that is driven by political largesse in the form of defence spending. This is how our model resolves political conflicts. What is important for us is that the resolution of political conflict also determines the equilibrium allocation of defence spending that in turn determines the equilibrium regional inequality. The equilibrium regional inequality maximises the probability of re-election of an incumbent government. The resolution of political conflict can have a serious ramification for the product market due to its impact on the allocation of defence spending and thereby on regional inequality. This is indeed a serious point to consider: the traditional political theory highlights the failure of the majority-rule voting caused by the absence of a stable electoral equilibrium. As a result, political instability can create significant instability in product markets. This is where we apply the probabilistic voting theorem to highlight the existence of a stable voting equilibrium to establish that democratic political markets are well organised to promote the vote-maximising allocation of defence spending that will, in turn, lend stability to the product markets: the model predicts that the vote-maximising government adopts an optimal allocation of defence spending that induces an electoral equilibrium that, in turn, maximises its chances of re-election. However, the achievement of product market stability is accompanied with a regional inequality that can seriously destabilise a political system.

ECONOMIC GEOGRAPHY AND PEACE

Chapter 5 focused on the economics and politics of a regional economy that seeks to invite outside foreign firms to boost the regional growth. The theoretical model concludes that multiple equilibria can characterise the proposed privatisation game peopled with three types of agent – foreign firm, local firm and government. We establish two stable equilibria being

separated by an unstable one. We also demonstrate that only one of the stable equilibria entails Pareto-improving privatisation. This implies that foreign direct investment, which takes the post-privatisation outcome to this low level of equilibrium, is not sustainable. Investing below this unstable equilibrium will lead to a stable equilibrium where the Pareto-improving privatisation objectives are not met and therefore the system is not Pareto improved and some agents lose out who will subsequently clog the wheel of market forces. Therefore, in order to achieve Pareto-improving privatisation, the government needs to invest beyond this investment point for a stable and high-level equilibrium to be reached. If the post-privatisation outcomes homes in on this high-level equilibrium, foreign direct investment is sustainable since everyone gains from the entry by MNC/foreign firm into a privatised industry. It is very important to note that equilibrium will not occur in all cases. Simulation analysis determined the parameter ranges where equilibrium will occur and what level of government investment is required for the system to be Pareto improved. The corollary of this is that if there is disequilibrium in the system then no level of government investment will be adequate to enable Pareto-improved privatisation. This of course is a case that argues against privatisation because it will not lead to higher levels of income, efficiency and equity-sustainable foreign direct investment. The simulation analysis concluded that even if the system is Pareto improved through the two-tier game played by the domestic and foreign firm/MNC, and the foreign firm with the government, the system can easily become Pareto deficient with unfavourable movements in highly sensitive market and technology parameters. That is, even the government as a highly influential player in this game is unable to prevent Pareto deficiency in a system highly dependent on favourable market-driven input–output parameters.

TERRORISM: GLOBAL PEACE VIS-À-VIS REGIONAL PEACE

In Chapter 6, the fundamental idea that we seek to establish is that the establishment of regional, or local, peace calls forth global peace. In other words, our argument is that local and regional conflicts are partly driven by global factors, especially what is commonly known as international tension. In order to achieve meaningful and sustained peace, there is a reason to believe that it is mandatory to manage and contain international tensions. The main thesis of this chapter is to explain, or posit, conflicts as a product

of continuing international chasms, splits and differences of political and social ideologies in our modern world. Thus, we argue that conflicts are, to some extent, driven by international tension, or global, ideological and geo-political factors. Notwithstanding the global influence, local factors – such as income inequality, income growth or lack of it and political institutions – can and do exacerbate conflicts and a peaceful resolution of conflicts becomes a difficult phenomenon.

In order to drive our point home, we introduce a new index of conflict called the beta index. The purpose of this section is to understand how to evaluate and measure the risk of conflict for an individual country, which is linked to international tensions (see Abolfathi, 1978 for the concept). In other words, how to measure to what extend local conflict in a country is driven by international tension/global factors. Note that the beta index measures the relative variance of the country-specific terror asset I with respect to the return from the global portfolio of terror asset. If the beta value of a country is greater than 1, the country's terror activities, or conflicts, are more sensitive to the global terror activities. Hence, the country is more exposed to the global or international tension. On the contrary, if a country's beta value is less than 1, the country is less susceptible to international tension. In the following section, we try to capture the value of beta for several nations for which we have data by assuming the return from conflicts to a terror group being equal to actual victims from conflicts in the relevant country.

Our model therefore portrays conflicts as the following: there are several production units of terror attacks in each country of our world. The funding, logistics and technology are given by global financiers (or players) who are the relevant decision-makers in our model. Actual conflicts are carried out by foot soldiers – mostly as terror attacks or open insurgencies. These terror attacks by a unit can range from a simple demonstration to an actual warfare. The larger the casualty of an attack, the bigger is the return for the global financiers/decision-makers.

We offer the beta values of 92 nations for which we have data from 1970 to 2004. One can see over the period, India is the country that had the highest risk due to international ideological tension while New Zealand and Fiji had the lowest such risks. A few quick observations are in order: first, 57 (61%) out of 92 nations display violent conflicts due to international tension during 1970–2004. Their beta index has a value in excess of 1. Secondly, in the top end, we see countries from the developing world and Africa and countries with significant ethnic polarisation (like South Africa and Turkey). There is a reason to believe that their regional/internal conflicts

might have been exacerbated by international tensions. Possibly, the developing world became the region of contest between superpowers for influence peddling. Finally, it is interesting to note that in the bottom end, we have countries mainly from the developed world and also from the communist world where global tensions failed to reach because of their firm commitments to their respective ideologies, or because conflicts were kept at bay.

Examining the calculated figures one can glean a few quick observations: first, 47 (75%) out of 63 nations had a maximum beta during 1983–1991, while 16 countries experienced the opposite. Secondly, all the countries experienced a major change in their beta during 1983–1991. A possible reason behind might be that the Cold War between United States and USSR has reached its peak during 1983–1991 period of time. The Cold War was the modern era of rivalry, conflict and tension between the United States and the Soviet Union and their respective allies from the mid-1940s through to the early 1990s. We ask two questions to enquire the dynamic patterns of terrorism over time: do countries stay conflict-ridden over time? Do countries with little conflict stay conflict-free over time? Our main goal here is to see if the international tension remained static, or it changed its course. This is the notion of temporal fluctuations. In order to understand the dynamics of the international tension, we consider the beta values of 92 countries at three different points in time and measure the index of mobility of conflict that we can attribute to international tension. We have ranked 92 nations in a descending order in terms of their beta values in 1970 and 1983. The first deciles comprises the countries with the highest values of beta and the second deciles is composed of the next nine nations as ranked in terms the descending values of their beta. And we thus derive the countries of 10 deciles in 1970 and 1980. Then we construct the transition matrix by looking at the movement of countries from one decile to another. Let us look at the first row called Decile 1 in Table 6.6: in 1970–1982, there are nine countries in Decile 1 who had the largest values of beta. In 1983–1991, five countries out of these nine countries remained in Decile 1, while one moved to Decile 2, one to Decile 3, one to Decile 4 and one to Decile 5. No nations moved any further away from Decile 1.

What is important for us is the observation that the mobility index based on the transition matrix shows a mild decline of 1.47%. This has some message for us: during the full blast of the Cold War, the role of international tension was as high as the influence of international tension on conflicts during the post-Iraq war days. In the light of the beta mobility matrix of conflicts, one can argue that the role of international tension has

not changed much in determining the local/country-specific conflicts – subject to the limitations of the proposed measures.

In the subsequent conceptual model, the risk of conflicts due to international tension is considered a function of inequality, as well as of GDP growth, military expenditure, internationalisation index, political index and openness. The results indicate that the signs of the parameters are almost as hypothesised. Inequality, military expenditure increases beta. Moreover, GDP growth, internationalisation index and political index lower beta. Inequality and military expenditure have a positive coefficient and statistically significant with beta. A unit increase in inequality and military expenditure causes an increase in the level of intensity of conflicts by 4.28% and 19.82%, respectively. Conversely, GDP growth, internationalisation index and openness index negatively affect beta. A unit decrease in GDP growth, internationalisation index and openness index causes an increase in beta by 13.47%, 71.54% and 0.82%, respectively. This result is consistent with support that a lower growth rate would increase the risk of conflict, as individuals have less to lose from conflict in low-income situations. The period dummy variables Dum1 and Dum2 are statistically significant and have a positive coefficient which increases beta by 1.21 and 0.122, respectively. As for the fixed effect model, we find that there is a significant positive relation between beta and inequality. A one unit increase in inequality would result a decrease in beta by 6.5%. Beta decreases by 12.2%, 67.74% and 0.77% for a one unit increase in GDP growth, internationalisation index and openness index, respectively. On the other hand, a one unit decrease in military expenditure would cause a decrease in beta by 23.4%. Our main contention in the theoretical findings here is that local and regional factors create a ground for local agents to engage in conflicts to redress local problems. However, in their conflictual pursuits, local agents need help in terms of technology, logistics and funding either from friendly nations or international sources. The main goal of this section is to explain how such a partnership between local and international and also among local agents can take place.

Furthermore, this chapter offered a major theoretical model to explain how local conflicts can be created by international tension. We examine conflicts mainly in the context of violence perpetrated by terrorist groups. Ours will be a first model in understanding the economics of terrorist group formation in a competitive model. This model depends on the endogenous partnership formation between terrorist agencies/organisations across borders. The findings of the model explain how local and global issues of conflict can mix to give rise to an equilibrium conflict, which therefore has a

tendency to self-perpetuate. The model also explains the incentive structures of terrorist organisations and their sizes. Finally, we explained the possibility of endogenous-driven cyclical paths for conflicts and terrorist activities through developing a simple model of terror assets.

POVERTY, FOOD ENTITLEMENTS AND PEACE

In Chapter 7, we examine the role of food markets in creating local peace. We have steadfastly highlighted that violent conflicts and peace are the flip sides of the same coin of our societies. Many societies helplessly watch the continuation of violent that destroys economic and social assets and causes needless loss of human lives. This chapter argues that violent conflicts and food entitlements seem to bear mutual feedbacks:

- As violent conflicts often result in destruction of economic assets, conflicts usually tell upon the cultivation of foods, procurement and storage of foods and also the distribution and marketing of foods.
- The disruption in the agrarian sector can and does trigger severe food shortages through the decline in food availability and consequent famines, which can exacerbate and fuel further conflicts.
- On the other hand, an asymmetric distribution and local shortages, or non-availability, of foods can trigger violent conflicts in backward societies as a means to acquire and retain food entitlements, which can in turn jeopardise the agrarian equilibrium and regional peace.
- Thus, the relationship between food entitlements and conflicts are a double-edged sword that can lend precarious instability to a backward society.
- During the last five decades, governments in developing nations have kept a close vigil on their agrarian sector, yet there is a clear indication in the global economy that warns of a looming food crisis, especially in the poorer regions of our globe.
- Food crises can seriously challenge local peace and thereby feed on global peace. Conflicts and hunger are hence complex phenomena. This chapter provides a comprehensive, and possibly the first, study of the economics of food entitlements and potential threats of conflicts in the current conjuncture.

We examine the *strategic* aspects of 'shortages' created by speculative stockholdings of food items in developing nations. Speculators can affect the future food prices by withholding supply of current period. As a result,

speculators increase current profit by reducing current supply and, thereby, increase current price. Against this gain, the speculators make a loss by reducing the future price by increasing the stock that embodies future supply. Thus, there exists an optimal stock that achieves the optimal relative price (future price and current price ratio) that maximises the intertemporal profits of the speculators. Thus, if the market is unhindered, the speculators may significantly warp market prices to augment their profits by extracting larger consumer surplus. In protecting mainly the poor consumers from such intertemporal price discrimination, the governments in developing nations take active role in such markets. The governments attempt to engender a '*just price*' by manipulating market supplies through hoarding and dishoarding of stocks of food and imports of food. Thus, such a market is characterised by *circular interdependence* between the speculators and the government. The precise contribution of this chapter is to develop a game to endogenously determine the optimum level of speculative stockholdings as the equilibrium outcome of strategic interactions between the speculators and the government.

We model the equilibrium outcome of the food market in which the farmer–traders strategically hold stocks to distort market prices in their favour, while the government manipulates its own stocks and imports to keep the food price close to the 'desired level'. The equilibrium is characterised as a perfect Nash equilibrium of the proposed sequential game. This chapter establishes that such a market will be characterised by one of the four possibilities: in Case 1, there exist two equilibria – low-speculation and high-speculation equilibria. The low-speculation equilibrium is unstable, while the high-speculation equilibrium is stable. Thus, the government can only goad the market to the high-speculation equilibrium. Also note that there is nothing sacrosanct about the stability of the high-speculation equilibrium, since it depends on the relative steepness of the slopes of the reaction functions. This case is described in Diagram 7.1. In Case 2, the possibility of a unique and stable equilibrium is the best that the government can aspire to achieve. Case 3 highlights the possibility and consequent instability of the non-existence of a pure-strategy equilibrium. Case 4 highlights the possibility of three equilibria – two stable equilibria separated by an unstable one. In this case, any momentary deviation of speculation beyond the critical level will have a lasting impact on the food prices, levels of speculation and on the economy. Government mismanagement will also have similar deleterious long-run impact on the market and the economy. This chapter also establishes that the selection of equilibrium in such markets is hinged either on the expectations or the history. The

government plays a crucial role in stabilising volatile expectations and burst of speculative activities through its hoarding and dishoarding of food.

PEACE BY NEGOTIATIONS: PROBLEMS AND PROSPECTS

In Chapter 8, we examine the negotiation and peace processes. In order to understand the basic value of the work, let us start off with some recent flashpoints: the never-ending cycles of conflicts between Israel and the Palestinians has come to be viewed as a political problem requiring a political will to home in on a political solution. Historically, the strategies of peace process have dwelt on issues of land, governance and security. It is a moot point whether these political initiatives can lead to productive negotiations and a peace settlement. We posit that it would be erroneous to assume that they will establish a lasting peace. The main obstacle to a lasting peace is inter-country inequality and the cascading grievances that flow from the inequality. In other words, the long-term peace will falter as long as there will be a mass of poor people who will scan the pomp and glory of another nation across a border. In other words, unless we are successful in creating adequate opulence among the Palestinians, the peace will always be fragile between Israel and the Palestinians.

In such a situation, what we propose is to take a set of economic measures to promote economic progress of backward regions, which can bring losses to all involved parties in the short run. However, the virtue of peace can outweigh all pecuniary losses. What we ask for is a principle of sacrifices, which will act as the *just* price of peace. In the negotiation between Israel and the Palestinians, we can now introduce a third party – the representative of the international community. Let us call the representatives of these three groups as A, B and C. In the negotiation process, agent A representing Israel makes commitments to pump economic resources into the Palestinian regions, while agent B representing the Palestinians makes commitment to reduce intensity of violence and agent C commits to a special market access to the Palestinian firms. In the short run, none makes an economic gain as each strategy is costly for each party. It is also fraught with uncertainty as they do not know what will be the real outcome despite the firm commitments. What we propose is that it is possible to home in on an equilibrium choice that will equalise the relative loss to each party in the short-run and can pave the way for peace and prosperity in the long run.

If agents base their decisions on some reasonable axioms, the equilibrium can be easily enforced by the spontaneous formation of a grand coalition of all interested parties.

One can easily sense that what we propose has a historical precedent in the context of bloody conflicts between Japan and South Korea. Japan engendered a peaceful, mutually beneficial relationship only in the long run with a hostile South Korea by funding its poorer neighbour's economic development. Japan's history with South Korea has been fraught with violent conflicts, which is quite reminiscent of the current flashpoints in the Middle East and the South Asian regions. In simple terms, the Japanese and the Koreans have had deep, long-standing distrust and hostilities. Japan attacked and violently annexed Korea in 1910, which created simmering unrest in the occupied region. The continuing unrest prompted Japan to integrate Koreans into the Japanese culture. Towards this end, Japan, in the late 1930s before the Second World War, initiated a programme of cultural assimilation that lasted until Korea's liberation in 1945 by the allied troops.

This traumatic shared history could have acted as a deterrence for the peace process between Japan and Korea. Interestingly, with subsequent turning point in 1965, Japan and Korea buried all their past animosities and re-established diplomatic relations. The peace negotiations were driven by the following strategies, which turned the tide of animosity and hostility between Japan and South Korea.

- Japan made firm commitments to provide resources and capital for the industrialisation in South Korean.
- Japan committed to increase loans, investment and trade in South Korea.
- In the next iteration, Japanese industries formally began to shift labour-intensive tasks to South Korean companies.
- South Korea agreed to participate in a division of labour and markets.
- Japan concentrated on lucrative high-tech exports, South Korea focused on labour-intensive products.
- The Western nations allowed Japanese exporters to enter the lucrative Western market for high-tech products.
- The Western nations allowed South Korea to specialise in the low and intermediate technologies and created markets for their exports to developing nations.
- Japanese commitment to technological assistance to the South Koreans' steel and shipyard industries created the industrial linkages to make the South Korean economy became one of the Asian tigers.

The coalition of Japan, South Korea and the Western nations (mainly, the United States) unleashed a series of measures that erased the economic inequality off the region and gradually created an economic powerhouse in the region. A peaceful state of affairs in the region came from the initial costly steps. The main threat to such an end state of peace and shared prosperity lies in the internal dynamics that can thwart the peace process at any stage. Modern economic and game theories have offered a clear insight in the present context. On the theoretical front, the peace process faces an uphill task due to an incompatibility between the Coase theorem and the bargaining set stability, which has been modelled in terms of conflicts of interest amongst the negotiating agents. A grand coalition allocation fails to materialise if some agents receive higher joint payoffs from a sub-coalition. In such an event, the formation of a sub-coalition can block the grand coalition which yields a Pareto-efficient allocation. Such a formation of sub-coalition engenders an 'insider–outsider' problem which precipitates a conflict of interests. If two agents form a sub-coalition, third agent becomes an 'outsider'. Since agents do not know which coalition would survive, each agent now faces pure uncertainty whether other agents would 'gang up' against him or not. This fear of being an 'outsider' forces the agents to negotiate to reconcile their conflicting interests. A successful grand coalition, hence, hinges upon the resolution of these conflicts. The resolution of conflicts is shown to be feasible under a set of belief structures and in a specific bargaining process. It is further shown that such a grand coalition is possible if and only if agents use the principle of equal relative sacrifice while determining the actual allocation. We also derive a set of conditions which renders the principle of equal relative concession a rational choice for each negotiating agent. The upshot is that the Coase theorem and the stable bargaining set are compatible under the principle of equal relative concession, albeit under a set of conditions, wherefrom sustainable peace can emerge. A concrete example of a negotiated peace can be gleaned from the peace dynamics between Japan and South Korea.

BIBLIOGRAPHY

Abolfathi, F. (1978). Defence expenditure in the Persian Gulf, internal, interstate, and international factors in the Iraqi-Iranian arms race, 1950–1969. In: W. L. Hollist (Ed.), *Exploring competitive arms processes* (pp. 99–129). New York: Marcel.

Abreu, D. (1986). Extremal equilibria of oligopolistic supergames. *Journal of Economic Theory*, *39*, 191–225.

Acemoglu, D. (2003). Why not a political Coase theorem? Social conflict, commitment and politics. *Journal of Comparative Economics, 31*, 620–652.

Acemoglu, D., & Robinson, J. (2005). *Economic origins of dictatorship and democracy*. New York: Cambridge University Press.

Aivazian, V. A., Callen, J. L., & Lipnowski, I. (1987). The Coase theorem and coalitional stability. *Economica, 54*, 517–520.

Akerlof, G. (1980). A theory of social custom of which unemployment may be one consequence. *Quarterly Journal of Economics, 94*, 749–775.

Akerlof, G. A. (1976). The economics of castes and of the rat-race and other woeful tales. *Quarterly Journal of Economics, 90*(4), 599–617.

Alesina, A., Angeloni, I., & Etro, F. (2005). International Unions. *American Economic Review, American Economic Association, 95*(3), 602–615, June.

Alesina, A., Özler, S., Roubini, N., & Swagel, P. (1996). Political instability and economic growth. *Journal of Economic Growth, 1*, 189–212.

Alesina, A., & Rodrik, D. (1991). Distributive politics and economic growth. *Quarterly Journal of Economics, 109*, 465–490.

Alesina, A., Baqir, R., & Easterly, W. (1999). Public goods and ethnic divisions. *Quarterly Journal of Economics, 114*, 1243–1284.

Allais, M. (1953). Le Comportement de l'Homme Rationnel devant le Risque, Critique des Postulats et Axiomes de l'Ecole Americaine. *Econometrica, 21*(4), 503–546.

Armstrong, C. M., Cowan, S. G., & Vickers, J. S. (1994). *Regulatory reform, economic analysis and British experience*. Cambridge, MA: MIT Press.

Arrow, K., & Kurz, M. (1970). *Public investment, the rate of return, and optimal fiscal policy*. Baltimore, MD: Johns Hopkins University Press.

Atkinson, R. D. (1993). Defence spending cuts and regional impacts: An overview. *Economic Geography, 69*(2), 107–122.

Aumann, R. J. (1976). Agreeing to disagree. *Annals of Statistics, 4*, 1236–1239.

Aumann, R. J. (1989). *Lectures on game theory*. Boulder, CO: Westview Press.

Aumann, R. J., & Maschler, M. (1964). The bargaining set for cooperative games. In: M. Dresher, L. S. Shapely & A. W. Tucker (Eds), *Advances in game theory*. Princeton, NJ: Princeton University Press.

Aumann, R. J., & Peleg, B. (1960). Von Neumann-Morgenstern solutions to cooperative games without side payments. *Bulletin of the American Mathematical Society, 66*, 173–179.

Axelrod, R. (1990). The concept of stability in the context of conventional war in Europe. *Journal of Peace Research*, *27*(3), 247–254.

Azam, J. P. (2005). Can the peace be imported? Paper presented at a workshop at McGill University, Montreal, Canada, June 17.

Azam, J.-P., & Mesnard, A. (2001). Civil war and the social contract. Presented at the Royal Economic Society Annual Conference, Durham, 9–11 April.

Bagwell, K., & Ramey, G. (1991). Oligopoly limit pricing. *The RAND Journal of Economics*, *22*, 155–170.

Bailey, S. (1990). *Four Arab-Israeli wars and the peace process*. London: Macmillan.

Bain, J. S. (1956). *Barriers to competition*. Cambridge: Harvard University Press.

Baland, J. M. (1993). Foodgrain stocks and macroeconomic adjustment in a dual-semi industrialised economy. *Journal of Development Economics*, *41*, 171–185.

Baltagi, B. H. (1995). *Econometric analysis of panel data*. West Sussex, England: Wiley.

Bandiera, O. (2003). Land reform, the market for protection and the origins of the Sicilian Mafia: Theory and evidence. *Journal of Law, Economics and Organization*, *19*, 218–244.

Banerjee, A. V. (1992). A simple model of herd behavior. *Quarterly Journal of Economics*, *107*, 797–817.

Bardhan, P. K. (1984). *Land, labour and rural poverty*. New York: Columbia University Press.

Bardhan P. K., & Rudra, A. (1978). Interlinkage of land labour and credit relations. An analysis of village survey data in East India. *Economic and Political Weekly*, February.

Barro, R. (1990). Government spending in a model of endogenous growth. *Journal of Political Economy*, *98*, 103–125.

Barro, R. J. (1996). *Determinants of economic growth: A cross-country empirical study*. NBER Working Papers 5698. National Bureau of Economic Research.

Basu, K. (1983). The emergence of isolation and interlinkages in rural markets. *Oxford Economic Papers*, *34*, 1–18.

Basu, K. (1986). One kind of power. *Oxford Economic Papers*, *38*, 145–167.

Basu, K., & Bell, C. (1991). Fragmented duopoly: theory and applications to backward agriculture. *Journal of Development Economics*, *36*, 145–165.

Basu, K., & Singh, N. (1990). Entry-deterrence in Stackelberg perfect equilibrium. *International Economic Review*, *31*, 61–71.

Bates, R. (2001). *Prosperity and violence*. New York: Norton.

Battistelli, F. (1991). Regional and occupational dependence on defense contracting in the Rome area. In: L. Paukert & P. Richards (Eds), Defence expenditure, industrial conversion, and local employment (pp. 71–98).Geneva: International Labour Office.

Becker, G. S. (1991). A note on restaurant pricing and other examples of social influence on prices. *Journal of Political Economy*, *99*, 1109–1116.

Belleflamme, P. (2000). Stable coalition structure with open membership and asymmetric firms. *Games and Economic Behavior*, *30*, 1–12.

Benabou, R. (1993). Workings of a city. *Quarterly Journal of Economics*, *108*, 619–652.

Benhabib, J., & Day, R. H. (1980). Erratic accumulation. *Economics Letters*, *6*, 113–117.

Benhabib, J., & Day, R. H. (1982). A characterization of erratic dynamics in the overlapping generations model. *Journal of Economic Dynamics and Control*, *4*, 37–55.

Benoit, E. (1973). *Defence and economic growth in developing countries*. Lexington: Lexington Books.

Benoit, E. (1978). Growth and defence in developing countries. *Economic Development and Cultural Change*, *26*, 271–280.

Bernauer, T., Koubi, V., & Ernst, F. (2009). National and regional consequences of Swiss defence spending. *Journal of Peace Research*, forthcoming.

Bernheim, D. (1994). A theory of conformity. *Journal of Political Economy*, *102*, 841–877.

Besley, T., & Persson, T. (2007). *War and state capacity manuscript*. London: London School of Economics.

Bevan, P. (2004). Conceptualising insecurity regimes. In: I. Gough & G. Wood (Eds), *Insecurity and welfare regimes in Asia, Africa and Latin America: Social policy in developing contexts* (pp. 88–118). Cambridge: Cambridge University Press.

Bhaduri, A. (1973). A study in agricultural backwardness under semi-feudalism. *Economic Journal*, *75*, 23–42.

Bhattacharya, R. (2003). Sources of variations in regional economies. *The Annals of Regional Science*, *37*, 291–302.

Bikhchandani, S., Hirshleifer, D., & Welch, I. (1992). A theory of fads, fashion, customs and cultural change as informational cascades. *Journal of Political Economy*, *100*(5), 992–1026.

Binmore, K. (1988). Modelling rational players. *Economics and Philosophy*, *3*, 179–214.

Bishop, P. (1992). *The impact of Devonport Dockyard/Naval Base on the economy of Devon and Cornwall*, mimeo. South West Economic Research Center, Polytechnic South West, Plymouth.

Bloch, F. (1995). Endogenous structure of associations in oligopoly. *The RAND Journal of Economics*, *26*, 537–555.

Bonanno, G. (1987). Location choice, product proliferation and entry deterrence. *Review of Economic Studies*, *54*, 37–45.

Bös, D. (1994). *Pricing and price regulation: An economic theory of public enterprise and public utilities* (3rd ed.). New York: Elsevier Science; North Holland.

Bourguignon, F., & Morrison, C. (1998). Inequality and development: The role of dualism. *Journal of Development Economics*, *57*, 233–257.

Bowles, S. (1999). Social capital and community governance. *Focus*, *20*, 6–10.

Bowles, S., & Gintis, H. (1988). Contested exchange, political economy and modern economic theory. *American Economic Review*, *78*, 145–150.

Boycko, M., Shleifer, A., & Vishny, R. W. (1996). A theory of privatisation. *Economic Journal*, *106*, 309–319.

Braddon, D. (1995). The regional impact of defense expenditure. In: K. Hartley & T. Sandler (Eds), *Handbook of defense economics* (pp. 491–521). Amsterdam: Elsevier.

Brander, J., & Spencer, B. (1983). Strategic commitment with R&D: The symmetric case. *Bell Journal of Economics*, *14*, 225–235.

Brander, J., & Spencer, B. (1985). Export subsidies and international market share rivalry. *Journal of International Economics*, *18*, 83–100.

Braverman, A., & Srinivasan, T. N. (1981). Credit and sharecropping in agrarian societies. *Journal of Development Economics*, *9*, 289–312.

Braverman, A., & Stiglitz, J. E. (1982). Sharecropping and the interlinking of agrarian markets. *American Economic Review*, *72*, 695–715.

Bresnahan, T. (1982). Duopoly models with consistent conjectures. *American Economic Review*, *71*, 934–945.

Brito, D., & Intriligator, M. (1995). Arms race and proliferation. In: K. Hartley & T. Sandler (Eds), *Handbook of defense economics* (pp. 130–161). Amsterdam: Elsevier.

Brito, D., & Intriligator, M. (2000). Arms race. *Defense and Peace Economics*, *11*, 45–54.

Brown, B. (2000). *Comparative politics, notes and readings*. Fort Worth, TX: Harcourt College Publishers.

Bruno, M., Ravallion, M., & Squire, L. (1995). *Equity and growth in developing countries: Old and new perspectives on the policy issues*. World Bank Working Papers in Macroeconomics and Growth no. 1563.

Bulow, J. J., Geanakoplos, J. D., & Klemperer, P. D. (1985). Multimarket oligopoly, strategic substitutes and complements. *Journal of Political Economy*, *93*, 488–511.

Caselli, F., & Cunningham, T. (2007). Political decision making in resource abundant countries. Paper presented at the 2007 Oxcarre Launch Conference, Oxford. Available at: http://www.oxcarre.ox.ac.uk

Chatterji, K., Dutta, B., Ray, D., & Sengupta, K. (1993). A non-cooperative theory of coalitional bargaining. *Review of Economic Studies*, *60*, 463–477.

Cobban, A. (1934). *Rousseau and the modern state*. London: Allen & Unwin.

Coleman, J. (1987). Norms as social capital. In: G. Radnitzky & P. Bernholtz (Eds), *Economic imperialism, the economic approach applied outside economics*. New York: Paragon House.

Collier, P., & Hoeffler, A. (1998). On economic causes of civil war. *Oxford Economic Papers*, *50*, 563–573.

Collier, P., & Hoeffler, A. (2002a). On the incidence of civil war in Africa. *Journal of Conflict Resolution*, *46*, 13–28.

Collier, P., & Hoeffler, A. (2002b). *Greed and grievance in civil wars*. Working Paper, Centre for the Study of African Economies, Oxford, WPS 2002-01.

Cooper, R., & Haltiwanger, J. (1996). Evidence on macroeconomic complementarities. *Review of Economic and Statistics*, *78*, 78–93.

Cooper, R., & John, A. (1988). Coordinating coordination failures in Keynesian models. *Quarterly Journal of Economics*, *103*, 441–463.

Crampton, P. (1984). Bargaining with incomplete information: An infinite horizon model with continuous uncertainty. *Review of Economic Studies*, *51*, 571–594.

Crawford, V. (1982). A theory of disagreement in bargaining. *Econometrica*, *50*, 607–631.

Day, R. H. (1982). Irregular growth cycles. *American Economic Review*, *72*, 406.

Day, R. H. (1983). The emergence of chaos from classical economic growth. *Quarterly Journal of Economics*, *98*, 202–215.

Day, R. H. (1994). *Complex economic dynamics*. Cambridge, MA: MIT Press.

Deininger, K., & Squire, L. (1998). New ways of looking at old issues, inequality and growth. *Journal of Development Economics*, *57*, 259–287.

Desai, M. (1984). Powers and agrarian relations, some concepts and measurements. In: M. Desai, S. H. Rudolph & A. Rudra (Eds), *Agrarian power and agricultural productivity in South Asia*. New Delhi: Oxford University Press.

Diamond, P. A. (1982). Aggregate demand management in search equilibrium. *Journal of Political Economy*, *90*, 881–894.

Dixit, A. (1984). International trade policy for oligopolistic industries. *Economic Journal*, *94*(Suppl.), 1–16.

Dixit, A. (2004). *Lawlessness and economics, alternative modes of governance*. Princeton, NJ: Princeton University Press.

Dixit, A., & Grossman, G. (1986). Targeted export promotion with several oligopolistic industries. *Journal of International Economics*, *21*, 233–249.

Dixit, A., & Londregan, J. (1994). The determinants of success of special interests in redistributive politics, mimeo, Princeton University.

Dixit, A. K. (1980). The role of investment in entry deterrence. *Economic Journal, 90*, 95–106.

Dixon, H. (1985). Strategic investment with competitive product markets. *Journal of Industrial Economics, 33*, 483–500.

Dixon, H. (1986). Strategic investment with consistent conjectures. *Oxford Economic Papers, 38*, 111–128.

Donahue, J. D. (1998). *The privatisation decision, public end, private means.* New York: Basic Books.

Doppelhofer, G., Miller, R., & Sala-I-Martin, X. (2004). Determinants of long-term growth: A Bayesian averaging of classical estimates (BACE) approach. *American Economic Review, 94*, 813–835.

Dréze, J., & Sen, A. K. (1990). *Hunger and public action.* Oxford: Clarendon Press.

Dunne, P., & Smith, R. (1990). Military expenditure and unemployment in the OECD. *Defence Economics, 1*, 57–73.

Dunne, P., Smith, R. P., & Willenbockel, R. (2005). Models of military expenditure and growth: A critical review. *Defence and Peace Economics, 6*, 449–461.

Durlauf, S. (1999). The case against social capital. *Focus, 20*, 1–5.

Dutt, A. K. (1982). Essays on growth and income distribution in an underdeveloped economy. Ph.D. Dissertation, MIT, Cambridge, MA.

Dutt, A. K. (1986). Stock equilibrium in flexprice markets in macro models for LDCs. *Journal of Development Economics, 21*, 89–110.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy, policies and ethnic divisions. *Quarterly Journal of Economics, 12*, 1203–1250.

Eaton, J., & Grossman, G. (1986). Optimal trade and industrial policy under oligopoly. *Quarterly Journal of Economics, 101*, 383–406.

Elbadawi, I., & Sambanis, N. (2002). Why are there so many civil wars in Africa? Understanding and preventing violent conflict. *Journal of African Economies, 9*, 244–269.

Enders, W., Parise, G., & Sandler, T. (1992). A time-series analysis of trans-national terrorism, trends and cycles. *Defense Economics, 3*, 305–320.

Enders, W., & Sandler, T. (2000). Is trans-national terrorism becoming more threatening? A time-series investigation. *Journal of Conflict Resolution, 44*, 307–332.

Enelow, J. M., & Hinich, M. (1984). *The spatial theory of voting: An introduction.* Cambridge: CUP.

Esping-Andersen, G. (1990). *Three worlds of welfare capitalism.* Cambridge: Polity Press.

Esping-Andersen, G. (1999). *Social foundations of postindustrial economies.* Oxford: Oxford University Press.

Fafchamps, M. (2004). *Market institutions in Sub-Saharan Africa: Theory and evidence.* Cambridge, MA: MIT Press.

Faria, J. R. (2003). Terror cycles. *Studies in Nonlinear Dynamics and Econometrics, 7*, 20–31.

Farrell, J., & Scotchmer, S. (1988). Partnerships. *Quarterly Journal of Economics, 103*, 279–297.

Feigenbaum, M. J. (1978). Quantitative universality for a class of non-linear transformations. *Journal of Statistical Physics, 19*, 25–31.

Fields, G., & Ok, O. (1919). The measurement of income mobility: An introduction to the literature. In: A. Jacques (Ed.), *Handbook on income inequality measurement* (pp. 553–597). Boston: Kluwer.

Flaherty, M. T. (1980). Dynamic limit pricing, barriers to entry, and rational firms. *Journal of Economic Theory*, *23*, 160–182.

Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *American Economic Review*, *90*, 869–887.

Fox, K., & Milbourne, R. (1999). What determines research output of academic economists? *Economic Record*, *75*, 256–267.

Friedman, J. W. (1979). On entry preventing behaviour. In: S. J. Brams (Ed.), *Applied game theory* (pp. 236–253). Vienna: Verlag.

Friedman, J. W. (1983). Limit price entry prevention when information is lacking. *Journal of Economic Dynamics and Control*, *5*, 187–199.

Friedman, J. W. (1986). *Game theory with applications to economics*. New York: Oxford University Press.

Friedman, J. W. (1991). The "Folk" theorem and continuous reaction function: A synthesis. In: K. J. Arrow (Ed.), *Issues in contemporary economics* (pp. 121–136). London: Macmillan.

Fudenberg, D., & Tirole, J. (1983). Capital as a commitment, strategic investment to deter mobility. *Journal of Economic Theory*, *31*, 227–250.

Fujita, M. (2005). *Spatial economics*. In: International Library of Critical Writings in Economics (Chap. 20, Vol. 1, pp. 233–256). Cheltenham: Edward Elgar.

Fujita, M., & Krugman, P. (2004). The new economic geography: Past, present and the future. *Papers in Regional Science*, *83*, 139–164.

Fujita, M., & Mori, T. (2005). Frontiers of the new economic geography-super-. *Papers in Regional Science*, *84*(3), 377–405.

Furth, D. (1986). Stability and instability in oligopoly. *Journal of Economic Theory*, *40*, 197–228.

Gambetta, D. (1993). *The Sicilian Mafia: The business of private protection*. Cambridge, MA: Harvard University Press.

Gangopadhyay, P. (1997). Differential profit rates and convergence to the natural state. *Manchester School*, *LXV*(5), 534–568.

Gangopadhyay, P. (1999). On the feasibility of interest rate control: The role of disequilibrium and adaptive learning. *Metroeconomica*, *50*(1), 87–117.

Gangopadhyay, P. (2000). Coase theorem and coalitional stability: The principle of equal relative concession. *Theory and Decision*, *49*, 179–191.

Gangopadhyay, P. (2002). Politics and nature of competition in oligopolistic markets. In: A. Woodland (Ed.), *Economic theory and international trade: Essays in honour of Murray Kemp* (pp. 236–243). Cheltenham: Edward Elgar.

Gangopadhyay, P. (2004). Strategic manipulation and information market microstructure. *Australian Economic Papers*, *43*, 75–86.

Gangopadhyay, P. (2005). Chaotic discrimination and non-linear dynamics. *American Journal of Applied Sciences*, *2*, 440–442.

Gangopadhyay, P., & Chatterji, M. (2005). *Economics of globalisation*. Aldershot: Ashgate.

Gangopadhyay, P., & Nath, S. (2001). Bargaining, coalitions and local expenditure. *Urban Studies*, *38*(13), 2379–2391.

Gangopadhyay, P., & Sengupta, K. (1987). Small farmers, moneylenders and trading activity. *Oxford Economic Papers*, *39*, 333–342.

Gangopadhyay, S., & Sengupta, K. (1986). Interlinkages in rural markets. *Oxford Economic Papers*, *38*, 112–121.

Garfinkel, M. R. (1994). Domestic politics and international conflict. *American Economic Review*, *84*, 1294–1309.

Gaskins, D. W. (1971). Dynamic limit pricing, optimal pricing under threat of entry. *Journal of Economic Theory*, *42*, 306–322.

Gilbert, R., & Vives, X. (1986). Entry deterrence and free rider problem. *Review of Economic Studies*, *53*, 71–83.

Gillies, D. B. (1959). Solutions to general non-zero sum game. *Annals of Mathematical Studies*, *40*, 47–85.

Gough, I., & Wood, G. (2004). *Insecurity and welfare regimes in Asia, Africa and Latin America: Social policy in developing contexts* (Introduction, pp. 1–11). Cambridge: Cambridge University Press.

Greif, A. (1993). Contract enforceability and economic institutions in early trade: The Maghribi traders coalition. *American Economic Review*, *83*, 525–548.

Greif, A. (1994). Cultural beliefs and the organization of society: A historical and theoretical reflection on collectivist and individualist societies. *Journal of Political Economy*, *102*, 912–950.

Greene, W. H. (1997). *Econometric analysis* (3rd ed.). New York: Prentice-Hall.

Grossman, H. I. (1991). A general equilibrium model of insurrections. *American Economic Review*, *81*, 912–921.

Grossman, H. I. (1994). Production, appropriation and land reform. *American Economic Review*, *84*, 705–712.

Grossman, H. I. (1998). Producers and predators. *Pacific Economic Review*, *3*, 169–187.

Grossman, H. I. (2004). *Peace and war in territorial disputes*. NBER Working Paper no. 10601.

Gurr, T. (1970). *Why men rebel?* Princeton, NJ: Princeton University.

Guth, W., & Selten, R. (1991). Majority voting in a Condorcet Paradox as a problem of equilibrium selection. In: R. Selten (Ed.), *Games equilibrium models* (Vol. IV, pp. 9–25). New York: Springer-Verlag.

Haavelmo, T. (1954). *A study in the theory of economic evolution*. Amsterdam: North Holland.

Hargreaves Heap, S., & Varoufakis, Y. (2002). Some experimental evidence on the evolution of discrimination, cooperation and perception of fairness. *Economic Journal*, *112*, 697–703.

Harrington, J. E. (1986). Limit pricing when the potential entrant is uncertain about its cost functions. *Econometrica*, *54*, 429–437.

Harrington, J. E. (1987). Oligopolistic entry deterrence under incomplete information. *The RAND Journal of Economics*, *18*, 211–229.

Harsanyi, J. (1961). On the rationality postulates underlying the theory of cooperative games. *Journal of Conflict Resolution*, *5*, 179–196.

Harsanyi, J. C. (1966). A general theory of rational behaviour in game situations. *Econometrica*, *34*, 613–634.

Harsanyi, J. C. (1974). An equilibrium-point interpretation of stable sets and a proposed alternative definition. *Management Science*, *20*, 1472–1495.

Harsanyi, J. C. (1977). *Rational behaviour and bargaining equilibrium in games and social institutions*. Cambridge: Cambridge University Press.

Hegre, H., Ellingsen, T., Gates, S., & Petter Gleditsch, N. (2001). Toward a democratic civil peace? Democracy, political change, and civil war, 1816–1992. *American Political Science Review*, *95*, 33–48.

Hirsch, F. (1977). *Social limits to growth*. London: Routledge.

Hirshleifer, J. (1988). The analytics of continuing conflict. *Synthese Journal*, *76*, 201–233.

Hirshleifer, J. (1989). Conflict and rent-seeking success functions, ratio vs. difference models of relative success. *Public Choice*, *63*, 101–112.

Hirshleifer, J. (1991). The paradox of power. *Economics and Politics*, *3*, 177–200.

Hirshleifer, J. (1995a). Anarchy and its breakdown. *Journal of Political Economy*, *103*, 27–52.

Hirshleifer, J. (1995b). Theorizing about conflict. In: K. Hartley & T. Sandler (Eds), *Handbook of defense economics* (pp. 165–189). Amsterdam: Elsevier.

Hirshleifer, J. (2000). The macro-technology of conflict. *Journal of Conflict Resolution*, *44*, 773–792.

Hollis, M. (1987). *The cunning of reason*. Cambridge: Cambridge University Press.

Holt, C. (1982). An experimental test of the consistent-conjectures hypothesis. In: A. Daughety (Ed.), *Cournot oligopoly characterizations and applications* (pp. 179–200). Cambridge: Cambridge University Press.

Hommes, C. H. (1991). Adaptive learning and roads to chaos: The case of the cobweb. *Economics Letters*, *36*, 127–132.

Hommes, C. H. (1993). Periodic, almost periodic and chaotic behaviour in Hicks Non-Linear Trade Cycle model. *Economics Letters*, *41*, 391–397.

Hooker, M. A., & Knetter, M. A. (1997). The effects of military spending on economic activity: Evidence from state procurement spending. *Journal of Money Credit and Banking*, *29*, 400–421.

Horn, H., & Persson, L. (2001). Endogenous mergers in concentrated markets. *International Journal of Industrial Organization*, *53*, 307–333.

Huck, B. J. (1991). The regional and occupational dependence on defence contracting in the Greater Munich Area. In: L. Paukert & P. Richards (Eds), *Defence Expenditure, Industrial Conversion, and Local Employment* (pp. 51–70). Geneva: International Labour Office.

Humphreys, M. (2005). Natural resources, conflict and conflict resolution: Uncovering the mechanisms. *Journal of Conflict Resolution*, *49*, 508–537.

Intriligator, M. D., & Britto, D. L. (1985). Heuristic decision rules, the dynamics of arms race, and war initiation. In: U. Luterbacher & M. Ward (Eds), *Dynamic models of international conflict* (pp. 133–160). Boulder, CO: Lynne Rienner.

Isard, W., & Azis, I. J. (1999). A cooperative analysis procedure for use by diplomats and negotiators, with a proposed step for resolving conflict on the Korean Peninsula. *Peace Economics, Peace Science, and Public Policy*, *5*, 1–22.

Isard, W., & Chung, Y. (2000). A proposal for North/South Korea cooperation that proved effective: A plea for more multi-analytic approaches in conflict management. *Peace Economics, Peace Science and Public Policy*, *6*, 1–11.

Jarvis, S., & Jenkins, S. (1998). How much income mobility is there in Britain? *Economic Journal*, *108*, 428–443.

Jensen, R. V., & Urban, R. (1984). Chaotic price behaviour in a Non-Linear Cobweb Model. *Economics Letters*, *15*, 235–240.

Justino, P. (2006). *On the links between violent conflict and chronic poverty: How much do we really know?* HCN Working Paper no. 18, Institute of Development Studies, University of Sussex.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*, 263–291.

Kalai, E., & Smorodinsky, D. (1975). Other solutions to Nashs bargaining problem. *Econometrica*, *43*, 413–418.

Kaldor, M. (2001). *New and old wars: Organised crime in a global era*. Cambridge: Polity Press.

Kaldor, N. (1940). A model of trade cycle. *Economic Journal*, *50*, 78–92.

Kalecki, M. (1971). *Costs and prices, in selected essays on the dynamics of capitalist economy, 1933–1970*. Cambridge: Cambridge University Press.

Kamien, M., Muller, E., & Zang, I. (1992). Research joint ventures and Rand D cartels. *American Economic Review*, *82*, 1293–1306.

Kamien, M. I., & Schwartz, N. L. (1971). Limit pricing and uncertain entry. *Econometrica*, *39*, 441–454.

Kamien, M. I., & Schwartz, N. L. (1983). Conjectural variations. *Canadian Journal of Economics*, *16*, 191–211.

Kant, I. (1795). Perpetual Peace, A Philosophical Sketch available at the Constitution Society, Great Books and Classics, http://www.grtbooks.com/exitfram.asp?idx = 0&yr = 1724&aa = MA&at = J&ref = kant&URL = http://www.constitution.org/kant/perpeace.txt

Karl, T. (1995). The hybrid regime of Central America. *Journal of Democracy*, *6*, 72–86.

Katz, M. L., & Shapiro, C. (1985). Network externalities, competition and compatibility. *American Economic Review*, *75*, 424–440.

Kay, J. A., & Thompson, D. J. (1986). Privatisation: A policy in search of a rationale. *Economic Journal*, *96*, 18–32.

Keefer, P. (2004). What does political economy tell us about economic development – And vice versa? *Annual Review of Political Science*, *7*, 247–272.

Keynes, J. M. (1978) [1921]. Sunday Times. 11 September 1921, p. 271. In: E. Johnson & D. Moggridge (Eds), *Collected Writings of J.M. Keynes*, Vol. 17. Cambridge: Cambridge University Press and the Royal Economic Society.

Keynes, J. M. (1982) [1934]. The New Statesman and Nation, 10 November 1934, p. 34. In: E. Johnson & D. Moggridge (Eds), *Collected Writings of J.M. Keynes*, Vol. 28. Cambridge: Cambridge University Press and The Royal Economic Society.

Klemperer, P. D. (1987a). Markets with consumer switching costs. *Quarterly Journal of Economics*, *102*, 375–394.

Klemperer, P. D. (1987b). The competitiveness of markets with switching costs. *The RAND Journal of Economics*, *18*, 138–150.

Kikeri, S., Nellis, J., & Shirley, M. (1992). *Privatisation: The lessons of experience*, World Bank, No. 86, Washington, DC.

Knauss, R. L. (1988). Corporate governance – A moving target. *The Michigan Law Review*, *79*, 478–500.

Kopel, M. (1996). Simple and complex adjustment dynamics in Cournot duopoly models. *Chaos, Solitons and Fractals*, *7*, 2031–2048.

Krugman, P. (1991a). Increasing returns and economic geography. *Journal of Political Economy*, *99*(3), 483–499.

Krugman, P. (1991b). *Geography and trade*. Cambridge, MA: MIT Press.

Krugman, P. (1992). History or expectations. *Quarterly Journal of Economics*, *CVI*, 650–667.

Kuran, T. (1989). Sparks and prairie fires: A theory of unanticipated political revolution. *Public Choice*, *61*, 41–74.

LaFree, G., & Tseloni, A. (2006). Democracy and crime: A multilevel analysis of homicide trends in forty-four countries, 1950-2000. *Annals of the American Academy of Political and Social Science*, *605*, 26–49.

Laitner, J. (1980). Rational duopoly equilibria. *Quarterly Journal of Economics*, *95*, 641–662.

Lazear, E. P. (1999a). Culture and language. *Journal of Political Economy*, *107*(6), S95–S126.

Lazear, E. P. (1999b). Globalization and the market for team-mates. *Economic Journal*, *109*, C15–C40.

Li, J. S. (2003). Relation-based versus rule-based governance: An explanation of the East Asian miracle and Asian crisis. *Review of International Economics*, *11*, 651–673.

Lindbeck, A., & Weibull, J. (1987). Balanced budget redistribution as the outcome of political competition. *Public Choice*, *54*, 273–297.

Lipset, S. (1960). *Political man: The social basics of politics*. New York: Doubleday.

Lopez de Silanes, F. (1993). *Determinants of privatisation prices,* Harvard University, mimeo.

Marshak, T., & Nelson, R. (1962). Flexibility, uncertainty, and economic theory. *Metroeconomica*, *14*, 42–58.

Martin, P., & Rogers, C. A. (1995). Industrial location and public infrastructure. *Journal of International Economics*, *39*, 335–351.

Matthews, S. A., & Mirman, L. J. (1983). Equilibrium limit pricing: The effects of private information and stochastic demand. *Econometrica*, *51*, 981–996.

Matutes, C., & Padilla, J. (1994). Shared ATM networks and banking competition. *European Economic Review*, *38*, 1113–1138.

May, R. M. (1976). Simple mathematical models with very complicated dynamics. *Nature*, *261*, 459–467.

Mehay, S. L., & Solnick, L. M. (1990). Defence spending and state economic growth. *Journal of Regional Science*, *30*, 477–487.

Mellor, J., & Dar, A. (1968). Determinants and development implications of foodgrain prices in India, 1949-64. *American Journal of Agricultural Economics*, *50*, 962–974.

Miguel, E., Satyanath, S., & Sergenti, E. (2004). Economic shocks and civil conflict: An instrumental variable approach. *Journal of Political Economy*, *112*, 725–753.

Milgrom, P., & Roberts, J. (1982). Equilibrium limit pricing and entry under incomplete information: An equilibrium analysis. *Econometrica*, *50*, 443–460.

Minier, J. A. (1998). Democracy and growth: Alternative approaches. *Journal of Economic Growth*, *3*(3), 241–266.

Mishra, A. (1994). Clientelization and fragmentation in backward agriculture: Forward induction and entry deterrence. *Journal of Development Economics*, *45*, 271–285.

Mitra, P. K. (1983). A theory of interlinked rural transactions. *Journal of Public Economics*, *20*, 169–191.

Modigliani, F. (1956). New developments on the oligopoly front. *Journal of Political Economy*, *66*, 215–232.

Moyersoen, J. (2006). *On joint local satisficing actions for conflict resolution: The case of the conflict in Nepal*, mimeo, Oxford University.

Mueller, W. (1989). Antitrust in a planned economy: An anachronism or an essential complement? In: J. Warren (Ed.), *State, society and corporate power* (pp. 285–305). Oxford: Transaction.

Murshed, M., & Cuesta, J. (2008). *The micro-foundations of social contracts, civil conflicts and international peace-making, MICROCON research*. Working Paper no. 8, Brighton, MICROCON.

Neri, F., & Rodgers, J. R. (2006). Ranking Australian economics departments by research productivity. *Economic Record*, *82*(Special issue), S74–S84.

Newbery, D. M. (1975). Tenurial obstacles to innovation. *Journal of Development Studies*, *11*, 112–134.

Newman, J. (1957). The Lisbon earthquake. *Scientific American*, *July*, CXCVII.

Newman, P. (1961). Approaches to stability analysis. *Economica, 28*, 12–29.

Ostrom, V. (1987). *The political theory of compound republic*. Nebraska: University of Nebraska.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge, UK: Cambridge University Press.

Østby, G. (2008). Polarization, horizontal inequalities and violent civil conflict. *Journal of Peace Research, 45*, 143–162.

Palley, T. I. (1995). Safety in numbers: A model of managerial herd behavior. *Journal of Economic Behavior and Organization, 28*, 443–445.

Pareto, V. (1992) [1887]. *Libre-échangisme, protectionnisme et socialisme*. Geneva: Librairie Droz.

Peleg, B. (1963). Existence theorem for the bargaining set M(i). *Bulletin of the American Mathematical Society, 60*, 109–110.

Persson, T. (2005). *Forms of democracy, policy, and economic development*. Working Paper no. 11171, Cambridge, MA: NBER.

Perry, M. K. (1982). Oligopoly and consistent conjectural variations. *Bell Journal of Economics, 13*, 197–205.

Pigou, A. C. (1921). *The political economy of war* (New and revised edition). New York: Macmillan.

Polanyi, K. (1944). *The great transformation: The political and economic origins of our time*. Boston, MA: Beacon Press.

Pomfret, R. (2007). Why do Australian universities fare so poorly in international rankings? Evidence from economics departments and some hypothesis. *Economic Papers, 38*, 1–21.

Pomfret, R., & Wang, L. C. (2002). *Research productivity of Australian economists*. Working Paper, Adelaide University.

Putnam, R. (1993). The prosperous community: social capital and public life. *The American Prospect, 13*, 35–42.

Puu, T. (1998). The chaotic duopolists revisited. *Journal of Economic Behavior and Organization, 33*, 385–394.

Pyatt, G. (1971). Profit maximization and threat of new entry. *Economic Journal, 81*, 242–255.

Rakshit, M. (1982). *The labour surplus economy*. New Delhi: Macmillan.

Rattinger, H. (1975). Armaments, détente and bureaucracy: The case of the arms race in Europe. *Journal of Conflict Resolution, 19*, 571–595.

Ravallion, M. (1987). *Markets and famines*. Oxford: Clarendon Press.

Ravallion, M. (1995). Growth and poverty: Evidence for developing countries in the 1980s. *Economic Letters, 48*, 411–417.

Reuveny, R., & Maxwell, J. W. (2001). Conflict and renewable resources. *Journal of Conflict Resolution, 45*, 742.

Reynolds, P. (1987). *Political economy: A synthesis of Kaleckian and post Keynesian economics*. New York: St. Martins Press.

Richardson, H. W. (2004). *The impacts of globalization on urban development*. Heidelberg: Springer.

Richardson, L. F. (1960). *Arms and insecurity: A mathematical study of the causes and origins of war* (written in 1919 and published in 1960). Pittsburgh: Boxwood Press.

Robbins, L. (1939). *The economic causes of war*. London: Jonathan Cape.

Roth, A. (1979). *Axiomatic models of bargaining*. New York: Springer-Verlag.

Rothchild, D. (2005). Reassuring weaker parties after civil wars: The benefits and costs of executive power-sharing systems in Africa. *Ethnopolitics, 4*, 247–267.

Rousseau, J. J. (1964). *The first and second discourses*. In: R. D. Masters (Ed.). New York: St Martins Place.

Rub, F. W. (2002). Hybrid regimes. In: W. Friedbert (Ed.), *Zwischen demokratie und Diktatur* (pp. 93–115). Berlin: Opladen.

Rubinstein, A. (1982). Perfect equilibrium in a bargaining model. *Econometrica*, *50*, 97–109.

Rubinstein, A. (1988). Similarity and decision-making under risk (is there a utility theory resolution to the Allais paradox?). *Journal of Economic Theory*, *46*, 145–153.

Rubinstein, A. (1991). Comments on the interpretation of game theory. *Econometrica*, *59*, 909–924.

Rudra, A. (1982). *Indian agricultural economics: Myth and realities*. New Delhi: Allied Publisher.

Rudra, A. (1984). Local power and farm level decision making. In: M. Desai, et al. (Eds), *Agrarian power and agricultural productivity in South Asia* (pp. 23–46). Delhi: Oxford University Press.

Saari, D. G. (1996). The ease of generating chaotic behaviour in economics. *Chaos, Solitions and Fractals*, *7*, 2267–2278.

Saaty, T. (1990). How to make a decision: The Analytical Hierarchy Process. *European Journal of Operational Research*, *48*, 9–26.

Sah, R. K., & Stiglitz, J. E. (1986). The economics of price scissors. *American Economic Review*, *76*, 125–138.

Salop, S. C. (1979). Strategic entry deterrence. *American Economic Review*, *81*, 242–255.

Sambanis, N. (2002). What is a civil war? Conceptual and empirical complexities of an operational definition, unpublished manuscript, Yale University.

Samuelson, P. A. (1954). The transfer problem and transport costs, II: Analysis of effects of trade impediments. *Economic Journal*, *64*, 264–289.

Sanyal, A. (1995). Credit and price determination in a developing economy. *Journal of Post-Keynesian Economics*, *39*, 24–43.

Schelling, T. (1960). *The strategy of conflicts*. Cambridge, MA: Harvard University Press.

Sen, A. K. (1983). *Poverty and famines: An essay on entitlements and deprivation, chapters 4 and 5*. Oxford: Oxford University Press.

Sen, A. K. (1984). The profit motive. In: A. K. Sen (Ed.), *Resources, values and development* (pp. 90–110). Oxford: Basil Blackwell.

Shapiro, C. (1989). Theories of oligopoly behavior. In: R. Schamalensee & R. Willig (Eds), *Handbook of industrial organization* (pp. 329–414). Amsterdam: Elsevier.

Shapley, L. S., & Shubik, M. (1969). On the core of an economic system with externalities. *American Economic Review*, *59*, 678–684.

Skaperdas, S. (1992). Cooperation, conflict and power in the absence of property rights. *American Economic Review*, *82*, 720–739.

Simon, H. A. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*, *69*, 99–118.

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review*, *63*, 129–138.

Shorrocks, A. (1978). Income inequality and income mobility. *Journal of Economic Theory*, *19*, 376–393.

Smith, V. (1991). Testing Vickerys English auctions. In: R. Mark Isaac (Ed.), *Research in experimental economics* (Vol. 4). Greenwich, CT: JAI Press.

Stewart, F. (2000). Crisis prevention: Tackling horizontal inequalities. *Oxford Development Studies*, *28*, 245–262.

Sugden, R. (1988). *Game theory without backward induction*, mimeo, University of East Anglia.

Swan, T. W. (1962). Circular causation. *Economic Record*, 38, 421–426.

Sylos-Labini, P. (1956). *Oligopolio e progresso technico*. Milano: Guffre.

Sylos-Labini, P. (1969). *Oligopoly and technical progress*. Cambridge: Harvard University Press.

Taylor, L. (1982). Food price inflation, terms of trade and growth. In: M. Gersovitz, et al. (Eds), *The theory and experience of economic development*. London: Allen and Unwin.

Taylor, L. (1983). *Structuralist macroeconomics*. New York: Basic Books.

Taylor, P., & Jonker, L. (1978). Evolutionary stable strategies and game dynamics. *Mathematical Bioscience*, 40, 145–156.

Thomson, J. E. (1994). *Mercenaries, pirates and sovereigns*. Princeton, NJ: Princeton University Press.

Tilly, C. (1975). *The formation of national states in Western Europe*. Princeton, NJ: Princeton University Press.

Townsend, R. M. (1988). Forecasting the forecasts of others. *Journal of Political Economy*, 91, 546–568.

Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *Journal of Business*, 59, 251–278.

Twain, M. (1917). *A Connecticut yankee in King Arthurs Court: Chapters viii-ix*. New York: Modern Library Edition.

Veblen, T. (1915). *Imperial Germany and the industrial revolution* (Re-published in 1964). New York: A. M. Kelley.

Veblen, T. (1917). *An inquiry into the nature of peace and the terms of its perpetuation* (Re-published in 1964). New York: A. M. Kelley.

Vickers, J. S. (1995). Competition and regulation in vertically related markets. *Review of Economic Studies*, 62, 1–17.

Vining, A., & Boardman, A. (1993). Costs and benefits through bureaucratic lenses: Examples of highway projects. *Journal of Policy Analysis and Management*, 12, 532–555.

Vives, X. (1985). *Sequential entry and welfare with quantity commitment*, mimeo, University of Pennsylvania.

Von Neumann, J., & Morgenstern, O. (1944). *Theory of games and economic behaviour*. New York: Wiley.

Walter, B. F. (2002). *Committing to peace: The successful settlement of civil wars*. Princeton, NJ: Princeton University Press.

Wicksell, K. (1978) [1919]. The world war, an economists view, *Scandinavian Journal of Economics*, 80(2), 236–249.

Williamson, O. (2005). The economics of governance. *American Economic Review*, 95, 1–15.

Wittman, D. (1989). Why democracies produce efficient results. *Journal of Political Economy*, 97, 1395–1424.

World Bank. (2008). *World development indicators online*. Washington, DC: World Bank.

Yarrow, G. (1985). Measures of monopoly welfare loss in markets with differentiated products. *Journal of Industrial Economics*, 33, 515–530.

Yarrow, G. (1986). Privatisation in theory and practice. In: E. Bailey (Ed.), *The political economy of privatisation and deregulation* (pp. 245–295). London: Edward Elgar.

Yi, S. S. (1997). Stable coalition structure with externalities. *Games and Economic Behavior*, 20(2), 201–237.

Young, H. P. (1993). An evolutionary model of bargaining. *Journal of Economic Theory*, 59, 145–168.

Vives, X. (2005). Complementarities and games: New developments. *Journal of Economic Literature*, *XLIII*(2), 437–479.

Zinecker, H. (2007). *Regime hybridity and violent civil societies in fragmented societies: Conceptual consideration, peace studies program*. Ithaca, NY: Cornel University.

Zinnes, D. A., Gillespie, J. V., Schrodt, P. S., Tahim, G. S., & Rubinson, R. M. (1978). Arms and aid: A differential game analysis. In: W. L. Hollist (Ed.), *Exploring competitive arms processes* (pp. 17–38). New York: Marcel Dekker.

FURTHER READING

Acemoglu, D., Johnson, S., & Robinson, J. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, *91*, 1369–1401.

Acemoglu, D., Johnson, S., & Robinson, J. (2002). Reversal of fortune, geography and institutions in the making of the modern world income distribution. *Quarterly Journal of Economics*, *117*, 1231–1294.

Ainslie, G., & Herrnstein, R. (1981). Preference reversal and delayed reinforcement. *Animal Learning and Behaviour*, *9*, 476–482.

Albright, J., & Kunstel, M. (1990). *Their promised land*. New York: The Crown Publishing Group.

Alesina, A., & Perotti, R. (1996). Income distribution, political instability and investment. *European Economic Review*, *40*, 1203–1228.

Alexander, Y., & Sinai, J. (1989). *Terrorism, the PLO connection*. New York: Crane Russak.

American Jewish Yearbook. (1958, 1969, 1970, 1978, 1988, 2001). Philadelphia, PA: The Jewish Publication Society of America.

Amirahmadi, H. (1990). Economic reconstruction of Iran, costing the war damage. *Third World Quarterly*, *12*, 26–47.

Angell, N. (1933). *The great illusion*. Harmondsworth: Penguin.

Auvinen, J., & Nafziger, A. (1999). The sources of humanitarian emergencies. *Journal of Conflict Resolution*, *43*, 267–290.

Avneri, A. (1984). *The claim of dispossession, Jewish land-settlement and the Arabs, 1878–1948*. New Brunswick, NJ: The State University of New Jersey; Transaction Publishers.

Azar, E., Jureidini, P., & McLaurin, R. (1978). Protracted social conflict: Theory and practice in the Middle East. *Journal of Palestine Studies*, *8*, 41–60.

Bachi, R. (1977). The population of Israel. Jerusalem, CICRED, World Population Year Series.

Baddely, M. (2005). *Armed conflict, economic development and financial stability*. Cambridge: Cambridge Centre for Economic and Public Policy.

Bagwell, K., & Staiger, R. W. (1994). The sensitivity of strategic and corrective R&D policy in oligopolistic industries. *Journal of International Economics*, *36*, 133–150.

Bard, M. (2007). The Arab boycott. Jewish virtual library. Retrieved May 5, 2007, from Jewish Virtual Library online, http://www.jewishvirtuallibrary.org/jsource/History/Arab_boycott.html.

Baron, R., & Greenberg, J. (Eds). (1990). *Behaviour in organizations, understanding and managing the human side of work*. New York: Allyn and Bacon.

Barro, R. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, *106*, 407–443.

Barro, R. (1999). *Determinants of economic growth: A cross-country empirical study*. Cambridge, MA: MIT Press.

Becker, G. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 76, 169–217.

Begin, M. (1977). *The revolt, story of the Irgun*. New York: Nash.

Beinin, J., & Hajjar, L. (1989). Palestine and the Arab-Israeli conflict for beginners. In: Z. Lockman & J. Beinin (Eds), *Intifada, the Palestinian uprising against the Israeli occupation* (pp. 101–112). Cambridge: South End Press.

Ben-Arieh, Y. (1975). The population of the large towns in Palestine during the first eighty years of the nineteenth century, according to Western sources. In: M. Maoz (Ed.), *Studies on Palestine during the Ottoman period*. Jerusalem: Magnus.

Benhabib, J., & Rustichini, A. (1996). Social conflict and growth. *Journal of Economic Growth*, 1, 125–142.

Ben-Yehuda, H., & Mishali-Ram, M. (2006). Protracted conflicts, crises, and ethnicity, the Arab-Israeli and India-Pakistan conflicts, 1947–2005. *Journal of Conflict Studies*, 26, 75–100.

Bernstein, L. (1992). Opting out of the legal system, extralegal contractual relations in the diamond industry. *Journal of Legal Studies*, 21, 115–157.

Bickerton, I., & Klausner, C. (2001). *A concise history of the Arab-Israeli conflict*. New York: Prentice Hall.

Bickerton, I., & Pearson, M. (1986). *The Arab-Israeli conflict*. Melbourne: Longman Cheshire.

Binswanger, H., Deininger, K., & Feder, G. (1993). *Power, distortions, revolt, and reform in agricultural land relations*. Latin America and the Caribbean Technical Department and the Agriculture and Rural Development Department, World Bank, mimeo.

Blanchard, O. (1993). *What do firms do with cash windfalls?* NBER, Working Paper no. 4258.

Blavatsky, P. (2004). *Contest success function with the possibility of a draw: Axiomatization*. Working Paper, Institute for Empirical Research in Economics, University of Zurich, Switzerland.

Boix, C. (2003). *Democracy and redistribution*. New York: Cambridge University Press.

Boswell, T., & Dixon, W. (1990). Dependency and rebellion: A cross-national analysis. *American Sociological Review*, 25, 540–559.

Boulding, K. (1962). *Conflict and defense*. New York: Harpers.

Boulding, K. (1975). *Peace and the war industry*. New Brunswick, NJ: The State University of New Jersey; Transaction Publishers.

Boyce, J. (1996). *Economic policy for building peace, the lessons of El Salvador*. Boulder, CO: Lynne Rienner Publishers.

Brauer, J., & Marlin, J. T. (1992). Converting resources from military to non-military uses. *Journal of Economic Perspectives*, 6, 145–164.

British War Cabinet, Joint Planning Staff, Public Record Office, CAB 120/691/109040/002 (1945-08-11). Operation Unthinkable, Russia, Threat to Western Civilization (online photocopy). Retrieved July 8, 2008, from Department of History, Northeastern University online, http://www.history.neu.edu/PRO2/

Brockett, C. (1992). Measuring political violence and land inequality in Central America. *American Political Science Review*, 94, 169–176.

Bryant, J. (1983). A simple rational expectations Keynes-type model. *Quarterly Journal of Economics*, 97, 525–529.

Buchanan, J., & Tullock, G. (1962). *The calculus of consent, logical foundations of constitutional democracy*. Ann Arbor, MI: University of Michigan Press.

Bureau of Verification and Compliance. (2000). World military expenditures and arm transfers 1998, Fact sheet, August 21. Washington, DC: US Department of State. Retrieved August 25, 2007, from FAS online, http://www.fas.org/man/docs/wmeat98/wmeat98fs.html

Burn, D. (1961). *The steel industry, 1939–1959*. London: Cambridge University Press.

Cattan, H. (1969). *Palestine, the Arabs and Israel*. London: Longmans, Green and Co.

Cattan, H. (1973). *Palestine and international law: The legal aspects of the Arab-Israeli conflict*. London: Longman.

Chen, S., Datt, G., & Ravallion, M. (1995). Is poverty increasing in the developing world? Policy Research Department, the World Bank, Data Appendix, updated version 40, pp. 359–376.

Choucri, N., & North, R. (1975). *Nations in conflict*. San Francisco, CA: Freeman.

Clodfelter, M. (2002). *Warfare and armed conflicts: a statistical reference to casualty and other figures 1500-1999*. London: McFarland.

Cobban, H. (1984). *The Palestinian Liberation Organization: People, power and politics*. New York: Colombia University Press.

Cohen, M. (1986). Pluralism and theocrats: The conflict between religion and state in Israel. In: N. Biggar, J. S. Scott & W. Schweiker (Eds), *Cities of Gods, faith, politics and pluralism in Judaism, Christianity and Islam* (pp. 35–54). New York: Greenwood Press.

Collier, P. (2000a). *Economic causes of civil conflict and their implications for policy, World Bank*. Working Paper. Forthcoming In: C. A. Crocker, F. O. Hampson, & P. Aall (Eds), *Managing global chaos*. Washington, DC: US Institute of Peace.

Collier, P. (2000b). Doing well out of war, an econometric perspective. In: M. Berdal & D. M. Malone (Eds), *Greed and grievance: Economic agendas in civil wars* (pp. 91–112). Boulder, CO: Lynne Rienner.

Collier, P. (2000c). Rebellian as a quasi-criminal activity. *Journal of Conflict Resolution*, *44*, 839–853.

Collier, P., & Hoeffler, A. (1999). On economic causes of civil war. *Oxford Economic Papers*, *51*, 168–183.

Collier, P., & Hoeffler, A. (2000). *Greed and grievance in civil wars*. Working Paper, World Bank WPS 2000-18.

Conceição, P., & Ferreira, P. (2000). *The young persons guide to the Theil index: Suggesting intuitive interpretations and exploring analytical applications*. UTIP Working Paper no. 14. Retrieved August 27, 2007, from University of Texas (Inequality Project) online, http://utip.gov.utexas.edu/abstract.html#UTIP14

Cramer, C. (2003). Does inequality cause conflict? *Journal of International Development*, *15*, 397–412.

Damania, D. (1996). The scope for collusion and competition in a regulated vertically integrated industry. *Bulletin of Economic Research*, *48*(3), 253–264.

Dashwood, H. (2000). *Zimbabwe: The political economy of transformation*. Toronto: University of Toronto.

Deeb, M. (2003). *Syria's terrorist war on Lebanon and the peace process*. Houndmills: Palgrave Macmillan.

Deininger, K., & Squire, L. (1996). A new data set measuring income inequality. *The World Bank Economic Review*, *10*(3), 565–591.

De Melo, M., Denizer, C., & Gelb. A. (1996). *From plan to market, policy research*. Working Paper no. 1564, World Bank, Washington, DC.

Dershowtiz, A. (2003). *The case for Israel*. Indianapolis, IN: Wiley.

De Soto, H. (2000). *Mystery of capital: why capitalism triumphs in the West and fails everywhere else*. New York: Basic Books.

Deutsch, M. (1973). *The resolution of conflict, constructive and destructive processes*. New Haven, CT: Yale University Press.

Diamond, L. (2004). What went wrong in Iraq. *Foreign Affairs*, *83*(5), 34–56.

Dowty, A. (2005). *Israel/Palestine*. Cambridge: Polity.

Duff, E., & McCamant, J. (1976). *Violence and repression in Latin America: A quantitative and historical analysis*. New York: Collier MacMillan.

Dwan, R., & Holmqvist, C. (2005). Patterns of major armed conflicts, Stockholm. Retrieved November 6, 2006, from Stockholm International Peace Research Institute online, http://www.sipri.org/contents/conflict/MAC_patterns.html

Eaton, J., & Lipsey, R. (1980). Exit barriers are entry barriers: The durability of capital as a barrier to entry. *Bell Journal of Economics*, *11*, 721–724.

Elbadawi, I. (1992). Civil wars and poverty: The role of external interventions, political right and economic growth. Development Research Group, World Bank, mimeo.

Elbadawi, I. (1999). Civil wars and poverty: The role of external interventions, political rights and economic growth, mimeo. Presented at the launch Workshop of the DECRG Research Project on Civil Conflicts, Crime and Violence, February, World Bank, Washington, DC.

El Kodsy, A., & Lobel, E. (1970). *The Arab world and Israel: Two essays*. New York: Monthly Review Press.

Encyclopædia Britannica. (1911). Encyclopædia Britannica. Retrieved February 23, 2007, from Encyclopædia Britannica online, http://www.1911encyclopedia.org/Palestine

Enders, W., & Sandler, T. (1993). The effectiveness of anti-terrorism policies, vector-auto-regression-intervention analysis. *American Political Science Review*, *87*(4), 829–844.

Ettinghausen, R., & Grabar, O. (2003). *The art and architecture of Islam 650–1250*. London: Yale University.

Farell, B. (1984). Review of Joan Peters, "From Time Immemorial". *Journal of Palestine Studies*, *53*, 126–134.

Farsoun, S. (1997). *Palestine and Palestinians*. Oxford: Westview.

Fattah, H. (1999). Sultan Abdul-Hamid and the Zionist Colonization of Palestine: A case study from Jerusalem. Retrieved January 15, 2007, from Jerusalemites online, http://www.jerusalemites.org/jerusalem/ottoman/1.htm

Fearon, J., & Laitin, D. (2003). Ethnicity, insurgency and civil wars. *American Political Science Review*, *97*, 75–90.

Fehr, E., & Gächter, S. (2000). Cooperation and punishment in public goods experiments. *American Economic Review*, *90*, 980–994.

Fitzgerald, V., & Grigsby, A. (2000). Nicaragua: The political economy of social reform and armed conflict. In: F. Stewart & V. Fitzgerald (Eds), *War and underdevelopment: Case studies of countries in conflict* (Vol. 2F). Oxford: Oxford University.

Folberg, J., & Taylor, A. (1984). *Mediation: A comprehensive guide to resolving conflicts without litigation*. San Francisco, CA: Jossey-Bass Publishers.

Foreign Trade Barriers, The Arab League, Office of the United States Trade Representative. (2007). Retrieved May 5, 2007, from Library Publications online, http://www.ustr.gov/assets/Document_Library/Reports_Publications/2007/2007_NTE_Repor/asset_upload_file353_10925.pdf

Forsyth, D. (1990). *Group dynamics*. Belmont, CA: Wadsworth Publishing.

Friedman, S. (2003). Are Jews who fled Arab lands to Israel refugees, too? *New York Times*, 10/11/03 Late Edition-Final, Section B, p. 11.

Friedman, T. (1995). *From Beirut to Jerusalem*. New York: Anchor.

Fudenberg, D., & Tirole, J. (1984). The fat-cat effect, the puppy-dog ploy, and the lean and hungry look. *American Economic Review*, *74*, 361–366.

Gambill, G. (1998). The balance of terror: War by other means in the contemporary Middle East. *Journal of Palestine Studies*, *28*, 51–66.

Gangopadhyay, P. (2007). Irrationality, non-equilibrium conflict and complex dynamics. *Peace Economics, Peace Science and Public Policy*, *13*(2), 23–34.

Garfinkel, R., & Skaperdas, S. (1996). *The political economy of conflict and appropriation: Conflict and appropriation as economic activities*. Cambridge: Cambridge University Press.

Garthoff, R. (1994). *Détente and confrontation: American-Soviet Relations from Nixon to Reagan*. Washington: Brookings Institution Press.

Giavazzi, F., & Tabellini, G. (2005). Economic and political liberalizations. *Journal of Monetary Economics*, *57*, 1297–1330.

Gil, M. (1997). *A history of Palestine, 634–1099*. Cambridge: Cambridge University.

Gilbert, M. (2002). *The Routledge Atlas of Arab-Israeli conflict (Routledge Historical Atlases)*. Oxford: Routledge.

Glaeser, E., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth? *Journal of Economic Growth*, *9*, 271–303.

Goldman, N. (1978). *The Jewish paradox*. New York: Grosset and Dunlap.

Graham-Brown, S. (1980). *Palestinians and their society 1880–1946*. London: Quartet Books.

Greif, A. (2006). *Institutions and the path to the modern economy: Lessons from Medieval Trade*. New York: Cambridge University Press.

Greif, A., Milgrom, P., & Weingast, B. (1994). Coordination, commitment, and enforcement: The case of the Merchant Guild. *Journal of Political Economy*, *102*, 745–776.

Greenstein, F. (1998). The impact of personality on the end of the Cold War: A counterfactual analysis. *Political Psychology Journal*, *19*(1), 1–17.

Grose, P. (1988). The president versus the diplomats. In: W. R. Louis & R. W. Stookey (Eds), *The end of the Palestine mandate*. Austin, TX: University of Texas.

Grossman, H. I. (1999). Kleptocracy and revolution. *Oxford Economic Papers*, *51*, 267–283.

Haddad, A. (1990). Jordans income distribution. In: K. A. Jaber, et al. (Eds), *Retrospect in income distribution in Jordan*. Boulder, CO: Westview Press.

Hajjar, L., & Beinin, J. (1988). Palestine for beginners. *Middle East Report*, *154*, 17–20.

Hardy, M. (1979). Economic growth, distributional inequality, and political conflict in industrial societies. *Journal of Political and Military Sociology*, *7*, 209–227.

Harkabi, Y. (1992). The Arab-Israeli conflict on the threshold of negotiations. Center of International Studies, Monograph Series Number 3, Princeton University.

Havrilesky, T. (1980). The discordance-inequality trade-off. *Public Choice*, *35*(3), 371–377.

Hilmer, F., Raymer, M., & Taperell, G. (1993). *National competition policy*. Canberra: AGPS.

Hiro, D. (2003). *The essential Middle East: A comprehensive guide*. New York: Carroll and Graf.

Hoffman, J. (2002). Sharon warns Saudi plan may be Arab plot, *Jerusalem Post*. Retrieved February 15, 2006, from The United Jerusalem Foundation online http://www.unitedjerusalem.org/index2.asp?id = 81626&Date = 3/4/2002

Homer-Dixon, T. (1994). Environmental scarcities and violent conflict: Evidence from cases. *International Security*, *16*, 4–40.

Hourani, A. (1991). *A history of the Arab peoples*. Cambridge: Belknap.

Human Development Report. (2007). United Nations development programme. Retrieved May 20, 2007, from United Nations online, http://hdr.undp.org/en/media/hdr_20072008_en_complete.pdf

Hume, D. (1888). *Treatise on human nature*. Oxford: Oxford University Press.

Humphreys, M. (2003). Economics and violent conflict. Retrieved July 7, 2007, from HPCR online, http://www.preventconflict.org/portal/economics

Imai, K., & Weinstein, J. (2000). *Measuring the economic impact of civil war*. CID Working Paper no. 51, Harvard.

Isard, W. (1998). *Methods of interregional and regional analysis*. Aldershot: Ashgate.

Isard, W. (2002). Developing mutual improvement joint actions: A need for interdisciplinary research. *Peace Science, Peace Economics and Public Policy*, *8*, 1–30.

Isard, W. (2004). A Jordan/West Bank development proposal. *Peace Economics, Peace Science and Public Policy*, *10*, 36–55.

Isard, W., & Hara, T. (2003a). The Old City of Jerusalem as a tourist international magnet: an initial proposal for a first step cooperation in the Middle East. Part II: Projection of decrease in hostilities and terrorist activity. *Peace Science, Peace Economics and Public Policy*, *9*, 1–9.

Isard, W., & Hara, T. (2003b). Some theoretical thoughts on constructing a poverty-eliminating social accounts bill of goods. *Peace Science, Peace Economics and Public Policy*, *9*, 1–14.

Isard, W., & Moyersoen, J. (2003). A preliminary look at the relevance of psychology's prospect theory for identifying mutual improvement joint actions. *Peace Economics, Public Policy and Peace Science*, *9*, 27–38.

Isard, W., & Smith, C. (1983). *Conflict analysis and practical conflict management procedures*. Ithaca, New York: City and Regional Planning Department, Cornell.

Jalilian, H., Kirkpatrick, C., & Parker, D. (2003). *Creating the conditions for international business expansion: The impact of regulation on economic growth in developing countries — A cross-country analysis*. Centre on Competition and Regulation, Working Paper no. 54, IDPM, University of Manchester.

Jean, F., & Rufin, J. (1996). *Économie des guerres civiles*. Paris: Hachette.

Johnson, P. (1987). *A history of the Jews*. New York: Harper and Row.

Kalecki, M. (1954). *Theory of economic dynamics: An essay on cyclical and long run changes in capitalist economy*. New York: Rhinehart.

Kapitan, T. (1997). *Philosophical perspectives on the Israeli-Palestinian conflict*. Armonk, NY: M.E. Sharpe.

Kapitan, T. (2004). Terrorism in the Arab-Israeli conflict. *The Philosophical Issues*, *I*, 175–191.

Karpat, K. (1978). Ottoman population records and the census of 1881/82–1893. *International Journal of Middle East Studies*, *XCI*(2), 237–274.

Keen, D. (1998). *The economic functions of violence in civil wars*. Adelphi Paper 320 for the International Institute of Strategic Studies, Oxford.

Keen, D. (2000). Incentives and disincentives for violence. In: M. Berdal & D. M. Malone (Eds), *Greed and grievance, economic agendas in civil wars* (pp. 19–42). Boulder, CO: Lynne Rienner.

Kelman, H. (1995). Contributions of an unofficial conflict resolution effort to the Israeli-Palestinian breakthrough. *Negotiation Journal*, *11*, 19–27.

Kendall, S. (2004). *Case histories in international politics*. London: Longman.

Keynes, J. M. (1940). *How to pay for the war?* New York: Harcourt Brace, Jovanovich.

Keynes, J. M. (1982) [1937]. Letter to the Editor, *The Times*, 28 September 1937, p. 82. In: E. Johnson & D. Moggridge (Eds), *Collected Writings of J.M. Keynes*, Vol. 28, Cambridge: Cambridge University Press and The Royal Economic Society.

Khalaf, I. (1991). *Politics in Palestine: Arab factionalism and social disintegration 1939–1948*. Albany, NY: State University of New York.

Khalidi, R. (1993). *The Oxford Companion to Politics of the World*, Oxford.

Khalidi, W. (1971). *From heaven to conquest: Readings in Zionism and the Palestine problem until 1948*. Beirut: Institute for Palestine Studies.

Kikeri, S., & Nellis, J. (2001). *Privatisation in competitive sectors: The record so far*, mimeo, World Bank, Washington, DC.

Kimmerling, B., & Migdal, J. (2003). *The Palestinian people: A history*. London: Harvard University Press.

Konard, K. (2005). *Strategy in contests*. Berlin (WZB): Social Science Research Centre Berlin.

Kranton, R. (1996). Reciprocal exchange: A self-sustaining system. *American Economic Review*, *86*, 830–851.

Krystall, N. (1998). The de-Arabization of West Jerusalem 1947–50. *Journal of Palestine Studies*, *27*, 5–22.

Kydd, A. (2005). *Trust and mistrust in international relations*. Princeton, NJ: Princeton University Press.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1998). Law and finance. *Journal of Political Economy*, *106*, 1113–1155.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1999). The quality of government. *Journal of Law, Economics and Organization*, *15*, 222–279.

Laqueur, W. (1968). *The road to war 1967: The origins of the Arab-Israel conflict*. London: Weidenfeld and Nicolson.

Leibowitz, Y. (1992). *Judaism, human values, and the Jewish state*. Cambridge, MA: Harvard University Press.

Lewis, B. (1993). *The Arabs in history*. New York: Oxford University Press.

Lewis, B. (1995). *The Middle East*. London: Weidenfeld and Nicolson.

Lichbach, M. (1989). An evaluation of does economic inequality breed political conflict? *World Politics*, *41*, 431–470.

Lippmann, W. (1947). *The Cold War: A study in U.S. foreign policy*. New York: Harper & Brothers.

Loewenstein, J. (2004). Return to Rafah: Journey to a land out of bounds. *Journal of Palestine Studies*, *33*, 98–109.

Loewenstein, G., & Prelec, D. (1991). Negative time preference. *American Economic Review*, *81*, 347–352.

Londregan, J., & Poole, K. (1990). Poverty, the coup trap, and the seizure of executive power. *World Politics*, *XLII*, 151–183.

Luterbacher, U. (2004). Conflict and irrevocable decisions. *Peace Economics, Peace Science and Public Policy*, *10*, 1–21.

Mack, A. (2002). Civil war: academic research and the policy community. *Journal of Peace Research*, *39*, 515–525.

Mansfeld, Y. (1999). Cycles of war, terror, and peace: Determinants and management of crisis and recovery of the Israeli tourism industry. *Journal of Travel Research*, *38*, 30–36.

Mattar, I. (1983). From Palestinian to Israeli: Jerusalem 1948–1982. *Journal of Palestine Studies*, *12*, 57–63.

Mazur, J., & Herrnstein, R. (1988). On the functions relating delay: Reinforcer value, and behaviour. *Behavioural and Brain Sciences*, *11*, 690–691.

McAdam, D. (1982). *Political process and the development of black insurgency, 1930-1970*. Chicago, IL: University of Chicago Press.

McCarthy, J. (1981). The population of Ottoman Syria and Iraq, 1878-1914. *Asian and African Studies*, *15*, 3–44.

McCarthy, J. (1990). *The population of Palestine, institute for Palestine studies series*. New York: Columbia University Press.

Meldrum, A. (2000). Harare dispatch, good-bye Mugabe vs. Zimbabwe, New Republic. Retrieved April 17, 2007, from New Republic online, http://www.ucm.es/BUCM/compludoc/W/10001/00286583_7.htm

MidEast Web, Population of Ottoman and Mandate Palestine, Retrieved February 6, 2006, from Mid East Web online, http://www.mideastweb.org/palpop.htm

Midlarsky, M. (1988). Rulers and the ruled: Patterned inequality and the onset of mass political violence. *American Political Science Review*, *LXXXII*, 491–509.

Minnis, I. (2001). *The Arab-Israeli conflict*. Oxford: Heinemann.

Mitchell, E. (1969). Some econometrics of the Huk rebellion. *American Political Science Review*, *63*, 1159–1171.

Moore, M. (2001). *Political underdevelopment: What causes "Bad Governance"*. Working Paper, Institute for Development Studies, Sussex.

Morgan, W., & Clark, T. (1973). The causes of racial disorders: A grievance-level explanation. *American Sociological Review*, *38*, 611–624.

Morris, B. (1987). *The birth of the Palestinian refugee problem, 1947–1949*. Cambridge: Cambridge University.

Morris, B. (2001). *Righteous victims: A history of the Zionist-Arab conflict, 1881–2001*. London: Vintage.

Moyersoen, J. (2007). On joint local satisficing actions for conflict resolution: The case of the conflict in Nepal. *International Journal of Economic Research*, *4*, 135–170.

Muller, E., & Seligson, M. (1987). Inequality and insurgency. *American Political Science Review*, *LXXXI*, 425–451.

Muller, E. N. (1985). Income inequality, regime repressiveness, and political violence. *American Sociological Review*, *50*, 47–61.

Munger, M. (2006). Preference modification vs. incentive manipulation as tools of terrorist recruitment: The role of culture. *Journal of Public Choice*, *128*, 131–146.

Murdoch, J., & Sandler, T. (2001). *Economic growth, civil wars, and spatial spillovers*. Working Paper, The World Bank.

Mwanasali, M. (2000). The view from below. In: M. Berdal & D. M. Malone (Eds), *Greed and grievance, economic agendas in civil wars* (pp. 137–153). Boulder, CO: Lynne Rienner.

Nafziger, W., & Auvinen, J. (1997). *War, hunger and displacement*: *An econometric investigation into the sources of humanitarian emergencies*. Working Paper no.142, Helsinki, UNU/WIDER.

Nasr, K. (1997). *Arab and Israeli terrorism: The causes and effects of political violence, 1936–1993*. North Carolina: McFarland.

Nitzan, S. (1994). Modelling rent seeking contests. *European Journal of Political Economy*, *10*, 41–60.

Oded, E. (2002). Arab-Israel peacemaking. In: A. Sela (Ed.), *The continuum political encyclopaedia of the Middle East*. New York: Continuum.

OECD. (1993). *Regulatory reform, privatisation and competition policy*. Paris: OECD.

Olson, M. (1963). Rapid growth as a destabilizing force. *Journal of Economic History*, *XXIII*, 529–552.

Oren, M. (2002). *Six days of war: June 1967 and the making of the Modern Middle East*. Oxford: Oxford University.

Pacific Institute, Information on the Worlds Freshwater Resources, Retrieved June 8, 2007, from Pacific Institute online, http://www.worldwater.org/data.html

Paranzino, D. (1972). Inequality and insurgency in Vietnam: A further re-analysis. *World Politics*, *24*, 565–578.

Park, K. (1986). Re-examination of the linkage between income inequality and political violence. *Journal of Political and Military Sociology*, *XIV*, 185–197.

Parvin, M. (1973). Economic determinants of political unrest: An econometric approach. *Journal of Conflict Resolution*, *17*, 271–296.

Paukert, F. (1973). Income distribution at different levels of development: A survey of evidence. *International Labor Review*, *108*, 97–125.

Paukert, L., & Richards, P. J. (1991). *Defence expenditure, industrial conversion and local employment*. London: International Labour Office.

Peretz, D. (1996). *The Arab-Israel dispute*. New York: Facts on File.

Perthes, V. (1997). Syrias involvement in Lebanon. *Middle East Report*, *203*, 1–18.

Plot, C. R. (1982). Industrial organization theory and experimental economics. *Journal of Economic Literature*, *20*, 1485–1527.

Pondy, L. (1967). Organizational conflict, concepts and models. *Administrative Science Quarterly*, *12*, 296–320.

Porter, P. (2005). Beyond comfort: German and English military chaplains and the memory of the great war, 1919–1929. *Journal of Religious History*, *29*, 258–289.

Powell, B. (1982). *Contemporary democracies, participation, stability and violence*. Cambridge: Harvard University Press.

Rajan, R., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, *69*, 5–50.

Rashid, S. (1980). The policy of laissez faire during scarcities. *Economic Journal*, *90*, 493–503.

Rees, R. (1987). The theory of principal and agent: Part I and II. In: J. D. Hey & J. L Lambert (Eds), *Surveys in the economics of uncertainty*. Oxford: Basil Blackwell.

Reeve, S. (2001). *One day in September: The story of the 1972 Munich olympics massacre*. London: Faber and Faber.

Reich, B. (1996). *An historical encyclopedia of the Arab-Israel conflict*. Oxford: Greenwood.

Reno, W. (1995). *Corruption and state politics in Sierra Leone*. Cambridge: Cambridge University Press.

Reno, W. (2000). Shadow states and the political economy of civil wars. In: M. Berdal & D. M. Malone (Eds), *Greed and grievance, economic agendas in civil wars* (pp. 43–68). Boulder, CO: Lynne Rienner.

Rodinson, M. (1968). *Israel and the Arabs*. New York: Penguin.

Rodrik, D. (2002). *Institutional rule: The primacy of institutions over geography and integration in economic development*. NBER Working Paper no. 9305.

Ross, M. (2001). How does natural resource wealth influence civil war? Evidence from 13 case studies. Paper presented at the World Bank Conference on Civil Wars and Post-Conflict Transition. Irvine, University of California, May 18, 2001.

Roumani, M. (1983). The case of the Jews from Arab countries: A neglected issue, Tel Aviv, World Organization of Jews from Arab Countries (WOJAC).

Rowley, C., & Taylor, J. (2006a). The Israel and Palestine land settlement problem: An analytical history, 4000 B.C.E.–1948 C.E.. *Public Choice*, *128*, 41–75.

Rowley, C., & Taylor, J. (2006b). The Israel and Palestine land settlement problem, 1948–2005: An analytical history. *Public Choice*, *128*, 77–90.

Rubin, J., Pruitt, D., & Kim, S. (1994). *Social conflict, escalation, stalemate and settlement*. New York: McGraw-Hill.

Russo, A. (1972). Economic and social correlates of government control in South Vietnam. In: I. Feierabend, R. Feierabend & T. Gurr (Eds), *Anger, violence, and politics, theories and research*. Englewood Cliffs, NJ: Prentice Hall.

Saaty, T. (1980). *The analytic hierarchy process*. New York: McGraw Hill.

Sachar, H. (1987). *A history of Israel, volume II: From the aftermath of the Yom Kippur war*. Oxford: Oxford University Press.

Said, E. (1994). *The politics of dispossession: The struggle for Palestinian self-determination*. New York: Vintage.

Sauvain, P. (1996). *Key themes of the twentieth century*. Cheltenham, UK: Nelson Thornes.

Schmalensee, R. (1972). *The economics of advertising*. Amsterdam: North-Holland.

Schock, K. (1996). A conjectural model of political conflict: The impact of political opportunities on the relationship between economic inequality and violent political conflict. *Journal of Conflict Resolution*, *XL*, 98–133.

Scholch, A. (1985). The demographic development of Palestine 1850–1882. *International Journal of Middle East Studies*, *XII*(4), 485–505.

Schulze, K. (1999). *The Arab-Israeli conflict*. Essex: Addison-Wesley-Longman.

Segev, T. (2000). *One Palestine: Complete, Jews and Arabs under the British mandate*. London: Metropolitan Books.

Shaban, R. (1990). Economic inequality in Jordan: 1973–1986. In: K. A. Jaber, et al. (Eds), *Income distribution in Jordan* (pp. 78–96). Boulder, CO: Westview Press.

Shahid, L. (2002). The Sabra and Shatila massacres: Eye-witness reports. *Journal of Palestine Studies*, *32*, 36–58.

Shalim, A. (2001). *The Iron Wall, Israel and the Arab World*. New York: Norton.

Sharif, K., & Nihad, Z. (1987). *The village of Deir Yassin*. Bir Zeit: Beir Zeit University.

Shavit, A. (2003). Reality bites. Haaretz newspaper. Retrieved January 10, 2006 from Haaretz online, http://www.haaretz.com/hasen/pages/ShArt.jhtml?itemNo = 250053

Shirley, M. M., & Walsh, P. (2001). *Public versus private ownership: The current state of the debate*, mimeo, World Bank, Washington, DC.

Shuman, E. (2002). Israeli leaders express interest in Saudi peace initiative. *Israel Insider Newspaper*, February 25, 2002.

Sigelman, L., & Simpson, M. (1977). A cross-national test of the linkage between economic inequality and political violence. *Journal of Conflict Resolution*, *21*, 105–128.

Skaperdas, S., & Syropoulos, C. (1997). The distribution of income in the presence of appropriative activities. *Economica*, *64*, 101–107.

Smith, A. (1776) [1976]. *An inquiry into the nature and causes of the wealth of nations*. In: R. H Campbell, A. S. Skinner & W. B. Todd (Eds), Oxford: Oxford University Press.

Smith, W. (1982). Beirut goes up in flames, *Time Magazine*, *120*(7), Retrieved March 17, 2006 from Time Magazine online, http://www.time.com/time/magazine/article/0,9171,950719,00. html

Spencer, B., & Brander, J. A. (1985). International R&D rivalry and industrial strategy. *Review of Economic Studies*, *5*, 707–722.

Spilerman, S. (1971). The causes of racial disturbances: Tests of an explanation. *American Sociological Review*, *36*, 427–442.

Stewart, F. (1998). *The root causes of conflict: Some conclusions, Queen Elizabeth house*. Working Paper no. 16.

Stewart, F., & Fitzgerald, V. (2001). *War and underdevelopment: Country experiences* (Vol. 2). Oxford: Oxford University Press.

Szymanski, S. (2003). The economic design of sporting contests. *Journal of Economic Literature*, *41*, 1137–1187.

Tekiner, R., Abed-Rabbo, S., & Mezvinsky, N. (1988). *Anti-Zionism – Analytical reflections*. New York: Amana Books.

Telhami, S. (1999). From Camp David to Wye: Changing assumptions in Arab-Israeli negotiations. *The Middle East Journal*, *42*, 1–16.

Tiebout, C. (1954). A pure theory of local expenditure. *Journal of Political Economy*, *64*, 416–424.

Teveth, S. (1994). *Ben-Gurion and the Palestinian Arabs: From peace to war*. Oxford: Oxford University Press.

Thompson, W. R. (1982). Phases of the business cycle and the outbreak of war. *International Studies Quarterly*, *26*, 301–311.

Truman, H. (1965). *Memoirs: Years of trial and hope* (Vol. 2). New York: Signet.

Tullock, G. (1980). Efficient rent seeking. In: J. Buchanan, R. Tollison & M. Tullock (Eds), *Toward a theory of the rent seeking society* (pp. 3–15). College Station, TX: Texas A and M University Press.

UN Document A/AC 14/32, AD HOC Committee on the Palestinian Question, 11 November 1947, Retrieved November 16, 2007 from United Nations online, http://domino.un.org/ UNISPAL.NSF/0080ef30efce525585256c38006eacae/ba8f82c57961b9fc85257306007096-b8!OpenDocument.

Varese, F. (2001). *The Russian mafia, private protection in a new market economy*. Oxford: Oxford University Press.

Wallensteen, P., & Sollenberg, M. (1997). Armed conflicts, conflict termination and peace agreements, 1989-96. *Journal of Peace Research*, *34*, 339–358.

Walton, J., & Seddon, D. (1994). *Free markets and food riots: The politics of global adjustment*. Cambridge: Blackwell.

Wasserstein, B. (2001). *Divided Jerusalem: The struggle for the holy city*. London: Yale University Press.

Weede, E. (1981). Income inequality, average income, and domestic violence. *Journal of Conflict Resolution*, *26*, 639–654.

Weede, E. (1987). Some new evidence on correlates of political violence: Income inequality, regime repressiveness, and economic development. *European Sociological Review*, *3*, 97–108.

Wells, H. G. (1961). *The outline of history: Being a plain history of life and mankind*. New York: Doubleday Garden City.

Wenger, M., & Denney, J. (1990). Lebanon's fifteen-year war 1975–1990. *Middle East Report*, *162*, 23–25.

Wickham-Crowley, T. (1992). *Guerrillas and revolution in Latin America: A comparative study of insurgents and regimes since 1956*. Princeton, NJ: Princeton University Press.

Williamson, O. (1975). *Markets and hierarchies: Analysis and antitrust implications*. New York: Free Press.

Williamson, O. (1995). *The mechanisms of governance*. New York: Oxford University Press.

Woodroff, J., & Ellis-Jones, M. (2000). *States of unrest: Resistance to IMF policies in poor countries*. London: World Development Movement Report.

World Bank Institute. (2006). Governance and anti-corruption, online. Available at http://www.worldbank.org/wbi/governance, accessed 20 April 2006.

World Bank Research working paper No. 3045. Available at http://www.ssrn.com/abstract = 636407

Wright, C. (1983). The Israeli war machine in Lebanon. *Journal of Palestine Studies*, *12*, 38–53.

Zuk, G. (1985). National growth and international conflict: A revaluation of Choucri and Norths thesis. *The Journal of Politics*, *47*, 269–281.

INDEX