Gagari Chakrabarti · Chitrakalpa Sen
Editors

The Globalization Conundrum—Dark Clouds behind the Silver Lining

Global Issues and Empirics

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Foreword

There are, as the editors suggest, many volumes on the topic of globalization. This volume has a reach that is quite unusual. There are some articles that go beyond pure economics and into related social issues of concern like cybercrime or social media. Market capitalism has an innate tendency to expand in to the far reaches of the world. Its history has been patchy and non-uniform. Globalization as an idea has always relied heavily on the concept of free trade and minimally regulated markets. The realm of the state and the market has been thought to be distinctly separate. However, time and again, the state's support has been necessary for market expansion and third-party enforcement of contracts. This was true during the nineteenth century high-tide of British imperialism, as well as the period of the late twentieth century years.

The metaphorical dark clouds mentioned in the title are many in different contexts of history and geography. For one, free trade in practice is often not what it is made out to be in text-books. Large corporations, monopolistic markets, corrupt governments influence trade in ways not dreamt of by Smith or Ricardo. The second dark cloud comes from the theoretical understanding that though there are gains from trade for a nation in the aggregate, there are internal winners and losers and compensations must be aligned in such a way that the losers are not worse off and yet there is a net gain that remains. Without this happening, the losers gain voice in modern democracies. Political compulsions then call for a reversal of free trade and a return to protectionism. This was evident during the decline of the early twentieth century globalization, as it is now with USA and the impending exit of Britain from the European Common Market.

Within this big picture of a familiar change challenging the euphoria of the late twentieth century globalization, there are micro and sector-wise narratives that call for special understanding and interventions. This volume offers a diverse menu of studies that thread together the bigger picture of the challenges of globalization. The editors have brought together a wide range of scholars from different continents for this purpose. No one seems to be certain about alternatives, nor about the direction in which the world economy is heading. The age of great uncertainty is here. It is important that social scientists can make some sense of the changes in the world

that seem to have widespread effects on economy, society and polity. Changes in financial markets and labour markets, the use of new technologies, and the effects of political reactions are likely to be substantial. Such research and academic investigations might help policies to be better informed. At least if we cannot predict the future with any degree of significance, can we at least imagine a future that is likely to prevail in a couple of decades from now?

Kolkata, India
June 2018

Anup Kumar Sinha
Retired professor, IIM Calcutta
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Preface

The last decade of the twentieth century has witnessed burbling globalization—a process that received tremendous support from a major section of society including policy makers, corporates, and intellectuals. The initial euphoria, however, has reached a plateau, if not turned into pessimism, in recent years. Serious questions are being broached about the benefits of an integrated world with escalating apprehension about the clouds behind the silver lining—the potential harm with its social and political implications that globalization might bring in its train. The issues like increasing income and wealth inequalities, unanticipated adverse effects of trade liberalization, implications for integrated factor markets, and implications for and reshaping of our outlook, belief, identity, and personal and social attitudes are being raised at an increasing frequency, leading perhaps to a retreat to protectionism and rise of conservative nationalism.

The book seeks to navigate this territory of critical interrogation. It brings together experts from four continents (contributors are from India, USA, Mexico, Bulgaria, Ukraine, Turkey, and Ghana) from varied interest areas to look at a spectrum of problems created by globalization. The book explores economic and financial impacts, environmental impacts, legal impacts, cultural impacts, socioeconomic impacts, and social media impacts of globalization, to name a few. It not only aims to look at the problems from a number of perspectives, but also discusses the unique impacts of globalization on emerging nations across the globe. This collection of essays, therefore, is an attempt to quench the intellectual thirst of a broad set of readers from researchers to managers of business and of anyone who would be interested to be acquainted with the contemporary issues and debates about a world that is changing through integration.

We take this opportunity to express our appreciation to those who have influenced this work. We owe a lot to Prof. Amitava Sarkar, Retired Director, IISWBM, Kolkata; Professor Anup Kumar Sinha, Retired Professor, IIM Calcutta, and Director, Heritage Business School, Kolkata; Prof. Anindya Sen, IIM Calcutta; Prof. Sankarshan Basu, IIM Bangalore; Prof. D.Sc. George Penchev, Plovdiv University, Bulgaria; and Dr. Prithviraj Guha, Presidency University, Kolkata, for their constructive comments. A sincere word of appreciation goes to the editorial

and publishing team of Springer Nature, particularly to Ms. Sagarika Ghosh and Ms. Noopor Singh for their cooperation and support. While it is our pleasure to appreciate the suggestions of the anonymous referees, the usual disclaimer remains.

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June 2018

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About the Editors

Gagari Chakrabarti completed her master's, M.Phil., and doctorate in economics from the University of Calcutta, Kolkata, India, and is currently working as Assistant Professor at the prestigious Presidency University, Kolkata, India. Her areas of specialization are financial economics and the application of econometrics in financial economics. She has several national and international publications to her credit, including three co-authored SpringerBriefs with Chitrakalpa Sen—*Anatomy of Global Stock Market Crashes: An Empirical Analysis* in 2012, *Momentum Trading in Indian Stock Market* in 2013, and *Green Investing: The Case of India* in 2014.

Chitrakalpa Sen is Assistant Professor of economics at Jindal Global Business School, O.P. Jindal Global University, Sonipat, India. He teaches courses in the areas of economics and econometrics. His primary area of research is the study of high-frequency financial market dynamics. His other research interests include, but are not limited to, econometrics of green stocks and models of shared economy. He holds an M.Sc. in economics from the University of Calcutta and a Ph.D. from West Bengal University of Technology (now Maulana Abul Kalam Azad University of Technology), Kolkata. He has three previous co-authored publications with Springer—*Anatomy of Global Stock Market Crashes: An Empirical Analysis* in 2012, *Momentum Trading in Indian Stock Market* in 2013, and *Green Investing: The Case of India* in 2014.

Chapter 1
Introduction

Gagari Chakrabarti and Chitrakalpa Sen

Over the last half a century, probably more has been written on the topic of globalization than anything else. The way of life we are familiar with is molded by globalization . The undeniable positive impacts of globalization have helped nations grow faster than ever. A study by Pritchett and Summers (2014) showed that during the last century, the three nations that have achieved superfast growths for over three decades (China, between 1977 and 2010 at 8.1% annually, South Korea, between 1962 and 1991 at 6.9% annually, and Taiwan, between 1962 and 1994, at 6.8% annually) owe this rapid growth to a large extent, to globalization and opening up of the economies. India has also registered a superfast growth spurt between 2003 and 2011, when it grew at about 8%, a far cry from the low growth rate (at an average 3.5% annually) that existed in the four decades from the independence to liberalization.

However, despite globalization's undeniable, world-changing benefits, its clear negative influences cannot be ignored. As globalization improved the way of economics, politics, culture, education, and all other fields of life, each one of these spheres have experienced at least some negative impacts of globalization. There exists a vast body of literature discussing on the negative aspects of globalization, however, almost all of them discuss the problems with a particular, narrow focus. Traditionally, globalization's adverse impacts have always been linked with the most obvious economic, social, and environmental consequences (Stiglitz 2002, 2007). Bourguignon and Scott-railton (2017) and Milanovoic (2016) examined globalization in the light of inequality, while Rodrik (2012) explored a relatively wider range including its impact on trade, finance, and labor markets. The linkage between globalization and environment has been another most researched area.

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There has been a relatively large body of work that discusses the impact of globalization on sustainable development and environmental degradation (Thai et al. 2007; Christoff and Eckersley 2013; Newell 2012, etc.). The authors have explored the negative impact on globalization on other less obvious areas as well. Heine and Thakur (2011) looked at a much darker side of globalization, in the light of various expressions of "*uncivil society*" such as transnational flows of terrorism, drug and human trafficking, organized crime, money laundering, and global pandemics. On the legal side, Addicott and Bhuiyan (2011) highlighted the linkage between globalization, international law and human rights. Tomlinson (1999) studied the linkage between globalization and culture, including cultural imperialism.

Although library full of books have been written on each one of the individual downsides of globalization, interestingly, no one book within its two covers looked at all the different facets. This is a surprising gap in the existing literature on globalization. The true impact of globalization would not be comprehensible, until we look at the bigger picture as all the areas affected or influenced by globalization are closely intertwined. Looking at the issues created by globalization through a particular looking glass will create a tunnel vision effect, concentration on one central problem while leaving other equally important problems aside. This book aims to overcome that problem.

It brings together experts from four continents (contributors are from India, US, Bulgaria, Ukraine, Turkey, and Ghana) from varied interest areas to look at a spectrum of problems created by globalization. The book explored economic and financial impacts, environmental impacts, legal impacts, cultural impacts, socioeconomic impacts, and social media impacts of globalization to name a few. This book looks at the problems from not only a number of perspectives but also discusses the unique impacts of globalization in emerging nations across the globe.

Globalization is often seen as a by-product of capitalism. Although capitalism is often touted to be the best solution to eliminate poverty, it often fails to do so. Chapter 2 (*Saumya Chakrabarti*) looks homeward and into a crucial problem that of Indian informal sector. The study finds that globalization, or the *so-called progress fails to arrest the expansion of the pool of disadvantaged*. Furthermore, the study looks at the duality; the widening gap between the formal and informal sectors. Although developed countries have gained immensely from capitalism and globalization, they did not escape from its negatives completely. On the one hand, labor is successful in winning newer rights such as protection against labor market discrimination, family leaves, and on the other hand, labor experienced continuous deterioration of bargaining and negotiation rights. Chapter 3 (*Arindam Mandal*) continues with the labor market scenario in developing nations. This chapter uses the Cambridge Labor Regulation Index to analyze the post-globalization trends in the evolution of labor rights in developed countries.

One undeniable argument in favor of globalization is that it promotes growth. In the recent past, countries that have participated actively in the process of globalization through opening up the economy has experienced unprecedented growth, for example South Korea, Taiwan. Singapore, and China. Chapter 4 (*Vaishali Sharma, Subaran Roy and Nandita Choudhury*) explores the impact of globalization on

economic growth in the BRICS countries using econometric modeling. While the impact of globalization of growth cannot be denied, the coin also has a flip side. One of the biggest criticisms of globalization is that it promotes inequality. Proponents of globalization believe that some degree of inequality is indeed good, as it promotes efficiency. The most commonly used measure of inequality is the Gini index, a measure proposed by Corrado Gini in 1912, 106 years ago. In today's more complex and more globalized world, with more complicated problems, there is a clear need to relook at the measure. Chapter 5 (*Asis Kumar Banerjee*) points out the shortcomings of the Gini index. The chapter goes on to mathematically characterize an alternative measure, a multidimensional Gini index.

Globalization has seen an increasing degree of integration and interdependence among financial markets across the world. This has made the markets more exposed to exogenous shocks which can trigger a recession (as we have seen during the recent Chinese slowdown) and in the worst case scenario, a crisis. Chapter 6 (*Soma Das and Basabi Bhattacharya*) examines the impact of a financial crisis in the post-globalization era on the Indian stock market. Chapter 7 (*Soumya Saha and Gagari Chakrabarti*) aims to capture the foreign exposure effect at firm and industry level around the two different crisis period, i.e., Dot-Com crisis in 2001 and Subprime crisis in 2008 with respect to India. Last two decades have seen a number of financial crises around the world. The reverberations of the crisis of 2008–10 are still felt across the markets. Therefore, it is imperative to have an insight into the large negative black swan events. Chapter 8 (*Sudip Patra*) aims to do just that. It uses the quantum decision theory to explain the behavior of financial markets in the era of globalization to understand and model the behavior of agents in an asset market characterized by uncertainty, crisis, and contagion.

Another important area that requires some discussion in the light of globalization is its impact on environment. Globalization coupled with an increase in income leads to increasingly higher consumption, which puts significant pressure on the environment in terms of depletion of fossil fuel, pollution, nonbiodegradable waste, etc. Chapter 9 (*Işın Çetin, Hilal Yildirir Keser, Sema Ay*) delves into the problem of environmental degradation as a by-product of globalization and explores the "*green crimes*", air and water pollution, deforestation, species decline, and animal rights. The study uses spatial econometrics model to analyze the problem. Chapter 10 (*Bertha Osei-Hwedie, Napoleon Kurantin and Kwaku Osei-Hwedie*) uses a mixed quantitative–qualitative method and the theoretical frameworks of political ecology, neoliberalism, and globalization to explain the role of foreign investment and mining in Africa's development and its obvious ills in context of environmental degradation.

Globalization is also known to reshape consumer behavior, which may supercede the local value system and cultures. Chapter 11 (*Umashankar Venkatesh*) explores the realm of how global brands may be impacting local cultures of markets that they target and enter. Based upon selected examples of consumer goods and services from India, the chapter focuses on whether such global brands affect the self-oriented; other-oriented; and environment-oriented values and therefore the (consumption) narrative and culture in developing economies with their own

evolved and ancient cultures. Chapter 12 (*Kirti Dutta*) discusses the behavior and response of global brands when faced by a crisis, through a content analysis. Another by-product of globalization, mainly propagated by global brands is innovation. Chapter 13 (*Hanna Olasiuk*) explores the impact of globalization on innovation in the Indian context.

Another gift of globalization is social media. While its benefits are countless, sometimes social media experiences can be stressful and unpleasant, given the public nature of it. Chapter 14 (*Paroma Sen*) takes up the problem of social media trolling. Globalization has created a third space somewhere between personal and public spaces. In this context, trolling has taken the space "in between" and presently commands our decisions and choices. This paper looks at the social and political ramifications of online trolling.

Chapter 15 (*Anshu Sharma and Ankur Joshi*) explores the issue of globalization changing the nature of education as a tool of social dominance, often at the cost of indigenous culture.

Chapter 16 (*Dipyaman Pal, Chandrima Chakraborty and Arpita Ghose*) looks at the Indian agricultural sector in the light of liberalization, India's famous first major brush with globalization. The authors examined the impact of liberalization on rice production across Indian states and found that the liberalization policies may have either no or negative effect on the growth of rice production.

As the negative externalities of globalization, some of which are covered in chapters this book, are well established, it is time to explore alternative forms of globalization, with less adverse side effects. The concluding chapter, Chapter 17 (*Aleksandar Milanov*) proposes an alternate form of globalization, a holisitic globalization. It is driven by the service to the whole, which can be briefly described as aiming to achieve optimal integration between the interests of humankind, animals, plants, and Earth. The vision of conducting a holistic form of globalization results into the formation of holistic organization and later into a holistic society.

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Part I
Capitalism and Its Discontents

Chapter 2
Inclusive Globalization or Deepening Dualism? The Informal Sector of India

Saumya Chakrabarti

2.1 Introduction

Indian economy is experiencing a peculiar phenomenon. It is rapidly integrating with the global economy and growing steadily for a considerable period of time, but its informal sector—a major site of socio-economic exclusion (ILO 2014)—is also expanding fast (IHD 2014). This is contrary to what the conventional approach conjectures about growth and informality (La Porta and Shleifer 2014); instead of a projected negative relation between per capita income and the extent of informality (ibid.), India is rather showing a reverse trend.

It is, however, argued by the mainstream discourse that although there is an expansion of the informal sector in India, informality itself is transforming from its moribund past and entering into a phase of tortuous transition (Bardhan 2009); it is moving away from a state of stagnancy towards dynamism and global integration (Marjit and Maiti 2006; Pieters et al. 2010; Siggel 2010; Marjit and Kar 2011; Beladi et al. 2016). However, there are critical voices too (Harriss-White and Gooptu 2001; Sinha and Adams 2006; Mezzadri 2010; Bhattacharya et al. 2013; Breman 2013; Chakrabarti 2016; Chakrabarti et al. 2016; Raj and Sen 2016): although a section of the Indian informal sector is showing marks of progression, an overwhelmingly large part persists in limbo as a surplus population (Sanyal 2007).

Given these contesting claims, I posit my questions: Why does the informality persist and expand in India, despite the growth of the overall economy and that of

This chapter heavily draws on my recent working paper Chakrabarti, 2017: "Persistence of Informality in India//a Mark of Capital's Weakness or Expansion?" https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2981501.

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the formal sectors, in particular? Is it experiencing an evolution and a progressive transformation within itself; or, is it persisting and even spreading as a major site of misery? And finally, can the formal sector growth and the growth of the overall economy resolve the problems of the informal sector; or, do these actually aggravate the problems?

Contrary to the dominant claims and the popular perceptions, I rather argue that the growth of the economy itself (driven by its formal sectors) is the prime cause of expansion of the informal sector in India. Further, only a part of this informality is able to acquire the benefits of growth through its linkages with the formal, and a much larger segment has to procreate itself almost like an outsider being disjointed from the globalization process.

Given this context, let me now present some stylized facts and certain preliminary empirical relations about the Indian informal sector. These are essential not only as a backdrop but also as a crucial beginning for the subsequent empirical framework. However, after this exploratory analysis, I undertake a more comprehensive empirical exercise testing the hypotheses derived from this endeavour. Finally, I take up some political-economic implications of my study and briefly, some tentative policy issues.

2.1.1 Some Stylised Facts and Preliminary Empirical Relations

If we look at the (horizontal) bars (Fig. 2.1), we immediately find that, even in the global context, the size of the Indian informal sector is very large. Next, Table 2.1 shows the Indian scenario over time; not only the bulk of the workforce is engaged in the informal sector (farm and nonfarm taken together), its volume is also expanding even in times of high growth.

Further, Table 2.2 shows that a large part of the workforce is engaged also in the *non*-farm informal sector, self-employment segment—oae (particularly the rural part) being very large and its volume is expanding considerably (although the segment consisting of firms hiring labour, i.e. establishments-estt, is expanding faster).[1] The expansion of the informal sector is also visible from the subsequent Figs. 2.2, 2.3 and 2.4. The urban and rural as also the self-employment and establishment—all the sub-segments are expanding across Indian states and over time.

[1]Data on non-agricultural informal sector incorporating both informal manufacturing and services are provided by NSSO for two time points: 1999–2000 (55th round) and 2010–11 (67th round). But, the second round does not include construction. So, we exclude the values for construction from 55th round data as well.

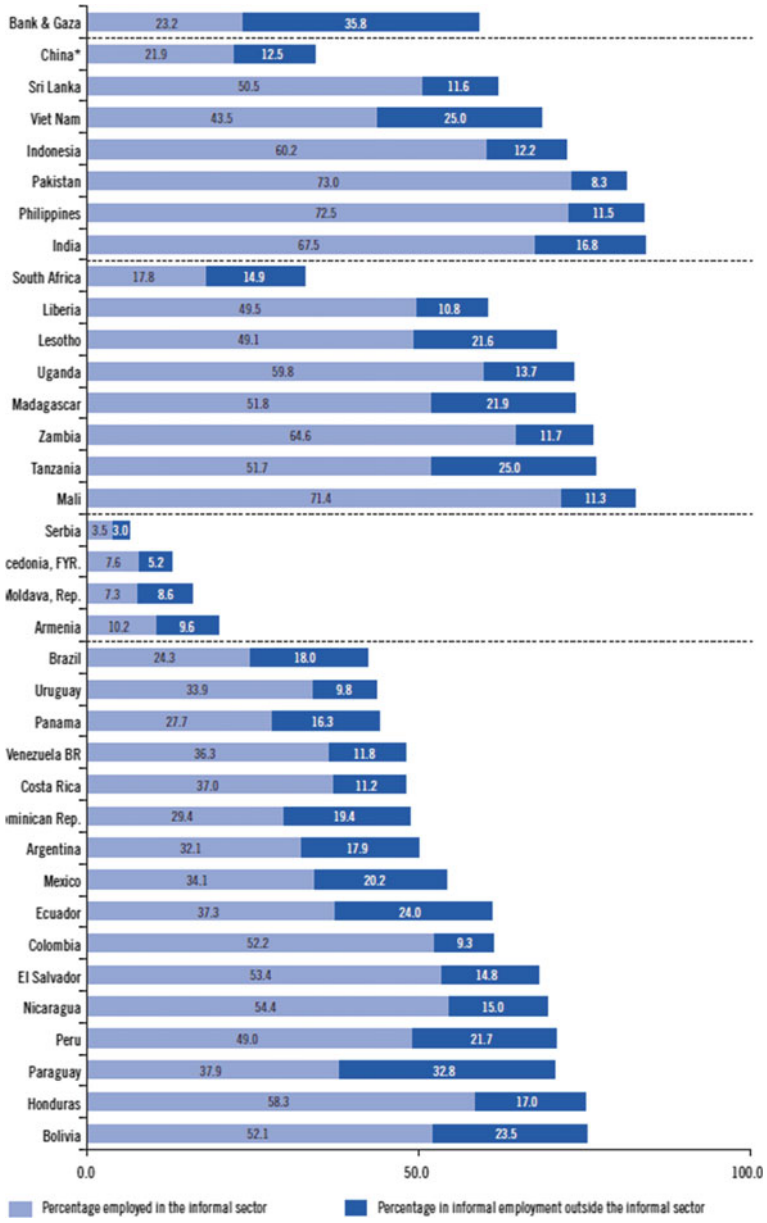

Fig. 2.1 Components of employment in the informal economy as percentage of non-agricultural employment (latest year available). http://www.ilo.org/wcmsp5/groups/public/—dgreports/—stat/documents/publication/wcms_234413.pdf. Women and Men in the Informal Economy: A Statistical Picture (2nd Edn); ILO, 2013, p. 9. *Data for China cover six cities, including Fuzhou, Guangzhou, Shanghai, Shenyang, Wuhan and Xi-an

Table 2.1 Total workers (in million) in unorganized/informal[a] and organized/formal sectors in India

Year\Sector:	Unorganized/ Informal	Organized/ Formal	Aggregate Employment (agri. + ind. + serv.)
1999–2000	358.0	38.9	396.9
2004–2005	403.4	54.0	457.4
2011–2012	391.8	80.2	472.0

[a]'[A]ll unincorporated proprietary & partnership enterprises (are) defined as **informal sector** enterprises. This definition differs from the concept of **unorganized** sector … In the unorganized sector, in addition to the unincorporated proprietary or partnership enterprises (i.e. informal enterprises), enterprises run by cooperative societies, trusts, private & public limited companies (… not registered under the Indian Factories Act 1948) are also covered' (National Sample Survey Office-NSSO, Government of India, Report No 459, 2001, p. 3)
Source IHD 2014, p.56 (derived from Table 2.5b)
Note A serious caveat is that, in the organized sector too, a large part is informal employment (without formal contracts and security) and it is rising

Table 2.2 Non-agricultural informal sector in India (excluding construction): estimated number of enterprise and worker across different location (rural/urban) and enterprise type (oae/estt)[a] over time: 1999–00 and 2010–11

	Rural			Urban			Rural + Urban		
	oae	estt	all	oae	estt	all	oae	estt	All
No. of enterprise (000)									
1999–2000	22,545	1342	23,887	14,556	4115	18,671	37,101	5457	42,558
2010–11	28,246	2645	30,891	20,564	6218	26,782	48,810	8863	57,673
No. of workers (000)									
1999–2000	32,950	5340	38,290	21,420	17,400	38,820	54,380	22,730	77,110
2010–11	41,700	11,483	53,182	28,064	26,732	54,797	69,764	38,215	107,979

[a]Own-account enterprise (oae): a firm, run without any hired worker employed on a fairly regular basis (self-employment). Establishment (estt): a firm, employing at least one hired worker on a fairly regular basis
Source NSSO 55th round and 67th round reports

Next, from Figs. 2.5 and 2.6, we find that there is wide heterogeneity within this sector so far as the crucial variable, gross-value-added (GVA)[2] per worker (average/state-level partial labour productivity)is concerned: (a) there are large rural–urban and oae-estt (i.e. self-employment—establishment) gaps; (b) the states are not performing uniformly; and crucially, (c) even the *advanced* states (Andhra Pradesh —AP, Gujarat—GJRT, Karnataka—KRNT, Maharashtra—MHST, Punjab—PNJB, Tamil Nadu—TN) are not always showing the expected results and sometimes the values are even falling over time (e.g. Gujarat's urban and estt values and Maharashtra's rural value); finally, (d) the oae-estt gap is rising over time.

[2]All GVA values are presented in real terms (at 1993–94 constant prices).

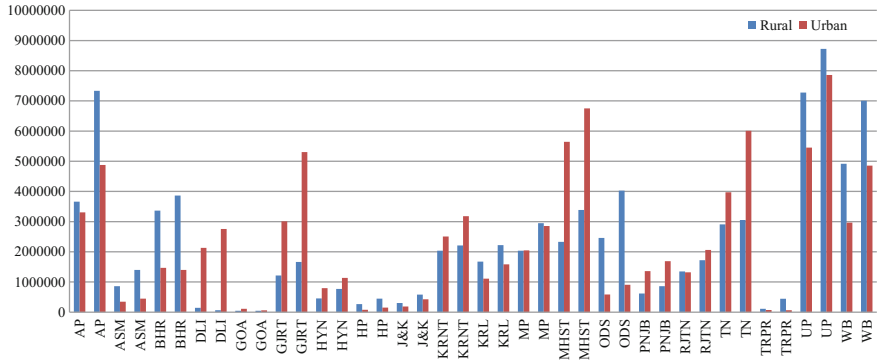

Fig. 2.2 Estimated employment in non-agricultural informal sector (excluding construction) across major states of India for rural and urban locations over time (1999–00 and 2010–11). *Source* Drawn using NSSO data

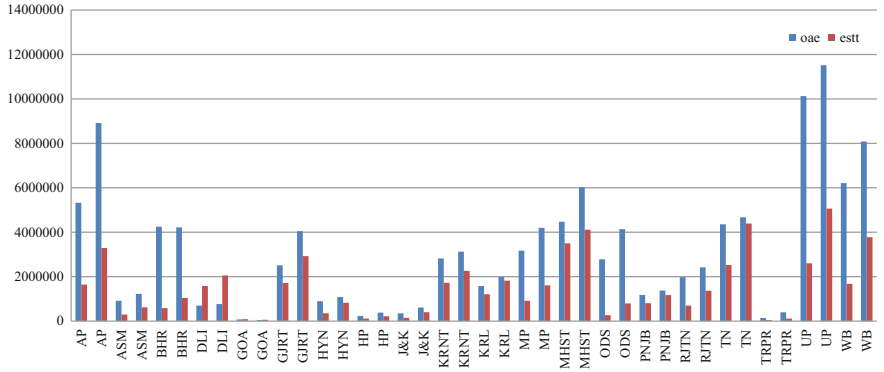

Fig. 2.3 Estimated employment in non-agricultural informal sector (excluding construction) across major states of India for oae (self-employment-based firms) and estt (firms hiring worker) segments over time (1999–00 and 2010–11) *Source* Drawn using NSSO data

Thus, from Figs. 2.3, 2.4 and 2.6, while the volume of the self-employment segment (oae) is expanding considerably over time, the oae-estt gap in terms of labour productivity is widening. This, in a way, questions the proposition of inclusion of the informality within the globalized mainstream of economic activities.

This critique is somewhat strengthened, if we look at the subsequent Figs. 2.7 and 2.8 on GVA per worker (partial labour productivity) in the self-employment segments of the unorganized services (oase) and manufacturing (oame) separately. Figure 2.7 shows that for the self-employment segment of unorganized service sector (oase), (state level) labour productivity is either rising only marginally or falling over time; further, the performance of many of the advanced states is worse than that of the relatively backward states. Figure 2.8 shows a very disturbing

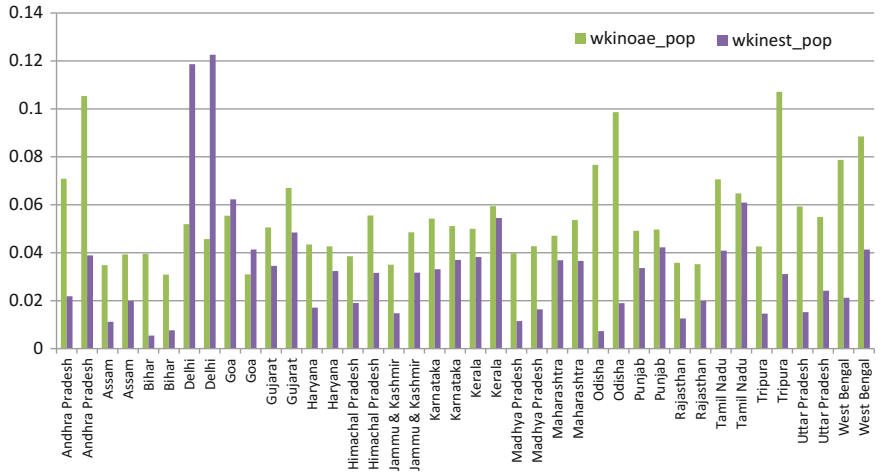

Fig. 2.4 Estimated share of non-agricultural informal sector employment (excluding construction) in population across major states of India for oae (self-employment-based firms) and estt (firms hiring worker) segments over time (1999–00 and 2010–11). *Source* Drawn using NSSO data

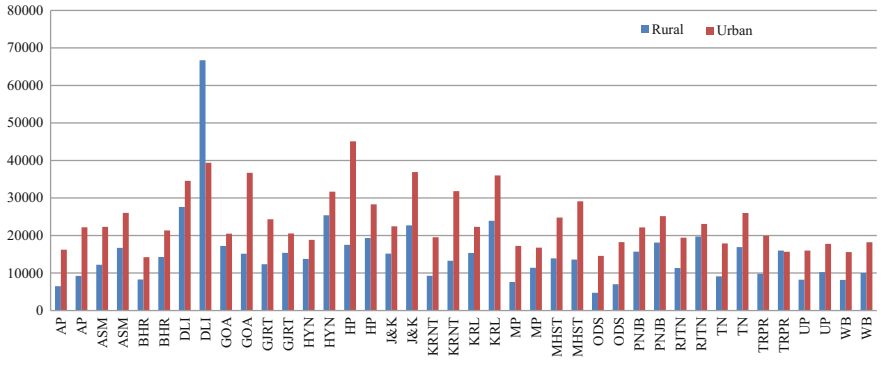

Fig. 2.5 Non-agricultural Informal Sector in India (excluding construction): Estimated Annual Real GVA per worker (in Rs.) across major states of India for rural and urban locations over time (1999–00 and 2010–11). *Source* Drawn using NSSO data. At 1993–94 price

result. The urban (state level) labour productivity values for the self-employment segment (of the unorganized manufacturing sector) are falling consistently for almost all the states in the post-liberalization phases (1994–95, 2000–01 and 2005–06). This is true for the advanced states as well!

All these Figs. 2.2 through 2.8 show that although the informal sector (as well as all its sub-segments like, oae-estt and rural–urban) is expanding in volume, the (state-level labour) productivity gaps across rural–urban and especially, across

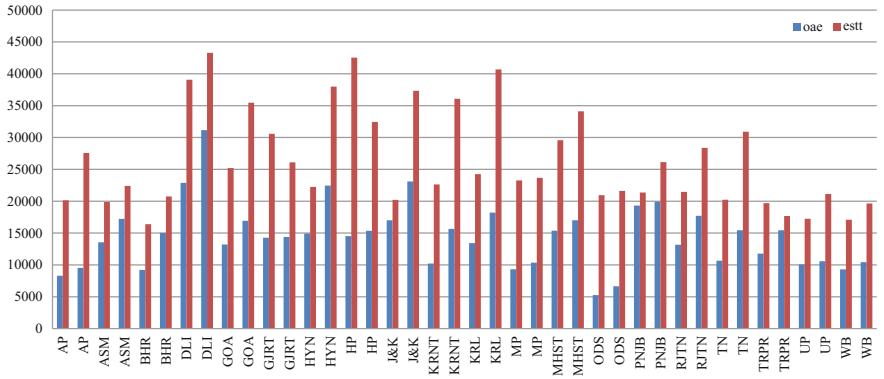

Fig. 2.6 Non-agricultural informal sector in India (excluding construction): Estimated Annual Real GVA per worker (in Rs.) across major states of India for oae (self-employment) and estt (firms hiring labour) segments over time (1999–00 and 2010–11). *Source* Drawn using NSSO data. At 1993–94 price

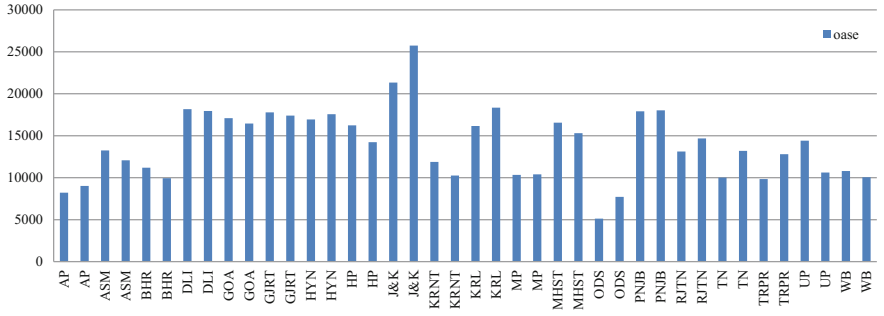

Fig. 2.7 Unorganized service sector in India (excluding trade): Estimated Annual Real GVA per worker (in Rs.) across major states of India for oae (self-employment) and estt (firms hiring labour) segments over time (2001–02 and 2006–07) *Source* Drawn using NSSO data. At 1993–94 price

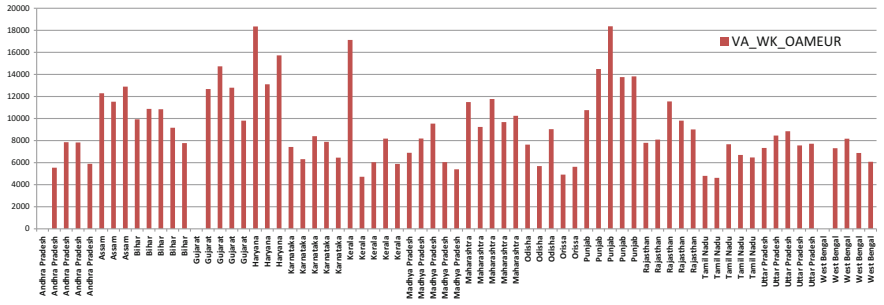

Fig. 2.8 Unorganized manufacturing sector in India: Estimated Annual Real GVA per worker (VA_WK) (in Rs.) across major states of India for urban (UR) OAME (self-employment) over time (1984–85, 1989–90, 1994–95, 2000–01, 2005–06). *Source* Drawn using NSSO data. At 1993–94 price. For Assam and Haryana (only 1994–95, 2000–01, 2005–06)

oae-estt segments are expanding over time; this rising (oae-estt) gap is fuelled even by a fall in labour productivity in the self-employment segment.

Now, contrary to the claim of a slow but inclusive transformation in India involving the informality (e.g. Bardhan 2009), I turn to a basic question (on the basis of the above-mentioned stylized facts): are these *heterogeneous* tendencies of the informal sector (sectoral *expansion* along with intra-sectoral *unevenness/differentiation*) related to the formal sectors growth? Is the formal sector *inducing* the informality and simultaneously creating *fissures* within it? Before going into a pertinent and more rigorous empirical analysis on these issues let me introduce some empirical *relations* involving the formal and informal sectors. These formal–informal relations would throw some more light on the behaviour of the Indian informal sector in line with what we have seen above, that is, expansion of the Indian informality along with widening intra-sectoral gaps.

Figures 2.9 and 2.10, show that, with an increase in the contribution of the formal sector across states (per capita net state domestic product of the formal sectors—ndpfs_pop[3]) the share of employment in the informal sector (across rural–urban and oae-estt segments) rises steadily. Thus, curiously, the informal sector expands in tandem with the formal sector; this is contrary to the traditional notion of structural transformation (Lewis 1954) where the modern sectors are supposed to internalize the traditional segments of the developing economies.

Next, Figs. 2.11 and 2.12 show a more striking result. Even if the dynamic formal sector's contribution in the state economies increase, the (state level) labour productivity in the informal sector (across rural–urban and oae-estt segments)—especially, in its self-employment and rural segments—stagnates (the outcomes are even more glaring, if we look at Figs. 2.13 and 2.14). This is indeed a disturbing trend and it questions the proposition of a transition of the Indian economy towards a more comprehensive capitalistic/modern economic environment (internalizing/involving the informality).

Thus, we get two fundamental observations:

1. The informal sector expands in tandem with the formal sector. When the formality expands, the (informal) zone of economic activity beyond its core also expands.
2. Even if the formal sector progresses, the informal sector—especially, its rural as well as self-employment segments—fails to gain in terms of labour productivity, although the conditions of the urban and establishment (estt) segments improve to a certain extent. Thus, the rural–urban and especially, the self-employment—establishment gap is widening.

[3]Net state domestic product of the formal sector (ndpfs) is calculated in the following way: first, deriving the net state domestic product of non-agriculture by subtracting net state domestic product of agriculture from the aggregate net state domestic product; then, deriving the ndpfs by subtracting the state-level aggregate value added in the non-agricultural informal sector from the aggregate net state domestic product of non-agriculture.

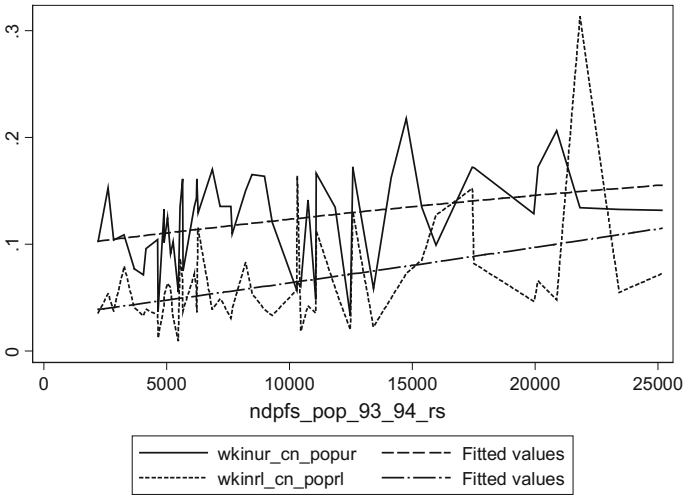

Fig. 2.9 Employment shares of urban and rural segments of the informal sector (excluding construction) in urban and rural populations, respectively (wkinur_cn_popur and wkinrl_cn_poprl), over per capita net state domestic product of the formal sectors (ndpfs_pop_93_94_rs) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers)

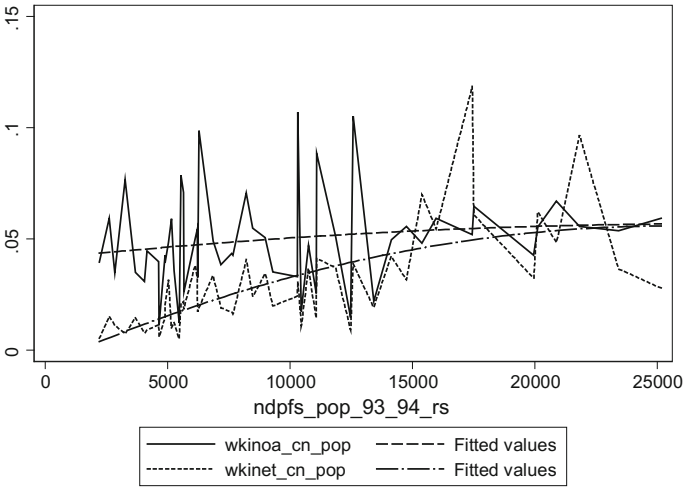

Fig. 2.10 Employment shares of self-employment (without hired labour) and Establishment (with hired labour) segments of the informal sector (excluding construction) in total population (wkinoa_cn_pop and wkinet_cn_pop), over per capita net state domestic product of the formal sectors (ndpfs_pop_93_94_rs) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers)

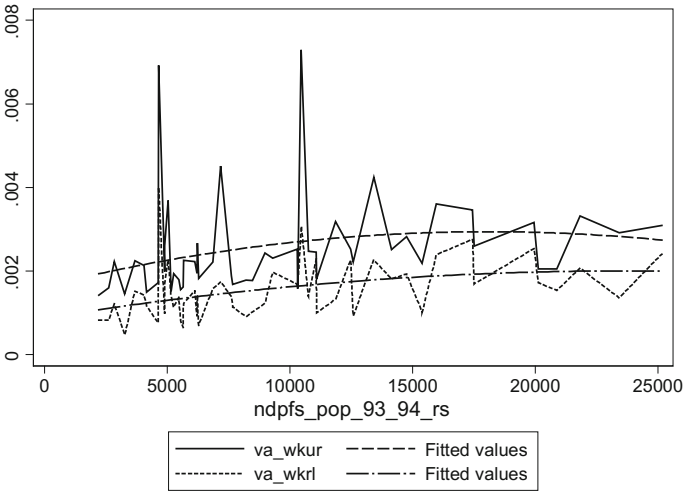

Fig. 2.11 Urban and rural informal sector labour productivity (excluding construction) (va_wkur and va_wkrl), over per capita net state domestic product of the formal sectors (ndpfs_pop_93_94_rs) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers). Value added measured in Rs. crore (10^7)

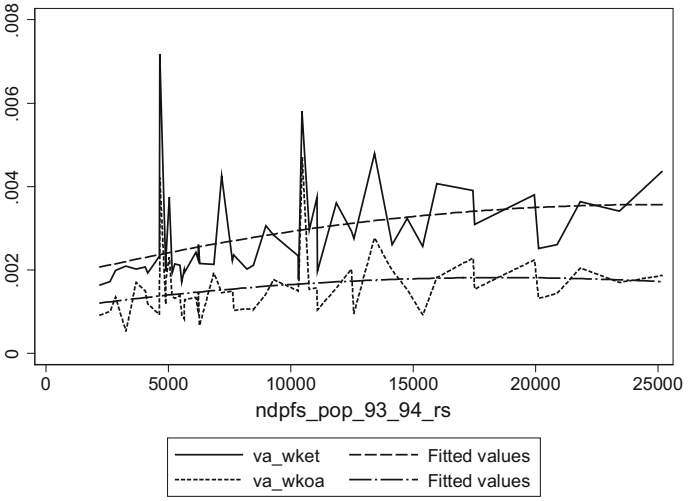

Fig. 2.12 Labour productivity of establishment (with hired labour) and self-employment (without hired labour) segments of the informal sector (excluding construction) (va_wket and va_wkoa), over per capita net state domestic product of the formal sectors (ndpfs_pop_93_94_rs) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers). Value added measured in Rs. Crore (10^7)

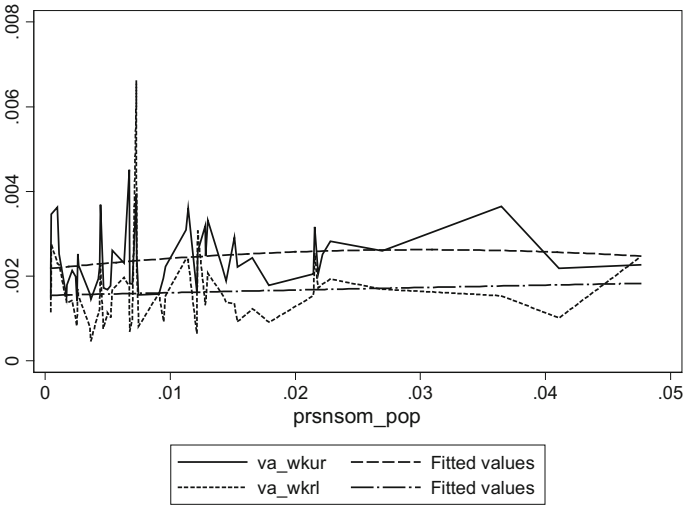

Fig. 2.13 Urban and rural informal sector labour productivity (excluding construction) (va_wkur and va_wkrl), over share of employment in organized/formal manufacturing in total population (prsnsom_pop) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers). Value added measured in Rs. crore (10^7)

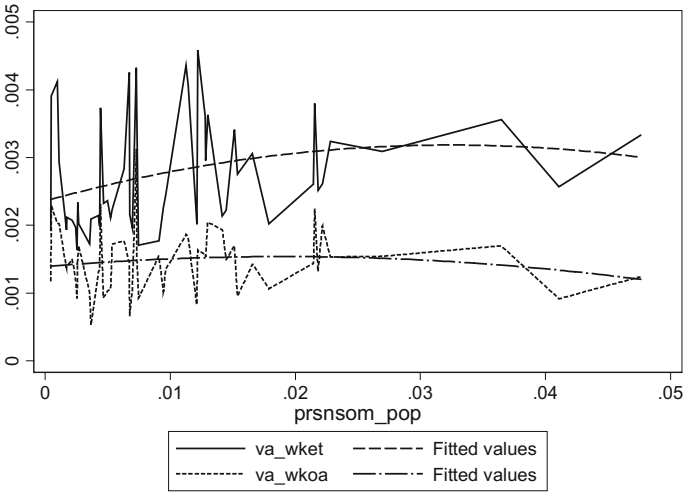

Fig. 2.14 Labour productivity of Establishment (with hired labour) and Self-employment (without hired labour) segments of the informal sector (excluding construction) (va_wket and va_wkoa), over share of employment in organized/formal manufacturing in total population (prsnsom_pop) for all the states and union territories of India and two NSSO rounds 1999–00 and 2010–11 (excluding extreme outliers). Value added measured in Rs. crore (10^7)

Not only that the informal sector is expanding along with the growth of the economy, its fissures are widening, questioning the narrative of transition towards a comprehensive dynamic economic environment (it also questions the proposition of an 'inclusive growth'). Consequently, I frame the fundamental question for this chapter as below.

> Our question in this paper is: Do the very pattern of the overall economy and the nature of formal sector growth generate such outcomes? Does the answer lie in the very structure and dynamics of the macroeconomy?

With this query, we now enter into our empirical analysis which tries to explain the persistence of informality along with its (intra-sectoral) heterogeneities in the Indian context.

2.2 Some Empirical Verification

We put forward three specific testable propositions on the basis of our above exploratory analysis and keeping in mind the fundamental question introduced just above:

1. When the formality expands, ceteris paribus, the relatively advanced as also the backward segments of the informal sector expand (through the operations of the push and pull factors).
2. These push and pull factors drive out labour away from traditional agriculture towards the informal sector.
3. Even if the formal sector progresses, the petty segments of the informal sector fail to gain in terms of labour productivity, although the conditions of the relatively advanced informal sector firms improve to a certain extent.

Before going into the formal testing of the propositions (especially, 1 and 3), we present an interesting observation in support of our second premise that is, the expansion of the economy based on fs growth pushes as well as pulls the distressed agrarian population to migrate to the infs. The following diagram is self-explanatory. It shows, as anticipated in the second proposition, with income growth the share of the workforce engaged in agriculture is reduced and the slack is picked up by the infs. Thus, with an economic expansion, maybe the workers are migrating from agriculture to the infs (Fig. 2.15).

Now, I wish to test the above-mentioned two propositions (1 and 3).

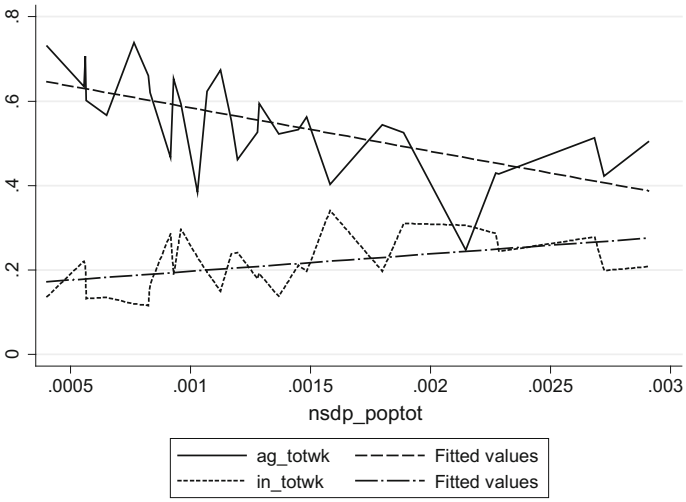

Fig. 2.15 Shares of total workforce engaged in agriculture (ag_totwk) and in informal sector without construction (in_totwk), respectively, over per capita net state domestic product (nsdp_poptot) across 15 major states of India pooled over 1999–00 and 2010–1. *Source* Author's derivation using NSSO, CSO and census data of Government of India

First, I consider the infs (*combining* both manufacturing and services, without construction). Data on Indian infs *firms* are available from NSSO *only* for the two rounds 1999–2000 and 2010–11. Other relevant data are collected from Central Statistical Organization (CSO, Government of India), Reserve Bank of India (RBI), Centre for Monitoring Indian Economy (CMIE) and Census of India. Using these data for 16 major (subnational) states,[4] I run some regressions (1–8) following the Least Square Dummy Variable (LSDV) method with Robust Standard Errors.

Consequently, I find the following striking results:

1. From regressions 1–4 (on relations between growth rates of different variables), it is found that: the (state level) sectoral size of the infs across its various sub-segments—rural, urban, own account (self-employment) and establishment (firms-with-hired-labour)—is positive and significantly influenced by the (per capita) contribution of the fs in the state economy, controlling the corresponding contribution of agriculture for the rural population and also the rural/total population ratio (found to be a major factor influencing the infs).

[4]Andhra Pradesh, Assam, Bihar (including Jharkhand), Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh (including Chhattisgarh), Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh (including Uttaranchal), West Bengal.

2. Further, from regression 1, it is found that the (rate of growth of) sectoral volume of rural infs is negative and significantly influenced by the contribution of agriculture for the rural population (a proxy for agricultural real income), controlling the (growth rate of) rural population itself (i.e. not allowing for rural-to-urban migration in the face of a hypothetical income shock in agriculture) and also controlling the fs activity. In regressions 3 and 4, a similar inverse relation between the volume of infs and agricultural income could be found, although not at significant levels.
3. On the other hand, regressions 5–8 show a crucial dichotomy within the infs. While the (rate of growth of) state-level labour productivity of the urban and establishment segments of infs is positive and significantly explained by the fs activity that of the corresponding rural and self-employment segments remains unaffected by the fs expansion. Thus, the fs may positively influence the labour productivity of those infs firms which are already in an advantageous position (in terms of location and size), but a vast majority of the rural infs firms and the self-employed may not get any benefit out of this fs activity.

Regressions 1–8 show an intriguing phenomenon: an expansion of the fs not only engenders a spread of the infs, but also creates a deep divide within it. Instead of an inclusive growth, the fs rather produces a fractured/distorted economic structure—a duality; it ensures the persistence of a fissured informality, most of which procreate at a precarious level and only the fortunate few are able to reap the benefits of global growth.

Regressions (2.1–2.8):

Regression (2.1–2.8) with robust standard errors on: Informal sector (*without* construction); 16 major states of India over 1999–00 and 2010–11. [*, **, and *** imply 10%, 5% and 1% levels of significance respectively]

Dependent variables:	Log of employment in informal sector				Log of labour productivity in informal sector (CPIIW with 1993–94 as the base year is used for deflating GVA/Lab.)			
Independent variables	Rural	Urban	Self-employment	Establishment (with hired labour)	Rural	Urban	Self-employment	Establishment (with hired labour)
Log of net state domestic product of formal sectors/ population	0.373902**	0.9793108***	0.1628907*	1.048847***	0.1285534	0.2648351***	0.1791508	0.3826427***
Robust Std Err	0.1678706	0.1764742	0.0906374	0.1789329	0.1198554	0.0761896	0.108267	0.0593902
Log of net state domestic product of agriculture/rural population	−0.4757824**	0.2598089	−0.0466526	−0.0239044	0.0574869	−0.0922579	0.1712836	−0.1610411**
Robust Std Err	0.1927736	0.1873097	0.1527226	0.217376	0.1432874	0.0919035	0.1694173	0.0752803
Log of rural population (to control rural–urban migration)	0.8163037***	–	–	–	−0.2538***	–	–	–
Robust Std Err	0.0617529	–	–	–	0.0519724	–	–	–

(continued)

(continued)

Regression (2.1–2.8) with robust standard errors on: Informal sector (*without* construction); 16 major states of India over 1999–00 and 2010–11. [*, **, and *** imply 10%, 5% and 1% levels of significance respectively]

Dependent variables:	Log of employment in informal sector				Log of labour productivity in informal sector (CPIIW with 1993–94 as the base year is used for deflating GVA/Lab.)			
Independent variables	Rural	Urban	Self-employment	Establishment (with hired labour)	Rural	Urban	Self-employment	Establishment (with hired labour)
Log of population (allowing rural–urban migration)	–	1.160156***	1.096137***	0.9174625***	–	−0.16401***	−0.168867	−0.1027821***
Robust Std Err	–	0.1012442	0.0967129	0.1248235	–	0.0537335	0.1001556	0.0349397
Dummy for year 2010–11 = 1	0.0744975	−0.687892***	−0.069197	−0.3677294**	0.2866646*	0.0805111	0.0720769	−0.0027382
Robust Std Err	0.195317	0.1219417	0.160246	0.1411317	0.1545614	0.0793139	0.1498833	0.0626286
Constant	−0.7273586	3.24148**	−3.818282**	5.27643***	−1.061234	−2.08306***	−1.062188	−2.693384***
Robust Std Err	0.8813804	1.473805	1.101517	1.818919	0.7547544	0.6497263	1.051188	0.4698547
R-squared	0.8647	0.9167	0.8562	0.8236	0.7102	0.6764	0.5278	0.7556
N(16 states X 2 years)	32	32	32	32	32	32	32	32

Source Author's derivation using NSSO, CSO and Census data of Government of India

Table 2.3 On firm-level labour productivity (across firm sizes)

Unorganized manufacturing of major states of India: *median* of firm-level real labour productivities (gva/labour in Rs.) across rural–urban locations over 2000–1 and 2005–6 for different firm-sizes		Rural			Urban		
		Firms with less than three labourers	Firms with three–five labourers	Firms with more than five labourers	Firms with less than three labourers	Firms with three–five labourers	Firms with more than five labourers
2000–01	N	34,040	8030	3942	36,985	16,041	8496
	GVA/Lab	5613.34	6907.43	10,511.74	9099.89	13,632.4	19,167.64
2005–06	N	27,087	5879	4091	21,830	9276	5534
	GVA/Lab	5379.51	8330.17	17,476.28	8291.27	13,670.07	26,077.77

Source Author's derivation using NSSO data, Government of India. CPIIW with 1993–4 as the base year is used for deflating GVA/Lab

These results are considerably strengthened, if we proceed further.

I take up the unorganized manufacturing instead of the informal sector (consisting of both informal manufacturing and services). Considering unorganized manufacturing (adequately sampled, large scale and representative) firm-level information on the major states[5] of India for the latest two available NSSO rounds (2000–01 and 2005–06), I introduce the following tabular analysis (Table 2.3):

1. Although the median[6] labour productivity for the larger urban firms (with more than five units of labour) has increased considerably over the two NSSO rounds, the conditions of the overwhelmingly large number of urban small (with one–two units of labour) and medium (with three–five units of labour) enterprises have either deteriorated or remained almost stagnant.
2. Although the median labour productivities for the large and medium rural firms (with more than two units of labour) have increased considerably over the two NSSO-rounds, the condition of large number of rural small firms (with one–two units of labour) has deteriorated.

[5]Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal, West Bengal.

[6]As the sample is very large and diverse, median happens to be a more reliable measure than mean.

Table 2.4 On firm-level labour productivity (across firm types)

Unorganized manufacturing: median of rural–urban firm-level labour productivities (gva/labour in Rs.) across firm types and over (major) backward and advanced states of India during 2005–06		Rural			Urban		
		rlent_type06 = 1: Self-employment	rlent_type06 = 2: Firms with hired worker and up to five labourers	rlent_type06 = 3: Firms with hired worker and more than five labourers	rlent_type06 = 1: Self-employment	rlent_type06 = 2: Firms with hired worker and up to five labourers	rlent_type06 = 3: Firms with hired worker and more than five labourers
Backward states	N	17,919	3731	2088	12,553	5603	2128
	GVA/Lab	5052	11,338	17,301.5	7287	14,374	23,887.5
Advanced states	N	10,465	2167	1916	9754	4909	3254
	GVA/Lab	4953	13,847	18,794.5	6689	17,547	29,397

Source Author's derivation using NSSO data, Government of India. CPIIW with 1993–4 as the base year is used for deflating GVA/Lab

Thus, surprisingly, over time, the condition of the small-petty unorganized manufacturing firms—which are very large in number—deteriorates, while that of the larger firms (though fewer in number) improves.

Similarly, sharp dichotomy between the petty firms and larger units could also be found from the following Table 2.4. Considering, as before, unorganized manufacturing firm-level information for the latest NSSO-round (2005–06) over two groups of major Indian states, advanced[7] and backward[8] (grouped on the basis of overall net state domestic product per capita and also the extent of industrial development), it is found that:

Although the median labour productivities increase considerably for the large rural–urban firms (**rlent_type06 = 3**, with at least one unit of hired labour and more than five units of labour in total) and the medium-sized rural–urban enterprises (**rlent_type06 = 2**, with at least one unit of hired labour and up to five units of labour in total) as we move from backward to advanced states, surprisingly, the condition of the overwhelmingly large number of rural–urban small/petty units (**rlent_type06 = 1**, without hired worker, i.e. only self-employment) somewhat deteriorates. Even if the larger units are performing better in the advanced states, the very large self-employment segment suffers in these so-called developed states in comparison to the relatively backward regions!

Next, a very interesting phenomenon is revealed through the following two Figs. 2.16 and 2.17 on rural and urban firm-level labour productivities (across labour size class) for the unorganized manufacturing sector in India during the year 2005–06 and for the six major states: Gujarat, Maharashtra, Kerala, Tamil Nadu, West Bengal and Uttar Pradesh, respectively.[9]

It is found, most curiously, that despite varied levels of industrial development across these states, a very large number of tiny firms (with one–three units of labour) are able to attain only similar labour productivities; overall development of the state, especially extent of industrial expansion (particularly, for Gujarat, Maharashtra and Tamil Nadu), is found to have almost no impact on the overwhelming majority of tiny firms. State-level development is found to benefit mostly the medium and large unorganized manufacturing units.

This duality between the small firm (self-employment) and the medium/large unit (hiring labour) across advanced and backward states becomes more explicit from the following regressions (9–14) (using unorganized manufacturing firm-level data as above, on labour productivity—gva/labour):

If we control labour usage and asset-labour ratio at the firm level, curiously, the coefficient of the dummy representing the advanced states becomes negative and significant for the rural–urban self-employed units, although for the medium–large

[7]Andhra Pradesh, Delhi, Goa, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu.

[8]Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Kerala, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh, Uttaranchal, West Bengal.

[9]Gujarat and Maharashtra being two important Western states and industrially developed; Kerala and Tamil Nadu, the two prominent Southern states—the latter being industrially advanced; West Bengal and Uttar Pradesh are two very large but industrially backward states.

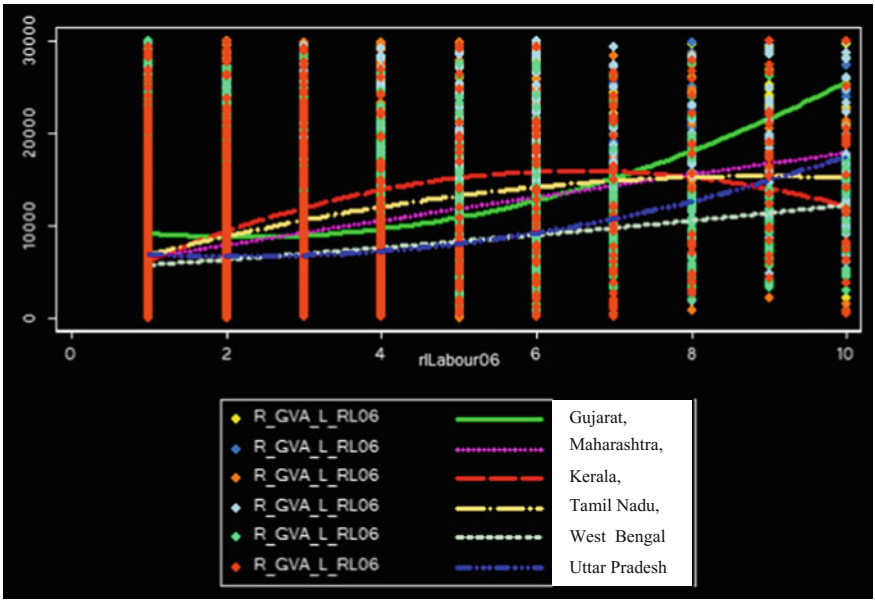

Fig. 2.16 Rural firm-level labour productivities (scatter, R_GVA_L_RL) across labour size class (rlLabour) and the fitted curves for unorganized manufacturing sector in the year 2005–06 for the six major Indian states: Gujarat, Maharashtra, Kerala, Tamil Nadu, West Bengal and Uttar Pradesh, respectively (excluding extreme outliers). *Source* Author's derivation using NSSO data, Government of India. CPIIW with 1993–4 as the base year is used for deflating GVA/Lab

units (hiring labour) the corresponding coefficients are positive and significant (except the urban large-firm segment). Thus, if we move across the states—from the backward to the advanced—the condition (labour productivity) of the overwhelming majority of self-employed deteriorates (controlling firm-size and firm-level input intensity), although the situation is reverse for the medium/large firms. Thus, in fact, the so-called advancement of the states—ceteris paribus—deepens the misery of the already disadvantaged, although the better placed firms benefit; the fissures within the infs aggravates along with the so-called progress.

Regressions (2.9–2.14) with robust standard errors. Unorganized Manufacturing Firm-level data. 2005–06.
Dependent variable: Log of (firm-level) gva/labour (labour productivity): [*** imples 1% level of significance]

Independent variables	RURAL			URBAN		
	Self-employment	Firms with hired worker and up to five labourers	Firms with hired worker and more than five labourers	Self-employment	Firms with hired worker and up to five labourers	Firms with hired worker and more than five labourers
Log (asset/labour)	0.2955454***	0.2203873***	0.3099813***	0.3641763***	0.2332345***	0.4153176***
Robust Std Err	0.0043027	0.0083366	0.0103352	0.0049303	0.0071686	0.0110557
Log (number of labourer)	−0.14086***	0.2591895***	0.1003313***	0.0674384***	0.1487637***	0.3856496***
Robust Std Err	0.0135567	0.0295394	0.030057	0.0147425	0.0199691	0.0293136
State-development Dummy (advanced state = 1)	−0.124115***	0.0739368***	0.0741099***	−0.13222***	0.0845413***	0.0351026
Robust Std Err	0.011457	0.0190556	0.0269284	0.0130419	0.0133756	0.0244659
Constant	6.027202***	6.942797***	6.499688***	5.361408***	7.042371***	4.958668***
Robust Std Err	0.0390787	0.085366	0.1232404	0.049276	0.07641	0.1196583
R-squared	0.1815	0.1600	0.2354	0.2336	0.1529	0.3065
N	28343	5894	4003	22288	10510	5378

Source Author's derivation using NSSO data, Government of India. CPIIW with 1993–4 as the base year is used for deflating GVA/Lab

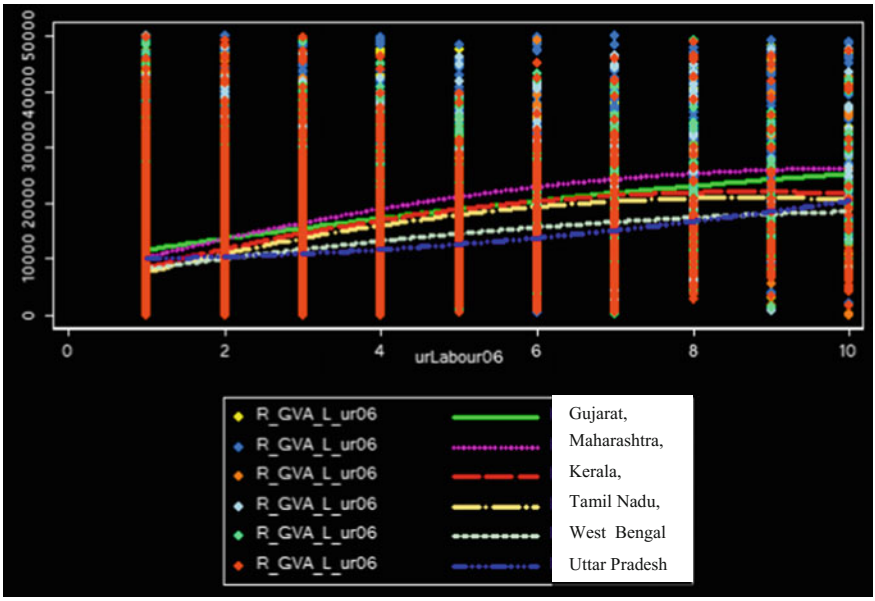

Fig. 2.17 Urban firm-level labour productivities (scatter, R_GVA_L_ur) across labour size class (urLabour) and the fitted curves for unorganized manufacturing sector in the year 2005–06 for the six major Indian states: Gujarat, Maharashtra, Kerala, Tamil Nadu, West Bengal and Uttar Pradesh, respectively (excluding extreme outliers). *Source* Author's derivation using NSSO data, Government of India. CPIIW with 1993–4 as the base year is used for deflating GVA/Lab

2.3 In Lieu of Conclusion: Some Political-Economic Implications

The conventional wisdom conjectures that with the overall growth of the economy (based on an expansion of the capitalistic/modern/formal sectors) the prevalence of the informality diminishes (La Porta and Shleifer 2014). However, my exploratory, as well as confirmatory data analysis on India, questions that. I find that the informality expands in tandem with the formal sector. So-called progress fails to arrest the expansion of the pool of disadvantaged; contrarily, the former (fs) may be inducing the latter (infs)—'evolution' producing 'involution' or at least a dualism!

This, in a way, questions the Besley and Burgess (2004) position as well, which argues that, the government regulation in India has adversely affected the formality and contrarily, induced the informality—implicitly indicating an inverse relation between the two segments of the economy. However, I find that the dominance of the former actually induces the latter.

All these fundamentally contradict the 'capital's weakness' thesis; instead of a phenomenon where the inadequacy of the formal sector perpetuates the informality (and therefore, expansion of the former is supposed/proposed to resolve the problem of the latter), I find just a reversal: formality engenders informality (as in Sanyal 2007).

Next, crucially, in contrast to an expressed optimism (Maloney 2004), I find that there are deep fissures within the informality in terms of the condition of labour in general; the very large self-employment segment suffers, while the larger firms prosper. Furthermore, this gap is widening over time. More fundamentally, I show that this duality/inequality is, in fact, aggravated by the expansion of the capitalistic formality. Instead of an inclusive growth driven by the formality, it rather produces a fractured/distorted economic structure; it ensures the persistence of a fissured informality.[10]

Not only that the Indian informal sector is expanding along with the growth of the economy, its fissures are widening, questioning the narrative of 'transition'. My theoretical question in this paper has been: Do the very structure of the overall economy and the pattern of formal sector expansion generate such outcomes? I try to find an answer to this enquiry using a variety of empirical analysis. This empirical study provides the following explanations for the above-mentioned stylised facts.

The (heterogeneous) informal sectors expand in tandem with the formal sector through the operations of the *push* and *pull* factors: As the formality grows the petty farmers are suffocated because of an input price rise (as in Rakshit 2014) and/or due to a direct drain of resources (as in Bhaduri 2017); the distressed farmers are *pushed* out of agriculture. However, only the fortunate few can get a refuge in the advanced segments of the informality (being *pulled* by the formality itself); but a very large

[10]This somewhat contradicts a section of heterodoxy as well (Sanyal 2007; Chatterjee 2008), which posits the informality as almost completely separated from the formality.

part of this migrant population is *pushed* to throng the underremunerative petty informal activities. Thus, the informality expands along with the deepening of its intra-sectoral inequality (could be found also in Himanshu et al. 2016).

The idea of inclusive growth driven by the formality with some institutional makeovers is questioned, as the very growth of the formality creates exclusion and persistence of informality; not only that, the expansion of the formality also deepens the misery of the vast section of self-employed. Given this conflict, the formal–informal symbiosis and construction of a 'hybrid economy' with a so-called peaceful coexistence and progress of both the formal and informal (Chen 2012, p. 20) seems to be quite difficult. Only a section of the informality could develop being pulled by the fs (as the fs needs it to maintain/increase profit); but, a larger part becomes economically redundant and persists only as an object of governance.

If the informality (especially, the larger portion that remains outside the extended circuit of capital) has to survive/thrive, it has to negotiate with the power of capital/formality; it cannot avoid the aggressive dynamics of the formal sector (as elaborated by Chakrabarti 2016). The challenge of the informal can be relevant, only if it can act as a cohesive collective and in this context, especially in the contemporary (mainstream)economic world mostly organized on the principles of private ownership, 'cluster' form of development of the informality could offer a respite/challenge. The prospects of clustering of the petty firms and the organization of socio-economic as also political power around that and most importantly, the abilities of the cluster of informal firms vis-a-vis the formality could be a very important area of research. In this context, Konzelmann and Wilkinson (2016), as well as the general literature on Industrial Cluster (UNIDO 2010), could provide some essential insights; and could be the basis for an important extension of the present paper.

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Part II
Labor Market Trends in Post-globalization Era

Chapter 3
Globalization and Labor Rights: Perspectives from Developed Countries

Arindam Mandal

3.1 Introduction

Globalization in recent years raised an intense debate across the industrialized world regarding its role in transforming the modern societies. No doubt globalization through trade, immigration, and flow of capital afforded great productivity increases, and hence higher standard of living. However, the speed of transformation is attracting much deeper scrutiny about the benefits of such transitions. On the one hand, globalization through trade brings competition by removing barriers to free flow of goods and services, and hence brings material benefits to consumers. This cross-border flow of goods and services are often accompanied by corresponding flow of labor and capital. This intersection of the movement of goods and services along with movement of capital and labor often leads to radical reallocation of resources in an economy. Though reallocation of resources increases productivity and efficiency, and as a result generates more economics surplus, however, this reallocation involves serious costs at an individual and local level. Often benefits of globalization fail to account for these reallocation costs. Real impact of globalization often goes beyond the accounted material costs and benefits. In economic debates related to globalization, noneconomic impact of globalization often taken a back seat.

This modern phase of globalization is primarily the product of the evolution of neoliberal policies emerged as a result of the election of Margaret Thatcher as the British Prime Minister in 1979 and Ronald Reagan as the U.S. president in 1981. The neoliberal policies, henceforth, implemented popularly known as the Thatcherism in U.K. and the Reaganism in U.S. According to Harvey (2007):

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> Neoliberalism … a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices.

This mantra of neoliberalism became the guiding star for policy-making across the world, which became more dominant after the dissolution of the Eastern European Communist bloc. This process of neoliberalization has entailed realignment of broader social, economic, political, and institutional structures in countries across the world, irrespective of level of economic development. On the one hand, developing and emerging economies like India, China, and Brazil became integrated into the global economic structure by becoming formal signatories of international institutions like the World Trade Organization (WTO), which governed flow of goods and services based on some common agreed upon rules which are implemented and adjudicated by an international body, whereas on the other hand developed economies carried out major institutional reforms, specifically related to labor's ability to organize as a way to accommodate neoliberal values in the name of freedom and achieving higher economic growth. This new arrangement ensured an opportunity for the developed economies to tap into growing labor force of the emerging economies as a source of cheap labor, and at the same time, emerging economies experienced rapid economic growth. International trade and cheap labor from the emerging economies ensured stable prices and lower inflation in developed economies, a great relief from inflationary forces unleashed due to oil shocks of late 1970s and early 1980s. Till the first decade of the twenty-first century this symbiotic arrangement worked reasonably well in ensuring rapid growth in consumption and stable prices across the world. However, this process was accompanied by slow but consistent deterioration of institutional structure in developed countries that had supported a solid middle class with strong labor rights since the conclusion of the World War II. This deterioration of institutional structure gave way to gradual weakening of labor power which resulted in stagnant wages and increased job insecurity. The wage stagnancy was countered via easy access to credit made possible by cheap inflow of international capital and policies of domestic central banks to keep interest rates under control by effective monetary policy (Silvers 2008). This saga came to a sudden stop with the 2007–2009 financial crisis that gripped the world as a result of housing crisis that started in the United States, and quickly spread out to the rest of the world through its interlinkages through international finance. The obvious outcome of all these is culminated in recent push back against globalization in the developed countries. The British referendum to leave the European Union and the ascent of Donald Trump as U.S. president with his nativist rhetoric became the new reality for the globalization that started in 1970s.

Recent literature on globalization that is emerging is increasingly focused on the noneconomic aspects of globalization with particular emphasis on evolution of institutions in response to globalization. Most of the literature, however, focused on the evolution of institutions in developing or underdeveloped countries (Mosley and

Uno 2007; Greenhill et al. 2009; Davies and Vadlamannati 2013). Impact of globalization on institutions in developed countries attracted little attention. This perhaps borne from the fact that institutional changes are assumed to be unidirectional.

In this essay, we are particularly interested in understanding the evolution of labor rights in post neoliberal era in developed countries. Forces of globalization often work through labor market; hence labor perhaps took the biggest hit in terms of losing ground to forces of globalization. Often, this weakening of labor took place through gradual dissolution of labor rights historically guaranteed through laws in these countries. One challenge to study institutions is that it is typically slow to change, and therefore one needs to observe relatively longer time frame to document the changes in institutions. For the purpose, we will be using Centre for Business Research Labour Regulation Index dataset (CBR-LRI) (Armour et al. 2016) to study evolution of labor rights since 1970s till 2013.

In the following sections, first, we will focus on the theoretical linkages connecting globalization and labor rights. Then we will discuss evolution of labor rights for 25 developed OECD countries for the period 1970–2013.

3.2 Globalization and Labor Rights—Understanding the Connections

Globalization can impact labor primarily through three channels—trade, finance, and migration. Impact of globalization on labor varied based on the channels through which globalization propagated. As a result, literature remained mixed in the assessment of the impact of globalization (Gallagher 2005; Hafner-Burton and Tsutsui 2005). Some aspects of globalization improve workers' position, whereas some other aspects do weaken workers' ability to ascertain their rights.

3.2.1 International Trade and Labor

Cross-border trade in goods and services embodies the gist of modern era of globalization process that started since 1970s. Economists for the last 200 years, starting with nineteenth century political economist David Ricardo, realized the power of trade as way to boost production and as a result standard of living in a country. Gains from trade are realized when a country increases production of goods that it does relatively well. Then countries can exchange this excess production for goods from another country. In the process, both the countries which engage in trade are better off. In economic jargon, it is known as the Theory of Comparative Advantage.

Politicians, policy makers, and economists who advocate benefits of trade, often confuses the fact that trade facilitates higher production not by employing more people but by increasing labor productivity (Stiglitz 2017; Klein et al. 2003). Higher labor productivity may not translate into creation of more jobs, rather it can exacerbate job losses if trade facilitates job destruction faster than job creation. In this scenario, a country can experience higher standard of living at the expense of creating wide gap between winners and losers from trade. Workers who lost jobs in import-substituting sectors may remain permanent losers in the process. This is to an extent is the case in most of the developed world where blue-collar workers lost jobs and livelihood because of gradual replacement of slow productivity growth sectors such as manufacturing by cheap imports from aboard. Though these countries experienced significant expansion in jobs in high productivity sectors, but these job gains were not enough to offset the jobs lost due to import.

Importance of trade in the modern era of globalization can be gaged by the fact that the volume of international trade expanded from $2 trillion in 1980 to $17 trillion by 2015 (Source: World Bank). Trade historically played an important role in boosting labor productivity both in the importing and the exporting countries (Danquah et al. 2014). Both the exporting and the importing countries gained because of expansion of trade. However, doubts remained regarding the distribution of these gains. Trade theory is silent about the distributional consequences of gains from trade. Proponents of trickle-down theory of economic growth, where it is believed gains of economic growth will eventually reach to all sections of society, pushed the agenda of more trade with little to no attention to distributional consequences of trade. As a result, trade created both gainers and losers, where society paid little attention to people who lost.

Trade by enhancing productivity played an important role in mitigating the effects of marked slowdown in labor productivity in developed OECD countries (Krüger 2003) observed since 1970s. Ability to freely trade with other countries provided developed countries an opportunity to reap the benefits of comparative advantage at an international level. At the same time, opportunity to trade provided developing countries a vehicle to boost economic growth by exploiting cheap labor easily available in most of these countries. On the one hand, trade helped these emergent economies to experience higher economic and material growth, however, at the same time, many developed countries lost many traditional industries and jobs due to outsourcing and relocation of manufacturing hubs from developed to developing countries. According to Economic Policy Institute report (Scott 2011), the enactment of the North American Free Trade Agreement (NAFTA) caused displacement of 682,900 jobs in U.S. as of 2010. Though job displacement may not mean permanent job loss, however, it can create uncertainties and insecurity in the life of working people. This is corroborated by the gradual decline of rust belt manufacturing hubs in U.S. over the last three decades. U.S. lost about 7 million manufacturing jobs between 1980 and 2016 (Source: U.S. Bureau of Labor Statistics). Similar trends are observed in other developed economies as well over the same time period. The recent pushback against international trade in developed

OECD countries is not surprising given the fact that trade has created a group of have-nots in the name of enhancing economic growth and trickle-down economics.

Trade also emerged as the primary tool for the expansion of modern multinational companies (MNCs). This is primarily possible due to the standardization of manufactured commodities, the liberalization of trade in manufactures, and the decline in long-distance transportation costs have facilitated the development of global production networks (Gereffi and Korzeniewicz 1994; Mosley and Uno 2007). This global network of suppliers gives MNCs immense bargaining power to negotiate the lowest cost possible. As a result, many of these MNCs instead of engaging in manufacturing directly, they employ subcontracting and outsourcing as means to produce goods and services. This increased bargaining power for MNCs may come at the cost of workers—both in the developed and the developing countries—who often emerged on the receiving end of this globalization process. This loss of bargaining power for workers often meant deterioration of constitutional protection of worker rights.

3.2.2 Immigration and Labor

The second pillar of modern globalization is international migration or immigration. This is evident from rapid increase in total migrant stock from 152 million in 1990 to 258 million in 2017 or 3% of the world population (United Nations 2017). If the trend in migration continued, it will increase the size of the immigrant population to 4–5% of the world's population soon. Immigration not only affects the life of people who are migrating, rather it has significant effects on life of people in the destination country. As a result, in recent decades, immigration emerged as a prominent economic and political issue in high-income countries. Political rise of leaders like Donald Trump in U.S. and Viktor Orbán in Hungary relied on exploiting rising immigration-related anxieties in these countries. It is difficult to deny the fact that immigrants do change lives of the people already residing in the destination countries in unanticipated ways—both culturally and economically. At a macro level, through efficient allocation of resource, immigration enhances economic welfare of the society, however, at a micro level immigration has significant reallocation and distributional costs on individuals. As a result, workers in the destination country who compete with immigrant worker for jobs often views immigration negatively. Whereas, people who employ immigrant worker generally holds positive opinion about immigration.

Globalization works through both trade and the movement of factors. Even the most rudimentary international economic theory distinguishes the fact that the trade is driven by comparative advantage, whereas factor movements are driven by absolute advantage. Comparative advantage ensures that trade is beneficial for both countries engaged, whereas international factor movement though globally Pareto efficient, but need not beneficial for both host and countries of origin. Rather it gives rise to third group of beneficiaries who are the migrants themselves. Migrants

would not be migrating unless net benefits of migration were not positive (Collier 2018). Though theoretically transfer from migrants to hosts and to those who are left behind might make everyone better off, but there is no guaranteed mechanism to ensure this transfer. As a result, real beneficiaries of migration may be limited in absence of any formal transfer mechanism.

Economists generally agree that impact of immigration on the overall economy is positive, but the extent of the benefit is up for debate. In this literature, what is missing is the discussion of the impact of immigration on institutions of destination country. Immigrants with them bring their own culture, expectations, tastes, and beliefs in the destination country. As immigrants integrate more in their new home, they can play a pivotal role in bringing significant changes in existing norms and institutions prevalent in the destination country. Not only this, people who are already residing in the destination country may move to solidify the institutions so that newcomers could be discouraged to bring changes. Labor rights are one of the important aspects of the existing institutions in developed countries. Studies documenting the impact of immigration on labor rights are very limited. Whatever limited studies available primarily focused on broader rights such as human rights, but labor rights may or may not be part of the human rights (Docquier et al. 2016).

3.2.3 Global Finance and Labor Rights

If international trade and migration embodies the life of globalization, then global finance is the oxygen that sustains this life. Barrier-free cross-border movement of capital is one of the basic tenets of modern era of globalization. This cross-border movement of capital often takes the form of Foreign Direct Investment (FDI). FDI increased significantly from less than $200 billion in 1990 to $1.5 trillion in 2017 (UNCTAD). International flow of finance is both the cause and the effect of the expansion of international trade. Growth in trade necessitated development of production facilities outside the country. Though developing nations are abundant in relatively cheaper labor, but capital is often a scarcer commodity. As a result, marginal returns on capital are relatively higher in capital-scarce developing countries. This ensured that excess capital in developed countries found its way into developing countries in search of higher marginal returns on investment. On the other hand, developing nations often relied on FDI as way to build necessary production infrastructure to produce tradeable commodities and generate employment for its large labor force. As a result, capital in developed economies found investment in developing economies to boost returns on their investment. FDI allowed foreign capital to make long-term investment in foreign countries with significant management rights and direct control over production process. On the other hand, availability of capital led to rapid expansion of production capacity in developing countries, which allowed these countries to provide goods at even lower cost by exploiting the scale effects of production.

Critics of globalization argue that FDI might have negative impact on workers' rights by increasing competitive pressure through cross-border movement of production processes. To reap the benefits of relaxed labor regulations, businesses in developed countries shift production processes to developing countries. Therefore, FDI might flow to countries with lax labor protections. At the same time to attract more FDI, countries might deliberately undercut each other's labor standards. Hence, globalization through FDI might lead to a race to the bottom (Drezner 2001; Olney 2013; Kiefer and Rada 2014).

3.3 Labor Rights in Developed OECD Countries

In this section, we will be discussing trends in evolution of labor rights across the high-income OECD countries since 1970s. Though economists have focused on the monetary costs and benefits of globalization on labor, however, the effects of globalization on institutions that protected workers are seldom studied at all. In recent years few handful of studies are done with emphasis on understanding the impact of globalization on labor market institutions (Mosley and Uno 2007). These studies are often limited by lack of availability of relevant data. Even if studies are done, most of these studies primarily focused on impact of globalization on labor in developing or low-income countries. This lack of interest in studying the impact of globalization on labor market institutions of high-income/developed countries may be due to the understanding that labor market protections in developed countries are already in place, and hence they are nonreversible.

Laws in the book do not mean those laws are implemented. Hence, most research on the impact of globalization on institutions primarily focused on the outcome or de facto measure of law. Study of evolution of labor market institution as enshrined in law (de jure) is often ignored. Mature civic institutions in developed western democracies ensure that laws in book are well executed. Hence, de facto aspect of law in developed countries is not an issue. Studying de jure aspect of labor market institutions is more important in developed countries. This helps to better understand the impact of globalization in developed countries which manifest through gradual change in institutions over time.

We analyze the trends in legal protection of labor rights using newly available de jure Labor Regulation Index developed by the Centre for Business Research (CBR-LRI) at Cambridge University (Armour et al. 2016). The CBR-LRI is constructed using a version of "leximetric" methodology which provides a basis for the quantitative analysis of legal rules. This measure of labor market regulation is much more comprehensive than any other prior measures (Adams et al. 2015). Five areas of labor law are coded, producing five sub-indices. These are: the law governing the definition of the employment relationship and different forms of employment; (including the regulation of the parties' choice of legal form, and the rules relating to part-time, fixed term and temporary agency work); the law on working time; the law relating to dismissal; the law governing employee representation; and the law

relating to collective action. The 40 variables in the index between them cover these areas during the period 1970–2013. A value between "0" and "1" is assigned to each indicator for each of the years covered by the dataset. "0" stands for no protection or the lowest protection offered to workers, and "1" stands for the maximum or highest protection offered. For our study, we added values assigned to each of these 40 variables. So, the CBR-LRI index varies between 0 and 40, with "0" been absolutely no protection for workers and 40 implies highly protected or regulated labor market in favor of workers. Hence, higher the CBR-LRI index implies better legal protection for workers.

Figure 3.1 summarizes the labor rights measure, by region and across time. On average, labor rights are most respected in Euro Area and least respected in the Middle East, North Africa and Pakistan, Sub-Saharan Africa and Emerging and Developing Asia. We can see a general increase in CBR-LRI over the time period under study, but the rate of growth flattened in the last decade. Aggregate measures fail to fully reflect evolution of labor regulations across countries.

For this study, we use data for 25 developed OECD countries—Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. The choice of time period 1970–2013 is primarily limited by the availability of data. Summary statistics describing mean of various measures of labor rights for selected years are presented in Table 3.1. The last three columns have information on maximum, minimum, and maximum possible score with maximum and minimum years in parentheses.

Average total labor rights across OECD countries increased from 14.49 in 1970 to 20.98 in 2013. The average remained significantly lower when we compare it with maximum possible score of 40. Though significant jump in laws protecting

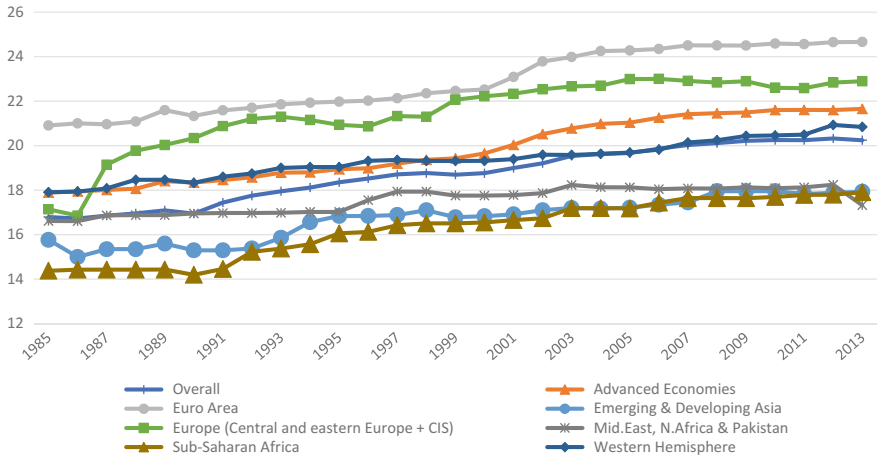

Fig. 3.1 CBR-labor regulations index

Table 3.1 Labour rights over the years

Labor rights	1970	1980	1990	2000	2013	Max (year)	Max possible score	Min (year)
Employee representation rights	2.84	3.43	3.61	3.64	3.68	3.77 (2009)	7	2.8 (1974)
Collective action rights	3.12	3.67	3.92	4.06	4.00	4.06 (2000)	9	3.06 (1972)
Regulation of work time rights	3.18	3.53	3.62	3.49	3.49	3.59 (2009)	7	3.18 (1970)
Dismissal procedure rights	2.58	3.86	4.16	4.43	4.43	4.49 (2002)	9	2.58 (1970)
Regulation of forms of employment	2.75	3.03	3.37	3.77	5.33	5.33 (2013)	8	2.75 (1970)
Total labor rights	14.49	17.51	18.67	19.39	20.95	20.98 (2010)	40	14.48 (1970)

Source CBR-LRI

total labor rights observed between 1970 and 1980, however, the rate of increase in total labor rights slowed down significantly since 1980s.

To get a sense of the evolution of total labor rights by country, we plot total labor rights for 25 OECD countries in Fig. 3.2. We find that there are significant variations in laws protecting workers across OECD countries. Typically, most protection is assured in OECD countries in Europe, whereas North American countries such as the United States and Canada historically have least protected workers. Most intriguingly, the protection of worker rights in these countries is not always trending upward. In 11 of these countries, constitutional protection of worker rights declined at some point since 1970.

In order to get a better gage of the evolution of labor rights in developed countries in the post-liberal era, we will delve into sub-indices of the Total Labor Rights, namely—(1) Employee Representation Rights, (2) Collective Action Rights, (3) Regulation of Work Time, (4) Regulation of Dismissal Procedures, and (5) Regulation of Forms of Employment.

(1) Employee Representation Rights

Laws governing employee representation primarily concerned with workers right to unionization, right to collective bargaining, employer's legal duty to bargain, extension of collective agreements to third parties at the national or sectoral level, closed shops, codetermination of board membership, and codetermination and information/consultation of workers in workplace-related decisions. In any country worker's ability to bargain through representation remained the most direct way of negotiating better terms of employment. Often, it is not only codified as worker's ability to bargain, but also as employer's duty to bargain in good faith. It is well established in economics literature that employer's often have monopsony power in the labor market, and hence can depress wages below the socially optimal perfectly

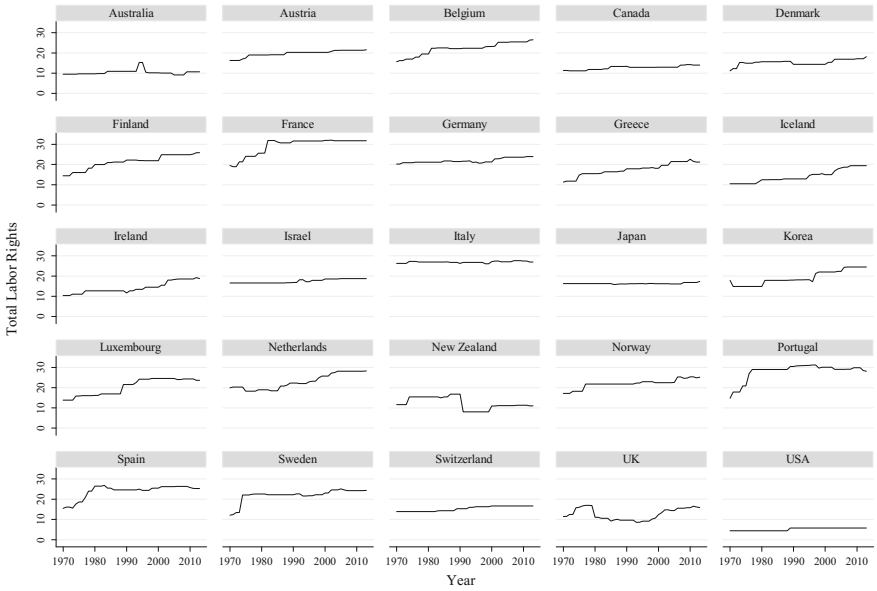

Fig. 3.2 Labour rights for OECD countries. *Source* CBR-LRI

competitive level. By ensuring bargaining rights to workers, monopsony power of the employer can be countered by bargaining wage at the perfectly competitive level, and by the process maximize social welfare (Boeri and van Ours 2008, Chap. 3). Maximization of social welfare not only raises wage, it also increases total employment. However, higher bargaining power to workers adversely affects firm profitability. So, there is always push from business community to deregulate the employee's power to bargain.

Different aspects of employee representation and bargaining rights are captured by seven aspects codified in CBR-LRI, where each of these aspects of law is coded between 0 and 1. All these aspects are aggregated with the maximum possible score of 7. Average employee representation rights across OECD countries remained low (refer to Table 3.1). Though significant progress was made in 1970s and 1980s in gaining ground to expand employee representation rights, however, the progress come to crawl during later time periods.

Figure 3.3 shows evolution of employee representation rights by country. There are wide variations in the protection of employee representations rights across countries. Finland, France, Greece, Iceland, Korea, Portugal, and Sweden experienced an increase in employee representation rights, whereas workers in twelve OECD countries experienced a decline in the constitutional protection of worker's representation rights. The decline is not surprising since deregulating representation rights remained as one of the primary goals of neoliberal policies. These deregulations often carried out in the name of affording greater freedom to individual

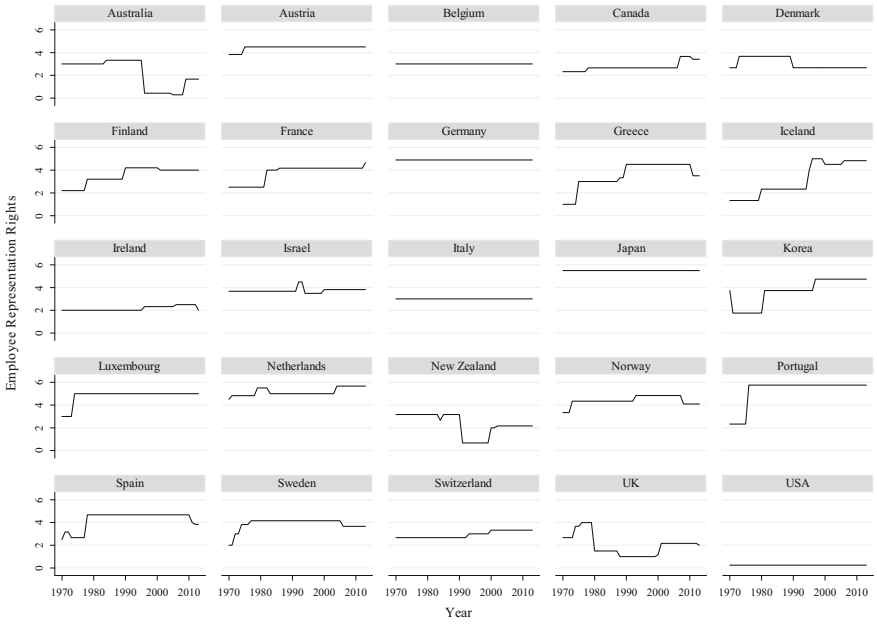

Fig. 3.3 Evolution of employee representation rights by country. *Source* CBR-LRI

workers. Free movement of goods, labor, and capital under the guise of globalization made these changes much more feasible by reducing the worker's ability to bargain.

(2) Collective Action Rights

Ability to bargain needs to go hand in hand with worker's ability to voice their concerns. Constitutional rights guaranteeing collective actions deal with protection to workers to take actions such as strikes, lockouts, and political industrial action. CBR-LRI captured various facets of collective action rights by documenting in separate aspects of labor protection. Aggregate score documenting rights protecting worker's ability to collective action varies between zero and nine in CBR-LRI. Collective action rights remained historically low across the countries under study. For OECD countries it increased from average 3.12 in 1970 to 4 in 2013 (refer to Table 3.1). It peaked in 2000, and then showed a declining trend across countries.

Country wise collective action rights are presented in Fig. 3.4. Only Belgium, France, and Italy have significant constitutional protection of collective action rights to start with. Rest of the countries has below average collective action rights. Since 1980s, this right remained fairly stable, except in U.K., we observe a steep decline in this right.

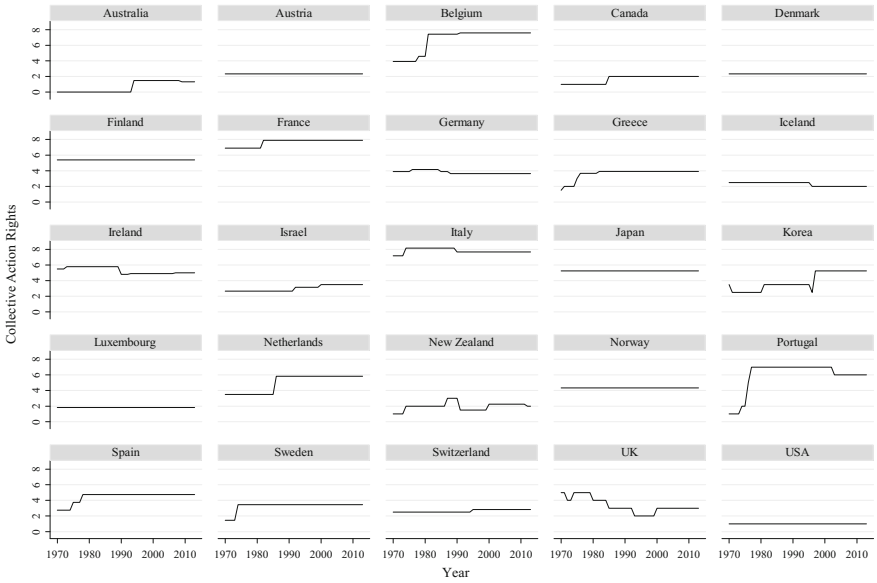

Fig. 3.4 Country wise collective action rights. *Source* CBR-LRI

(3) Regulation of Working Time

Regulation of working time primary deals with leaves and work hours related issues. Specifically, it includes annual leave entitlements, public holiday entitlements, weekend working, limits to overtime working, duration of normal working week, and maximum daily working time. CBR-LRI captured work time-related regulations by observing seven aspects related to protection of this right. Hence, it varies between zero and seven in the CBR-LRI data.

Neoliberal policies proposing freer labor market loathes the protection afforded to workers by controlling time and duration of work. Due to hard-fought wins, workers historically won significant constitutional protection of work time-related issues. However, protection of this right showing a downward trend since 1990s. Average regulations protecting working time across OECD countries increased from 3.18 in 1970 to 3.62 in 1990, but then it showed a declining trend (refer to Table 3.1).

Figure 3.5 shows charts documenting evolution of work time regulations in 25 OECD countries. Most of the European countries historically experienced relatively higher work time-related regulations. Countries such as Australia, New Zealand, and U.K. which historically had average or below average protection of work time-related regulations, experienced even further decline in these regulations especially in the 1980s and 1990s.

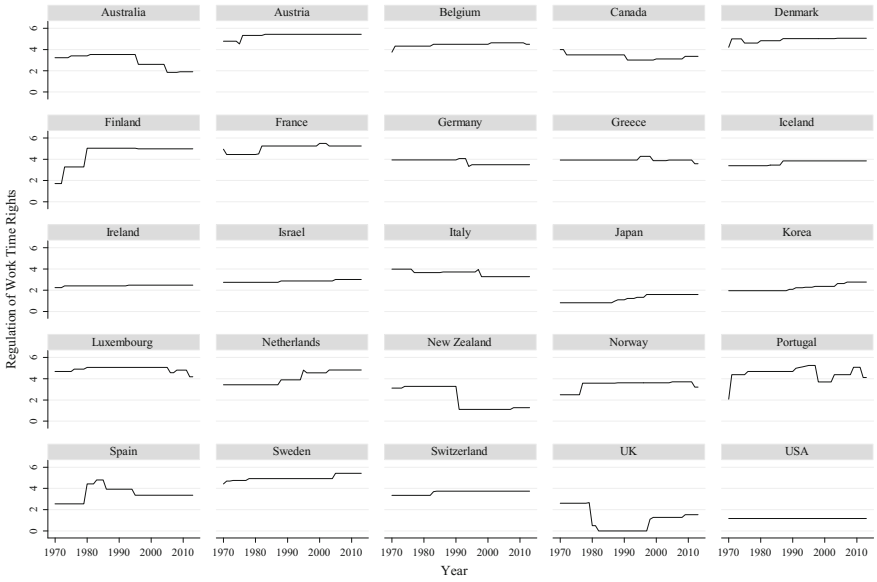

Fig. 3.5 Evolution of work time regulations in OECD countries.
Source CBR-LRI

(4) Regulation of Different Forms of Employment

Regulations concerning the eligible forms of employment primarily concerns with the nature of work contract between the employer and the employee. These regulations deal with issues like definition of employee, part-time and full-time labor contract, terms of employment, and duration of fixed term contract. CBR-LRI coded the regulations concerning forms of employment by documenting eight aspects, hence aggregate score varies between zero and eight.

Among the OECD countries, measure of regulation of forms of employment increased at a moderate pace from 2.75 in 1970 to 3.77 in 2000. However, significant increase observed since 2000 (refer to Table 3.1). Figure 3.6 plots the evolution of regulation of forms of employment for individual countries under study. Except for Japan and New Zealand, regulation of forms of employment either increased or remained constant during the period of this study.

(5) Regulation of Dismissal

This primary deal with protection afforded to workers for unfair dismissals from a job. It deals with issues related to legally mandated notice time for dismissal from a job, compensation in case of dismissal, procedural constraints on dismissal,

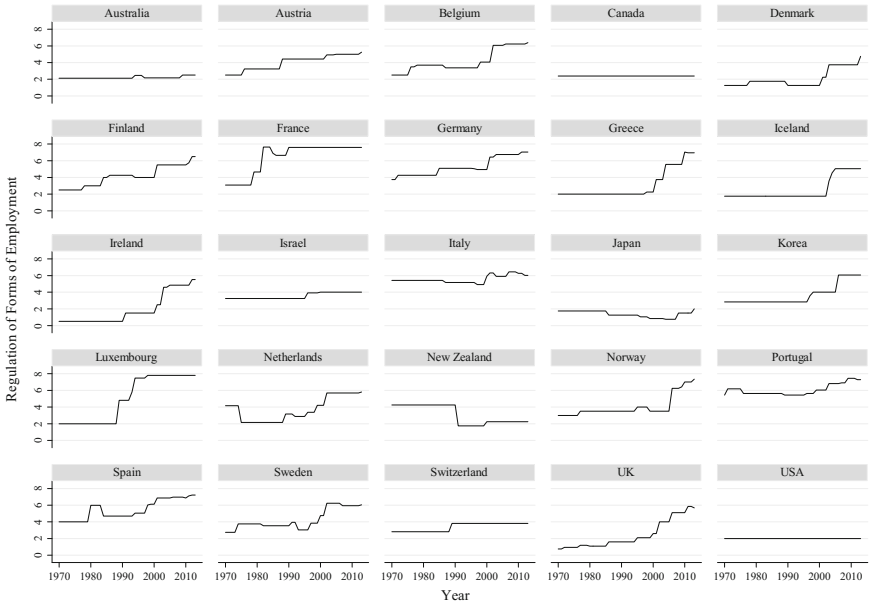

Fig. 3.6 Evolution of regulation of forms of employment for individual countries. *Source* CBR-LRI

reinstatement in job in case of unjust dismissal, and other issues related to dismissal. CBR-LRI codified this right by observing nine different aspects with aggregate score vary between zero and nine.

Average measure of this right for OECD countries increased from 2.58 in 1970 to 4.43 in 2000, however, it remained flat since 2000 (refer to Table 3.1). Figure 3.7 shows evolution of regulation of dismissal procedures for 25 OECD countries. For most countries, this right remained as one of the least protected rights among the rights we studied in this paper. So, it is not surprising that all most all the countries experienced an increase in the protection of this right. Only exception in this list is Portugal where this right showed a steady decline. This increase in codification of dismissal procedure may be grounded in economic reasons. Recent literature shows that countries with better dismissal procedure experience higher productivity growth (Acharya et al. 2013).

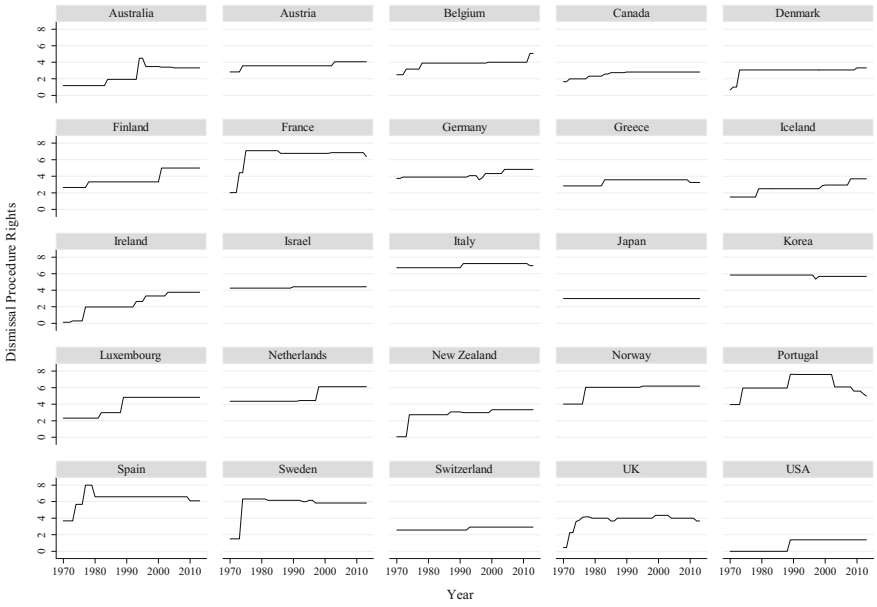

Fig. 3.7 Evolution of regulation of dismissal procedures for OECD countries. *Source* CBR-LRI

3.4 Conclusion

The primary purpose of this work is to document the evolution of labor rights in developed OECD countries. The motivation for this work came from recent pushback against globalization primarily from blue-collar middle-class workers in developed countries. Often, the effects of globalization are realized through labor market, and in this process historical institutions designed to protect workers are expected to change as well. However, most modern research documenting effects of globalization primarily focused on developing countries, with the assumption that institutional protection won by workers in developed countries are not reversible. Our study documents that this assumption has no valid reason, rather we observed that some of the crucial aspects of labor market institutions which were designed to protect worker interests have shown signs of crack in the period since 1970s. Foremost in this list is the employee representation rights. This remained the cornerstone of modern worker's bargaining power, however, neoliberal forces have chipped away this constitutional protection from workers in developed OECD countries. In addition, laws governing workers right to collective actions and those governing regulation of work time are also showing signs of gradual weakening over time. However, laws protecting dismissal procedure and regulating forms of employment have shown an upward trend. But, in our opinion, these rights are secondary to rights concerning employee representation and collective actions. In aggregate what we observe is the gradual change in the nature of protection that was afforded to workers in developed countries.

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Part III
Economic Growth, Inequality and Globalization

Chapter 4
FDI, Trade and Economic Growth: A Panel Approach to EU and BRICS

Vaishali Sharma, Subaran Roy and Nandita Choudhury

4.1 Introduction

The world is getting more integrated, internationalized and interdependent. Diffusion of technology, information, investment and mobility of workforce is enabling and influencing business and has resulted in creating and sharing more workable ideas which helps in creating plethora of opportunities for entrepreneurs. Globalization still remains the most controversial subject and it is ineluctable. Economic growth plays a vigorous role in decisive the foreign direct investment, prosperity of the people and market attractiveness of any country or trade block. The main drivers of globalization are progression in technology, and a seismic shift in economic and political policies. Globalization has led to the formation of many trade blocks who are now determining the concentration of wealth. The ideology behind the formation of these groups is a composed synergy of vision which is cohesive, robust and more competitive and integrated.

After 1941 and 1945 (Recession and World War II), subprime mortgage financial crisis of 2008 along with the collapse of the fourth-largest U.S. investment bank Lehman Brothers proved to be the worst crisis in the history of global trade. This chapter examines the impact of US per capita growth rate on other economies and how globalization affects economic growth and influence interrelated economies.

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4.2 European Union and BRICS

After the Second World War (1939–1945), the European Coal and Steel Community (ECSC) were established in 1951 by the Treaty of Paris, signed by six founding European countries (Belgium, France, West Germany, Italy, the Netherlands and Luxembourg). The ECSC formation initiated the integration of the steel and coal market. Later in 1957, the Treaty of Rome led to the formation of European Economic Community (EEC) as a common market concept. Alongside EEC, the Treaty of Euratom created the European Atomic Energy Community (Euratom) in 1957 for purposes of research and the tranquil utilization of nuclear energy. This eventually led to the formation of the EU in 1993. The belief behind this integration was the aspiration for a unified Europe to end the unrequired competitiveness amongst European countries. Presently, it is a trade bloc of 28 European countries with a GDP (constant 2010 US$) of more than $18 billion (World Development Indicators 2016) and out of these, 19 countries are a part of the common currency known as Eurozone.

BRIC was an acronym coined in 2001 by the Head of Global Economic Research Jim O'Neill, an employee of Goldman Sachs. BRICS is a group of five nations, namely Brazil, Russia, India, China and South Africa (joined in 2010). China is currently leading and influencing BRICS group and transforming the BRICS contribution in the world trade.

4.3 Trade, FDI and Growth

Trade plays a crucial role in developing an economy (it is the sum of exports and imports divided by the value of GDP). It has been progressing from the era of barter trade, bronze, copper, silver and gold to Special Drawing Rights, Foreign Direct Investment (FDI) and Institutional Investments. The world trade has doubled in size since 1990 despite the post-2007 financial crisis. The integration of technology along with the investment in trade is the vital sources for economic growth. Trade-off with other countries not only increases the accumulation of foreign exchange but also helps in interconnecting the world, creating jobs, increasing the standard of living and injecting the fuel of development and growth, which leads the world in prosperity.

FDI has become the most important catalyst for determining the economic growth of any developing economies (Buckley and Casson 1976; Roslan 2013). FDI not only indicates that the market is resilient and return of investment is rewarding, but it also shows the interest and the greater role of governments in enticing FDI inflows. Liu and Graham (1998) conducted an empirical investigation to check the impact of FDI outflows on trade, employment and balance of payments and concluded that FDI is complementary to trade.

4.4 US Growth and Financial Crisis

The Hegemonic stability theory states the prominence of having a global hegemon or supremacy of one country in the ecosphere to create solidity in the international structure. The end of World War II in 1945 is known as an era of the emerging American economy/hegemon that started declining in 1960, due to the speculative pressure on the global markets and expansionary monetary policy along with an expensive Vietnam Warand Nixon shock in 1971. Japan and West Germany emerged as strong economies in the 1970s, and now China is referred to as a world factory and a virtuous aspirant to become a successor of the superpower marathon.

The role of US subprime crisis received a close review by policymakers, economists and academicians. There is a large literature on the subprime financial crisis and how it has affected different countries in different manners (Varga and Wengert 2011; Vardhan et al. 2015; Rajan and Santhakumar 2018). According to International Monetary Fund (IMF), the global losses suffered by banks and other financial institutions in the US is estimated at $945 billion approximately and the actual loss could be even higher (IMF 2008).

In this regard, few authors (Bianco 2008; Bhutta and Canner 2009; Utzig 2010; Bhutta and Ringo 2015; Brescia 2015) had analysed how Community Reinvestment Act (CRA) enacted in 1977 in US had a low to moderate role in the 2007–2008 subprime financial crisis. The Act was established to encourage banks and other financial institutions to meet the credit requirements of small-scale businesses and low- and middle-income borrowers; however, the Act led to riskier lending by the banks. The CRA was unregulated before the financial crisis and credit rating agencies had been blamed for this unregulated act. Utzig (2010), Agarwal et al. (2012) discussed how regulators and community stood for the CRA and how economists remain divided in their outlook.

According to Demyanyk and Hemert (2008), subprime crisis was a boom-bust scenario or in other words, unpredictable growth and demand led to the breakdown of the market. Dimitriou and Simos (2013) studied the impact of financial crisis using GARCH model to estimate the equity markets of US, European Monetary Union (EMU), China and Japan and found that Japanese and EMU markets had been directly affected, whereas Chinese market had no repercussions and largely remain unaffected.

4.5 Estimation and Results

In our analysis, we have used data on 34 countries from BRICS and EU for the time period 2000–2015. The purpose of selecting EU is that it accounts for 16% of the world's imports and exports. BRICS is an emerging trade block that comprises the emerging economies such as China and India. In today's context, both these blocks have their own importance and implication not only in international trade but also

on overall globalization. Instead of clubbing these economies with all other countries, we wanted to conduct a study designed on these economies only. Since we are trying to explore the economic growth in our study, the natural candidate for the dependent variable is per capita (real) annual GDP growth rate. The primary explanatory variables are trade as a share of GDP and FDI as a share of GDP. We choose these two variables as major channels of globalization. Indeed there are various other channels but we chose this on basis of two criteria: (1) these are the most prominent and somewhat established channels and (2) more importantly, these measures can be easily quantified. Trade is measured as the sum of import and export as a share of GDP while FDI refers to net FDI inflows of countries. We have also included domestic investment as a per cent of GDP and inflation rate to control for the overall macroeconomic environment of these economies. Finally, we also have US per capita growth rate as a measure of spillover effect arising from the global phenomenon. Since the data runs from 2000 to 2015 for each country, we arranged the data in (balanced) panel format to conduct our formal statistical analysis in this paper. Data for all these variables were obtained from World Development Indicators Database (2016).

Before getting into the core statistical analysis, we calculated the correlation coefficient between US growth rates and the selected economies for the entire time period. For a large number of countries, the correlation coefficient turned out to be above 0.50. This definitely indicated a positive correlation between growth rates of our sample countries with the US growth rate. However, for India, China and South Africa, the correlation coefficient is positive but weak. In fact, the value is less than 0.2 for all three economies. This weak correlation between US growth rates for these economies further reinstates the popular thought that these economies (more for China and India) have become more diversified in terms of trade partners, investors, etc., and almost insulated from US shock waves. Apart from six countries, we have a healthy number of correlation coefficients above 0.5 in the dataset (refer to Fig. 4.1). Thus, prima facie, there exists some positive relationship between US growth rates and growth rates of these economies. Thus, it was an interesting starting point for us to investigate whether the popular channels of globalization are contributing to economic growth of these countries.

Our estimation procedure starts with pooled cross-sectional technique followed by fixed effect estimation and random effect estimation using the panel data. We describe the approaches briefly in this section. In Fixed Effect Estimation:

$$y_{it} = \beta_1 x_{it} + a_i + u_{it}, t = 1, 2, \ldots, T. \tag{1}$$

$$\bar{y}_i = \beta_1 \bar{x}_i + a_i + \bar{u}_i, \tag{2}$$

where i represents number of cross-sectional units and t represents time and where $\bar{y}_i = T^{-1} \Sigma_{t=1}^{T} y_{it}$, and so on because a_i is fixed over time, it appears in both equations. By subtracting (2) from (1) for each time period t, we get the following:

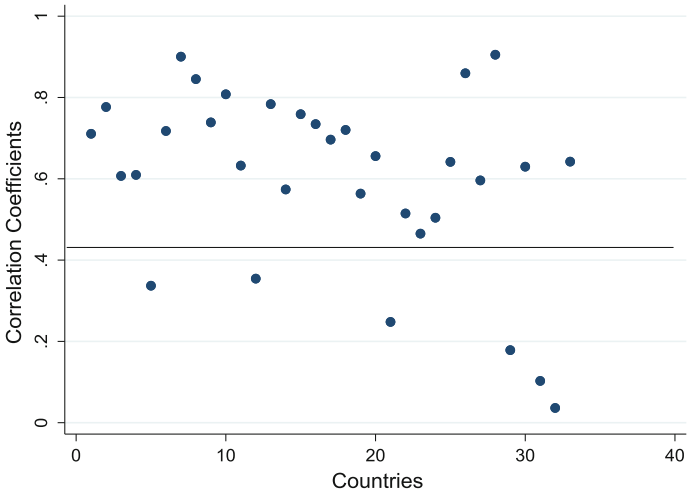

Fig. 4.1 Correlation coefficient between US growth rates and the selected economies

$$\begin{aligned} y_{it} - \bar{y}_i &= \beta_1 (x_{it} - \bar{x}_i) + u_{it} - \bar{u}_i, \quad t = 1, 2, \ldots, T. \\ \ddot{y}_{it} &= \beta_1 \ddot{x}_{it} + \ddot{u}_{it}, \quad t = 1, 2, \ldots, T \end{aligned} \tag{3}$$

where $\ddot{y}_{it} = y_{it} - \bar{y}_i$ is the time-demeaned data on y, and similarly for $\ddot{x}_{it}$ and $\ddot{u}_{it}$. This fixed transformation is also called the within transformation. Since in Eq. (3) the unobserved effect, a_i, has disappeared we can estimate (3) by pooled ordinary least square (OLS) estimator which is nothing but the fixed effects (FE) estimator also termed as the within estimator. Now the perfect random effects (RE) model includes all the FE assumptions and above the ideal requirements that a_i is independent of all explanatory variables in all time periods

$$y_{it} = \beta_o + \beta_1 + \cdots + \beta_k x_{itk} + a_i + u_{it}$$

Thus, it includes an intercept so that we can make the assumption that the unobserved effect, a_i, has zero mean. Finally, in order to determine which model fits better with our data, we have conducted the usual Hausman test. 'The Hausman test is used to differentiate between fixed effects model and random effects model in panel data. In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while the alternative Fixed effects (FE) is at least as consistent and thus preferred. However, for brevity of our results, we report estimation results of both models' (Wooldridge 2013).

As mentioned, we conducted the pooled cross-sectional regression to start our analysis. Results are reported in Table 4.1. In all three cases, US growth rate turns out to be significant and positive in magnitude. In fact, one per cent change in US growth rate change the growth rates of these economies by more than 1%. Specifically, the coefficient in third column suggests a considerable change of

Table 4.1 Pooled cross-sectional results

	(1)	(2)	(3)	(4)	(5)
US growth	1.163*** (0.00)	1.164*** (0.000)	1.145*** (0.000)	1.142*** (0.000)	1.104*** (0.000)
Trade	–	0.005 (0.253)	0.005 (0.222)	0.009*** (0.005)	0.011*** (0.001)
FDI	–	–	0.005*** (0.000)	0.003*** (0.001)	0.002*** (0.006)
INV	–	–	–	0.371*** (0.000)	0.328*** (0.000)
INF	–	–	–	–	−0.195*** (0.000)
Constant	0.499 (0.178)	0.001 (0.999)	−1.394 (0.067)	−10.134*** (0.000)	0.843*** (0.000)
N	528	528	528	528	528

* implies significant at 10% level of significance
** implies significant at 5% level of significance
*** implies significant at 1% level of significance

1.14%. The coefficient of FDI is also positive and significant. Although the magnitude of the effect seems to be a bit low. However, the coefficient of trade variable fails to gain any statistical significance at this stage. In the last two columns, we introduce two major macroeconomic variables one at a time. In column (4), we have control for domestic investment as a share of GDP. And finally, in column (5), inflation is also used as one of the explanatory variables. The primary objective of introducing these two variables is to confirm the robustness of our results. In column (4), as expected the coefficient of domestic investment turns out to be positive and statistically significant. The magnitude of the coefficient again confirms the important role the domestic investment plays in achieving higher growth rate. Specifically, a 100% increase in investment directly contributes to growth by 33%. But it is to be noted that in our variables of interest both FDI and TRADE are statistically significant at 1% level. Interestingly, the magnitude of the coefficient of TRADE variable increases compared to previous columns while the coefficient for FDI diminishes although remaining statistically significant. In the final column even after controlling for inflation, there is no major change in the quality of our results. The negative coefficient of inflation correctly depicts the situation that countries with higher inflation stagger in growth rate. Thus, from our pooled cross-sectional results, we can fairly conclude that there exists some role of globalization in the context of growth but the magnitude of coefficients are much smaller compared to the other studies after controlling for the general spillover effect (here captured by US growth rates). In all cases, the coefficient of US growth rate remains positive, statistically significant and with strong magnitude. Thus, our argument is if we are trying to proxy globalization through its two most important channels, then probably the effect of globalization on growth is not that strong as mentioned in various papers, media and popular press. As a next step, we look into a more sophisticated technique of panel data analysis to confirm our findings.

Table 4.2 Panel estimation results

	(1) FE	(2) RE	(3) FE	(4) RE	(5) FE	(6) FE	(7) FE	(8) RE
US growth	1.165 (0.000)	1.164 (0.000)	1.146*** (0.000)	1.145*** (0.000)	1.142*** (0.000)	1.142*** (0.000)	1.106*** (0.000)	1.104*** (0.000)
Trade	0.011 (0.140)	0.004 (0.296)	0.014 (0.064)	0.004 (0.288)	0.028*** (0.000)	0.009*** (0.003)	0.028*** (0.000)	0.011*** (0.000)
FDI	–	–	0.005*** (0.000)	0.005*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.002)	0.002*** (0.002)
INV	–	–	–	–	0.420*** (0.000)	0.371*** (0.000)	0.366*** (0.000)	0.328*** (0.000)
INF	–	–	–	–	–	–	−0.185 (0.000)	−0.195 (0.000)
Constant	−0.709 (0.004)	0.400 (0.998)	−2.377 (0.006)	−1.394 (0.028)	−13.177*** (0.000)	−10.134*** (0.000)	−12.364*** (0.000)	−9.684*** (0.000)
N	528	528	528	528	528	528	528	528
Hausman	1.14		2.53		14.83		11.21	

* implies significant at 10% level of significance
** implies significant at 5% level of significance
*** implies significant at 1% level of significance

Table 4.2 summarizes our estimation results from fixed effect and random effect methods. In column (1) and (2), we have US growth rate and trade variables as our only explanatory variables. Both random and fixed effect approaches leave these variables statistically insignificant. In the following two columns, we report results from both approaches using FDI as an additional independent variable. The coefficient of trade variable remains positive but insignificant. The US growth rate coefficient gains back its statistical significance and FDI also turns out to be positive. The coefficient of FDI is statistically significant but the magnitude still remains weak. The coefficient of trade variable is positive, significant but remains weak in terms of magnitude in random effect estimation result. The trade variable is not significant in fixed effect model. Column (5) and (6) report the estimation results after controlling for the domestic investment. It turns out that domestic investment and US growth rates plays a very strong and significant role in determining growth of these selected economies. In both occasions, FDI continues to play its weak but positive and significant role of its own in contribution towards growth. And in this model, the variable trade also becomes significant and with an expected positive sign. In terms of magnitude, it seems that trade as a channel of globalization contributes more to economic growth compared to FDI. Finally, in column (7) and (8), the results of the full model are documented. Specifically, in these two columns, we control for the overall macroeconomic environment of these economies. Results indicate that our primary findings remain the same. The coefficient of inflation variable is negative and statistically significant implying that higher inflation rate is associated with drop in the growth rate. Irrespective of the estimation method, both coefficients of FDI and trade variable remain positive and significant. Also, we note that the magnitude of the impact of these two variables almost remains the same in the final model. Thus, we are inclined to mention that the role of FDI and trade in the context of economic growth for these economies is positive but the magnitude is not very strong. Rather, the coefficient of US growth rate remains positive throughout and with a much stronger magnitude compared to coefficients of channels of globalization. As a final step of our empirical exercise, we interact with the FDI and trade variables with US growth rates to check if the effect of the globalization depends on the value of US growth rates. Thus, in presence of the interaction variable, the effect of trade and FDI also depends on the different values of US growth rates.

In conclusion, the results in Table 4.3 show that the interaction term between FDI and US growth rate are insignificant. Thus, the effect of FDI is not dependent on the spillover effect which arises from US growth rates. However, the coefficient of the interaction term between trade and US growth rate are positive and statistically significant indicating an additional channel through which trade positively affects the growth rate. Specifically, it indicates that for higher US growth rate, there is some additional benefit through the channel of trade. It may be the case that higher US growth rate stimulates the overall international trade in a positive and significant way. However, even in this model, the effect of FDI, trade and the interaction term (between trade and US growth rate) remains weak in their magnitude. If we interpret the coefficient of FDI and trade, we see that even a 100%

Table 4.3 Panel estimation results

	Pooled	FE	RE
US growth	0.887*** (0.001)	0.859*** (0.000)	0.887*** (0.000)
Trade	0.005*** (0.004)	0.023*** (0.001)	0.005 (0.118)
FDI	0.002*** (0.002)	0.028** (0.014)	0.002** (0.012)
FDI × US	−0.0002 (0.802)	−0.0001 (0.792)	−0.0002 (0.629)
Trade × US	0.002** (0.050)	0.002** (0.008)	0.002** (0.011)
INV	0.323*** (0.000)	0.036** (0.000)	0.323*** (0.000)
INF	−0.196*** (0.000)	−0.187*** (0.000)	0.196 (0.000)
Constant	−9.145*** (0.000)	−11.83*** (0.000)	−9.145*** (0.000)
N	528	528	528
Hausman	NA	10.78	

* implies significant at 10% level of significance
** implies significant at 5% level of significance
*** implies significant at 1% level of significance

increase in both of these variables contribute merely 2–2.5% for the selected economies. Thus, in our investigation to gauge the effect of globalization on economic growth of BRICS, our results show very weak but positive impact. This further reinforces the fact that globalization itself is not the engine of strong economic growth for BRICS and EU.

4.6 Conclusion

In this era of globalization, we wanted to conduct a simple exercise to figure out—whether really globalization matters for a country's economic growth. In order to do the investigation, we chose a set of countries who are supposed to be highly engaged in the process of globalization. Namely, we used BRICS and EU countries. We had to restrict ourselves to popular measures of globalization—trade and FDI due to availability of comparable data. Interestingly, our results indicate a very weak yet positive impact of globalization. On completing the fundamental calculations on contribution of globalization on growth reveal that even if a country doubles the amount of trade and GDP—the corresponding increase in the GDP growth is going to be less than 3%. Based on our results, we do cast a question on the so-called success and/or importance of globalization. It seems the fundamentals of growth may not include the globalization as an important ingredient.

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Chapter 5
Measuring Multidimensional Inequality: A Gini Index

Asis Kumar Banerjee

5.1 Introduction

One of the commonest criticisms of globalisation and liberalisation is that it has led to an increase in inequality. One would naturally like to check the veracity of this criticism by examining factual evidence. Obviously, this is basically an empirical issue.

Quite deep theoretical issues, however, raise their heads as soon as one asks what would be a satisfactory *method* of studying this empirical question. One of the very first questions that arise in this context is what particular inequality index should be used in this exercise. As is well known, even in the case where we are interested in studying the distribution of a single variable (say, income), this is a non-trivial issue since there are different inequality indices and different indices may lead to different rankings of a pair of income distributions.[1] In this paper, we shall bypass this issue. In the single-variable context, the Gini index (of relative inequality) is the most widely used inequality index. We shall follow this widely prevalent practice and shall not enter into the question of the relative merits and demerits of this particular index vis-à-vis other indices.

In this paper, however, we are concerned with the problem of measuring *multidimensional* inequality. Among the major understandings that have emerged in recent decades in the broad field of the measurement of standard of living, the one that is of central importance for this paper is that standard of living is a multidimensional notion, its dimensions including not only income but also other attributes of the individuals in the economy such as education, health, housing and so forth.

[1]In fact, so far as inequality indices are concerned, there is an embarrassment of riches because there are an infinite number of such indices. See Sen (1997).

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An immediate corollary of this understanding is that when it comes to inequality measurement, it is multidimensional inequality that we should be interested in measuring. Given the focus on the Gini index as the measure of inequality, this, in turn, implies that a multidimensional Gini index (MGI) is our desired index.

The problem is that while the unidimensional Gini index is uniquely defined, there is no universally agreed formula for an MGI. Various proposals have appeared in the literature based on various possible ways of arriving at such an aggregate index. This multiplicity is, again, a problem. Suppose X and Y represents the economy of a country before and after the start of the process of liberalisation and globalisation. The question whether inequality in Y is greater than that in X or not cannot be answered because the answer will depend crucially on which specific MGI (out of the many that have been suggested) is used to estimate inequality.

In this paper, we first obtain a specific MGI formula from a number of simple mathematical (or statistical) requirements. It turns out that the index characterised in this way is very simple and transparent in nature (unlike some of the other suggested MGIs in the literature). We then proceed to show that this index satisfies all of a number of properties that may be desired of an MGI from the point of view of economic theory. Finally, we note that the existing literature does not seem to contain any other suggested MGI that possesses all of these properties. The index derived in this paper is proffered as the suggested measure of multidimensional inequality which can be used by empirical researchers to investigate the effects of globalisation on inequality in specific cases.

Section 5.2 below introduces the notations and the preliminary definitions. Section 5.3 derives an MGI from a number of simple mathematical requirements that seem to arise naturally in our context. Section 5.4 addresses the question whether the index is an acceptable MGI from the viewpoint of economic theory. For this purpose, we discuss a number of properties that a 'candidate' MGI may be required to possess on intuitive grounds. We use these properties to formulate a definition of an acceptable MGI. It is then shown that the index derived in Sect. 5.3 are an acceptable MGI in this sense. Section 5.5 relates the work reported in this paper to other work on MGIs and concludes the discussion.

5.2 Notations

Consider an economy consisting of p individuals. There are q attributes of well-being. P will denote the set of individuals $\{1, 2, \ldots, p\}$ and Q the set of attributes $\{1, 2, \ldots, q\}$.

Let $Y = \left(y_i^j\right)$ be the $p \times q$ matrix in which y_i^j denotes the amount of the jth attribute ($j = 1, 2, \ldots, q$) going to the ith individual ($i = 1, 2, \ldots, p$). Y will be called a distribution matrix.

We shall assume that Y is non-negative. Some contributions to the literature assume Y to be positive. This is an important difference. It may turn out that positivity in this context is an overly restrictive assumption. For example, there may

be individuals with no education. If education is an attribute of well-being, Y will violate the positivity assumption. Similarly, if the list of attributes includes housing and if some individuals are homeless, Y will fail to be positive. To be sure, there are economies in which the basic necessities of life are supplied for free to the needy. However, this is not true of all economies. When we are trying to design an index of inequality, it is doubtful whether we should exclude from the realm of analysis those economies in which poverty and inequality are particularly severe problems. Accordingly, we shall permit some entries in a distribution matrix to be zero. We shall have to look for ways to solve the mathematical problems that this may entail.

Each column of Y will, however, be assumed to have at least one positive entry. This will ensure that there is a positive total amount of the attribute to distribute among the individuals. Indeed, otherwise, it does not make sense to include the attribute in the analysis of inequality. Let $\mathbf{Y}$ denote the set of all $p \times q$ non-negative distribution matrices with this characteristic where p and q are positive integers. If $q = 1$, this set will be denoted by $\mathbf{Y}^1$. $\mathbf{y_i}$ will denote the ith row of Y, $i = 1, 2, \ldots, p$, and $\mathbf{y}^j$ will denote its jth column, $j = 1, 2, \ldots, q$.

The transpose of a vector will be denoted by a prime sign on it.

For any Y in $\mathbf{Y}$, Y_μ will denote the matrix obtained by replacing each entry in Y by the arithmetic mean of the column containing the entry.

As stated in the Introduction, in this paper, our objective is to obtain an index which can be considered to be a multidimensional version of the unidimensional Gini index.

Definition 5.2.1 The mapping e $\mathbf{Y}^1 \to \Re$ is such that, for all $\mathbf{y} = (y_1, y_2, \ldots, y_n)$ in $\mathbf{Y}^1$, $e(\mathbf{y}) = (1/\mu(\mathbf{y})) \sum_{i=1}^{p} y_i w_i$ where $\mu(\mathbf{y})$ is the arithmetic mean of $\mathbf{y}$ and, for all i in P, $w_i = (2r_i - 1)/p^2$, r_i being the rank of the ith individual in a rearrangement of $\mathbf{y}$ in non-increasing order.

The p-vector $\mathbf{w}$ whose ith entry is w_i be called the Gini vector of weights on the individuals. Hence, for all $\mathbf{y}$ in $\mathbf{Y}^1$, $e(\mathbf{y}) = (1/\mu(\mathbf{y}))\mathbf{y}'w(\mathbf{y})$. The mapping e from $\mathbf{Y}^1$ into the real line with the property that, for all $\mathbf{y}$ in $\mathbf{Y}^1$, $e(\mathbf{y})$ is as defined above is the unidimensional Gini index of relative *equality*. The unidimensional Gini inequality index G^1 is now defined as follows.

Definition 5.2.2 G^1 is the mapping from $\mathbf{Y}^1$ into the real line with the property that, for all $\mathbf{y}$ in $\mathbf{Y}^1$, $G^1(\mathbf{y}) = 1 - e(\mathbf{y})$.

For all $\mathbf{y}$ in $\mathbf{Y}^1$, if $\mathbf{y}^*$ denotes the vector $\mathbf{y}/\mu(\mathbf{y})$, then, noting that $\mathbf{w}(y) = \mathbf{w}(y^*)$, we can write e($\mathbf{y}$) as $\mathbf{y}^{*\prime}\mathbf{w}(\mathbf{y}^*)$.

5.3 A Proposed Multidimensional Gini Index

For all Y in $\mathbf{Y}$, let Y^* denote the matrix obtained by scaling (i.e. dividing) each entry in Y by the mean of the column containing the entry. In order to obtain a multidimensional Gini index, we first seek a multidimensional version of the function e specified above. For all Y in $\mathbf{Y}$, let $W(Y^*)$ be the *Gini weights matrix*, i.e. the matrix

in which, for all j in Q, the jth column, $\mathbf{w}^j(Y^*)$, is the vector of the classical Gini weights on the individuals obtained from the distribution vector $\mathbf{y}^j$ [i.e. for all i in P and for all j in Q, the (ith row, jth column) entry w_i^j in $W(Y^*)$ is $\left(2r_i^j - 1\right)/p^2$ where r_i^j is the rank of individual i in a rearrangement of $\mathbf{y}^{j*}$ in non-increasing order].

Now, for all Y in $\mathbf{Y}$, the multidimensional analogue of the expression $\mathbf{y}^{*\prime}\mathbf{w}(\mathbf{y}^*)$ may be taken to be the matrix $Y^{*\prime}W(Y^*)$ which can be interpreted to be the 'blown-up' version of the expression. The problem, thus, boils down to the one of finding, for each Y in $\mathbf{Y}$, a suitable *scalar* equivalent of the matrix $Y^{*\prime}W(Y^*)$.

In order to find such a scalar equivalent of $Y^{*\prime}W(Y^*)$, we examine the nature of the entries of this matrix. In the multidimensional case, the indicator of the contribution of an attribute (j, say) toward the overall degree of equality existing in the economy is not just equal to $\mathbf{y}^{j*\prime}\mathbf{w}(\mathbf{y}^{j*})$ which is its 'direct' (or 'own') contribution and is the diagonal entry in the jth row of $Y^{*\prime}W(Y^*)$. The indirect effects working through its interactions with the other attributes are also to be considered. The (ith row, jth column) entry in the matrix $Y^{*\prime}W(Y^*)$, $\mathbf{y}^{i*\prime}\mathbf{w}(\mathbf{y}^{j*})$, is an indicator of the contribution of attribute i working through its interaction with attribute j. The matrix is, therefore, an enumeration of the direct and indirect contributions of the various attributes towards the overall degree of equality.

We propose that the *overall* degree of equality be interpreted as some sort of an average of the contributions of the various attributes. We formulate this idea as a condition on our proposed MGI, M^{G}, as follows.

Averaging (AV): For all Y in $\mathbf{Y}$, $\mathrm{M}^G(Y) = 1 - m(Y^{*\prime}W(Y^*))$ where, for any matrix X, $m(X)$ denotes an average of the entries in X.

It can be checked that, under our assumptions, for any Y in $\mathbf{Y}$, $Y^{*\prime}W(Y^*)$ is a positive matrix. Thus, we are on the trail of an appropriate average function, m, defined on the space $\mathbf{K}$ (say) of arrays of positive real numbers.

We shall identify a specific m function by imposing appropriate conditions on it. Obviously, the conditions that are chosen should be such that they would be desired properties of an average function in our specific context of averaging over the entries in the matrix $X^{*\prime}W(X^*)$. We propose four conditions on m. The first three of these are as follows.

Permutation invariance (PI): For all arrays K in $\mathbf{K}$, $m(K)$ is invariant with respect to permutations of the entries in K.

First-degree homogeneity (FDHOM): m is homogeneous of degree one, i.e. for all K in $\mathbf{K}$ and for all positive scalars α, $m(\alpha K) = \alpha m(K)$.

Invariance under averaging of pairs of numbers (IAP): For any K in $\mathbf{K}$ and for any two members (say, a and b) of K, $m(K) = m(L)$ where L is the array of numbers obtained from K by replacing both a and b by their average m(a, b).

PI states that, in calculating the average of an array of positive real numbers, it does not matter in what order we take the numbers. **FDHOM** implies that if all members in a set of positive numbers are multiplied by a positive number, the average is also be multiplied by the same number. **IAP** requires that the average of

an array of positive numbers is unchanged if each of a given pair of members of the array is replaced by the average of the pair.

It should be noted that all of these three conditions are very weak requirements. In particular, all of them are easily seen to be satisfied by the most widely used averaging formulas including the arithmetic, the geometric and the harmonic means.

To state the fourth condition recall that the entries in the matrix $Y^{*\prime}W(Y^{*})$ are the direct and the indirect contributions of the various attributes toward overall equality. All of these are positive numbers. Moreover, the direct contributions (i.e. the main diagonal entries in the matrix) do not exceed 1 in magnitude. Hence, the differences of these magnitudes from 1 are their direct contributions to inequality. (In fact, these differences are simply the unidimensional Gini indices of the various attributes.) The off-diagonal terms, however, may exceed 1. Hence, in general, it is not possible to interpret their differences from 1 as their (indirect) contributions toward inequality. However, if such a term happens to be less than 1, then the difference can be given this interpretation. For instance, if $\mathbf{y}^{i*\prime}\mathbf{w}(\mathbf{y}^{j*}) \leq 1$, then $1 - \mathbf{y}^{i*\prime}\mathbf{w}(\mathbf{y}^{j}*)$ can be said to be the indirect contribution to overall inequality of the ith attribute working through the jth.

Consider now the special case in which all entries in $Y^{*\prime}W(Y^{*})$ are strictly less than 1. The matrix $\left[1_{q\times q} - Y^{*\prime}W(Y^{*})\right]$ is then positive. Hence, there are grounds for requiring that the average of the entries in this matrix should be the indicator of overall inequality and, therefore, should be equal to 1 minus the average of the entries in $Y^{*\prime}W(Y^{*})$. It may also be noted that in the unidimensional case this is trivially true.

The remarks in the preceding two paragraphs motivate the following condition on the averaging function m on the space $\mathbf{K}$ of positive real numbers. For any K in $\mathbf{K}$, let the symbol $\mathbf{1} - K$ stand for the array of numbers obtained by replacing each member of K by 1 minus its value.

Additive Complementarity (AC): For any K in $\mathbf{K}$ such that all members of K are less than 1, $1 - \mathrm{A}(K) = \mathrm{A}(\mathbf{1}-K)$ i.e. $\mathrm{A}(K) + \mathrm{A}(\mathbf{1}-K) = 1$.

The following is a 90-year-old result in the mathematical theory of averages.

Lemma: The averaging function $m : \mathbf{K} \rightarrow \Re$ satisfies the conditions of **PI**, **FDHOM**, **IAP** and **AC** only if m is the arithmetic mean.

For proof see Huntington (1927).[2,3]

[2]Actually, in place of what we have called **IAP**, Huntington (1927) used a condition which is slightly weaker, requiring only that, for any K in **K**, m(K) = m(L) if L is obtained by replacing each of the *first two* members of K by their average. It is easily seen, however, that in the presence of **PI** the weaker version is equivalent to **IAP** as stated in the text.

[3]Attempts at characterisation of various types of averaging functions have by now a history of more than a hundred years. The first such attempt was by Schimmack (1909) who proved that a number of conditions on the averaging function uniquely identify the arithmetic mean. The independence of Schimmack's postulates was proved by Beetle (1915). For two reasons, however, we have preferred to use the Lemma which, as mentioned in the text, is due to Huntington (1927). First, the earlier literature which was in the German language may not be accessible to all readers. Secondly (and more importantly), Huntington's postulates were somewhat different from those

We now have the following proposition. For any matrix X, let μ(X) denote the arithmetic mean of the entries in X.

Proposition 5.3.1 $\left[\text{For all Y in } \mathbf{Y}, \mathrm{M^G(Y)} = 1 - \mu(\mathrm{Y'^*W(Y^*)})\right]$ if and only if [$\mathrm{M}^G : \mathbf{Y} \rightarrow \Re$ satisfies **AV** and the averaging function m in the statement of **AV** satisfies **PI**, **FDHOM**, **IAP** and **AC**]

Proof The 'only if' part follows easily from the fact that the arithmetic mean satisfies **PI**, **FDHOM**, **IAP** and **AC**]. The 'if' part is an immediate consequence of the Lemma. □

5.4 Is $\mathrm{M^G}$ an Acceptable MGI?

For our purposes (as explained in Sect. 5.1), however, the important question is whether the index $\mathrm{M^G}$ specified above is an acceptable MGI from the point of view of the economist. To answer this question, we have to specify what an economist would mean by a satisfactory MGI. Needless to say, such an MGI would be a satisfactory multidimensional inequality index (MII) with the additional feature that if $q = 1$, it would coincide with the classical Gini index. We, therefore, look at the properties that an economist would expect an MII to possess on intuitive grounds.

Let I be an index of relative inequality. It is a mapping from **Y** to the real line $\Re$. If, for any Y and Z in $\mathbf{Y}, I(Y) \geq I(Z)$, multidimensional inequality in the economy described by Y is interpreted to be no less than that in the economy described by Z.

The following conditions on I are straightforward extensions of the corresponding well-known conditions on a unidimensional inequality index.

Continuity (CONT): The mapping I is continuous.

Invariance with respect to row permutations (IRP): For all Y and Z in **Y** such that Y is obtained by a permutation of the rows of Z, $I(Y) = I(Z)$.

Replication Invariance (RI): For all Y and Z in **Y** if Y is obtained by a k-fold replication of the population in Z for some positive integer k, i.e. for all l in P,

$$\mathbf{z}_l = \mathbf{y}_l = \mathbf{y}_{p+l} = \cdots = \mathbf{y}_{p(k-1)+l},$$

then $I(Y) = I(Z)$.

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used by Schimmack. In fact, he gave several different sets of postulates all of which characterise the arithmetic mean (and, therefore, all of which are logically equivalent to each other). The Lemma stated in the text is based on *one* of his sets of postulates. Our choice of this particular set was motivated by the fact that all the postulates in the set, including the one that we called **AC**, seem to be natural requirements of the average in our specific context. (Huntington, however, did not use the names and the abbreviations given by us to the conditions in the text.) The curious reader will also find in Huntington's paper several alternative characterisations of each of three *other* types of average: the geometric mean, the harmonic mean and the root-mean-square.

Scalar Multiplication (SM): For any $p \times q$ matrix Y in $\mathbf{Y}$ and for any $q \times q$ diagonal matrix D with positive constants along the main diagonal, $I(Y) = I(\mathrm{YD})$.

CONT is self-explanatory. **IRP** says that the order in which the individuals are listed does not matter. **RI** requires that the value of an inequality index for a distribution matrix Y depends on the *per capita* allocations of the attributes. What is important is the proportion of the population (and not the absolute number of individuals) that gets a particular allocation of an attribute. **SM** implies that I is a *relative* index: multiplication of the columns of a distribution matrix Y by a positive constant (not necessarily the same for all the columns) keeps the ratios between the allocations of any given attribute among the individuals unchanged. Therefore, it should leave the degree of overall inequality in the economy undisturbed.

However, the four conditions I stated above are properties that would be desired of any relative index. They are not oriented toward the requirement that the greater is the degree of inequality in the economy described by a matrix Y, the greater should be the value of $I(Y)$. We now come to conditions that make I inequality-sensitive.

In unidimensional theory, a basic condition on an inequality index is the Pigou–Dalton (PD) transfer principle. If the attribute under consideration is income, a PD transfer is a transfer of income from a richer to a poorer individual by an amount which is less than their initial income difference. If $\mathbf{y}$ and $\mathbf{z}$ are vectors of the attribute, the following three statements are known to be equivalent (Hardy et al. 1934) and Marshall and Olkin(1979, Chap. 1): (1) $\mathbf{y}$ Lorenz dominates $\mathbf{z}$; (2) $\mathbf{y}$ *Pigou–Dalton majorises* $\mathbf{z}$**,** i.e. $\mathbf{y}$ is obtained from $\mathbf{z}$ by a *finite* sequence of PD transfers; and (3) $\mathbf{y} = \mathrm{B}\mathbf{z}$ for some bistochastic matrix B. (A bistochasic matrix is a non-negative square matrix in which each row sum is 1 and so is each column sum.)

The notion of Pigou–Dalton majorisation has been generalised to the multidimensional context. One such generalisation is the concept of Uniform Majorisation due to Kolm (1977). For all $p \times q$ matrices Y and Z in $\mathbf{Y}$ such that $Y \neq Z$ and Y is not a row permutation of Z, Y is said to be a uniform majorisation of Z if $Y = \mathrm{B}Z$ for some bistochastic matrix B. Since $Y = BZ$ implies, $\mathbf{y}^j = \mathbf{B}\mathbf{z}^j$ for all j in Q, $\mathbf{y}^j$ Pigou–Dalton majorises $\mathbf{z}^j$ for each j; and since the same matrix B is used to majorise all the columns of Z, the majorisation is called *uniform*.

Kolm (1977) assumed that there is a social evaluation underlying an inequality index. He used the notion of uniform majorisation (UM) to formulate a condition on the social evaluation and then to derive a multidimensional inequality index from the social evaluation. Restated directly in terms of an inequality index, Kolm's condition would take the following form: for all Y and Z in $\mathbf{Y}$ such that Y is a uniform majorisation of X, $I(Y) < I(Z)$.

The condition of UM, stated above, has some limitations [see, for example the critiques of this condition in Fleurbaey and Trannoy (2003) and Lasso de la Vega et al. (2010)]. There are at least three difficulties. (1) UM does not take into account the obvious fact that all attributes may not be transferable. (2) Even if we suppose

for the sake of argument that any attribute can be transferred, it is not clear why we should be concerned exclusively with the case in which all the attributes are transferred in the same proportion. (3) If there is a uniform transfer between two individuals such that neither is unambiguously richer than the other (i.e. individual 1 has less of some attributes than individual 2 but more of the others), there does not seem to be a convincing case for requiring that there is a fall in the degree of overall inequality in the economy.

We consider here the case where the proportions of the attributes that are transferred are allowed to be different for different attributes; moreover, the proportions are not required to be non-zero for all attributes. However, we assume (i) that transfers from an individual k to an individual l are allowed only if k is unambiguously richer than l (i.e. k has more of every attribute than l) and (ii) that transfers preserve the relative ranks of the individuals in all the attributes. We state these requirements formally in the following definition.

Definition 5.4.1 For all Y and Z in $\mathbf{Y}$, Z is said to be derived from Y by a **Rank-Preserving Bundle Transfer (RBT)** if there exists k and l in P such that

(i) $\mathbf{y}_k > \mathbf{y}_l$;
(ii) $\mathbf{z}_k = \mathbf{y}_k - \mathbf{d}$ and $\mathbf{z}_l = \mathbf{y}_l + \mathbf{d}$ for some $\mathbf{d}$ in $\Re_+^m$ such that $\mathbf{d} \neq 0$.
(iii) $\mathbf{z}_r = \mathbf{y}_r$ for all r in $P - \{k, l\}$;
(iv) for all j in Q for all r and s *in* P, $\left[z_r^j \geq z_s^j \text{ if and only if } y_r^j \geq y_s^j\right]$.

Part (i) of Definition 5.4.1 says that individual k is unambiguously richer than individual l in the initial allocation matrix Y. Part (ii) states that non-negative amounts of the different attributes are transferred from individual k to individual l. Note that the amounts or the proportions of the transfers may differ across the attributes. Moreover, it is *not* required that some amounts of *all* attributes must be transferred. In other words, we recognise the fact that some attributes may be non-transferable by nature. However, we require that the transfer is non-trivial, i.e. *some* positive amount of *at least one* attribute is transferred. Part (iii) says that all individuals other than k and l are unaffected by the transfer. Part (iv) requires that, for each attribute, the rank of any individual in an ordered rearrangement (in, say, the non-increasing order) of the relevant column of Y must be left undisturbed by the transfer.

As an illustration, consider the case in which $p = 3$, $q = 2$, $Y = \begin{pmatrix} 10 & 8 \\ 2 & 7 \\ 7 & 6 \end{pmatrix}$ and $Z = \begin{pmatrix} 9 & 8 \\ 3 & 7 \\ 7 & 6 \end{pmatrix}$. In Y individual, 1 is richer than individual 2 in both attributes. Z is obtained from Y by transferring a unit of the first attribute from individual 1 to individual 2. The third individual's allocations of both the attributes are left undisturbed. It is seen that all the requirements of Definition 5.4.1 are satisfied. Thus, the transfer by which Z is obtained from Y is an **RBT**.

Definition 5.4.2 An MII, I, satisfies the **Rank-Preserving Bundle Principle (RBP)** if, for all Y and Z in $\mathbf{Y}$ such that Z is obtained from Y by a finite sequence of RBT's, $I(Z) < I(Y)$.

Inequality sensitivity is, by definition, related to equity issues. However, extensions of the unidimensional transfer principle are concerned with only one particular type of equity issues. In the multidimensional case, the matter has other aspects. One of these is related to the interrelationship among the distributions of the different attributes. We now state a condition that is related to this aspect. Before stating the condition, however, we have to formalise the notion of a *comonotonic rearrangement* of a matrix.

Definition 5.4.3 For all Y in $\mathbf{Y}$ and for all j in Q, $\mathbf{y}^j$ is *non-increasing monotonic* if $y_1^j \geq y_2^j \geq \ldots \geq y_n^j$. It is *non-decreasing monotonic* if $\leq \leq \leq \leq y_1^j \geq y_2^j \geq \ldots \geq y_n^j$. For all Y in $\mathbf{Y}$, Y is called *comonotonic* if either $\mathbf{y}^j$ is non-increasing monotonic for all j in Q or it is non-decreasing monotonic for all such j. For all Y and Z in $\mathbf{Y}$, Z is called a *comonotonic rearrangement* of Y if Z is a comonotonic matrix obtained by rearranging, if necessary, the entries in each column of Y.

The following property of I is adapted from an essentially similar condition proposed by Dardanoni (1996).

Comonotonising Majorisation (CM): For all Y and Z in $\mathbf{Y}$ such that Z is a comonotonic rearrangement of Y but $Y \neq Z$ and Y is not a row permutation of Z, $I(Z) > I(Y)$.

There is a slightly different version of this condition. That version states that, for all Y and Z in $\mathbf{Y}$ such that Z is a comonotonic rearrangement of Y, $I(Z) \geq I(Y)$.

Comonotonising majorisation is a transparent condition. For example let $p = 2 = q$, $Z = \begin{pmatrix} 10 & 20 \\ 5 & 4 \end{pmatrix}$ and $Y = \begin{pmatrix} 10 & 4 \\ 5 & 20 \end{pmatrix}$. Then Z is a comonotonic rearrangement of Y. Suppose that we now ask whether multidimensional inequality in Z is higher than that in Y. In Z individual, 1 has greater quantities of both the attributes than individual 2 while in Y individual 1 has more of attribute 1 than individual 2 but has less of attribute 2. Therefore, in Z, the relative disadvantage of individual 2 with respect to attribute 1 is compounded by the disadvantage faced by her with respect to attribute 2. In Y, however, individual 1 has a relative advantage with respect to attribute 1 while with respect to attribute 2 it is individual 2 who gets a relative advantage. Yet, the *total* available amounts of both the attributes are the same in Y as in Z. Therefore, whatever the relative importance of the two attributes may be, it seems reasonable to require that $I(Z)$ should be greater than $I(Y)$.

The literature also contains other conditions which are quite similar in spirit. For instance, Decancq and Lugo (2012) use a condition on the social evaluation underlying the inequality index called Unfair Rearrangements. In terms of the inequality index, the condition can be stated as follows. Let Y and Z be such that Y is obtained by rearranging the entries in each column of Z in such a way that in

Y there is some individual who gets the highest allocation in each dimension, another individual who gets the second highest allocation in each of them and so on. If now, Y is not a row permutation of Z, then $I(Y) > I(Z)$. In what follows, we shall use **CM** as stated above as the condition that stresses the requirement that I is sensitive to the pattern of interrelationship between the distributions of the various attributes.

We now define an MII to be an index on **Y** satisfying the six properties discussed above.

Definition 5.4.4 A mapping from **Y** into the real line is an MII if it satisfies **CONT**, **IRP**, **RI**, **SM, RBP** and **CM**.

We can now formalise our notion of what constitutes an acceptable MGI.

Definition 5.4.5 A mapping from **Y** into the real line is an MGI iff (i) it is an MII as per Definition 5.4.4 and (ii) in the special case in which $q = 1$, it coincides with the classical Gini index G^1 defined in Definition 5.2.2.

We now show that the index M^G that we characterised in the previous section on the basis of purely mathematical considerations is an acceptable MGI in the sense specified in Definition 5.4.5 above.

Proposition 5.4.1 The mapping M^G is an MGI as per Definition 5.4.5.

Proof Since, for all Y in **Y**, each column of **Y** has at least one positive entry, it is easily checked that $Y^{*\prime}W(Y^*)$ is a positive square matrix. That M^G satisfies **CONT** is a consequence of the fact that the arithmetic mean of a set of positive numbers is continuous in each of these numbers.

To see that it satisfies **IRP** note that if Y and Z in **Y** are such that Z is a row permutation of Y, then $Y^{*\prime}W(Y^*) = Z^{*\prime}W(Z^*)$ so that $M^G(Y) = M^G(Z)$. **RI** is checked in a similar way: if Y and Z in **Y** are such that Z is obtained by a k-fold replication of the population in Y for some positive integer k, then we again have $Y^{*\prime}W(Y^*) = Z^{*\prime}W(Z^*)$. **SM** is easily verified.

To prove that M^G satisfies **RBP,** i.e. to show that if Y and Z in **Y** are such that Z is obtained from Y by a *finite* sequence of RBT's, then $M^G(Y) > G^M(Z)$, it suffices to establish this inequality in the case where Z is obtained from Y by a *single* RPBT. Recall that, according to Definition 5.4.1 of RBT, the notion of such a transfer from individual k to individual l includes the requirements that $\mathbf{y}_k > \mathbf{y}_l$ and that, for each dimension, the relative ranking between any pair of individuals in the matrix Y is the same as in the matrix Z.

Now, noting that the (ith row, jth column) entry in E(Y) is $\mathbf{y}^{*i\prime}\mathbf{w}(\mathbf{y}^{j^*})$, it is seen that the requirements mentioned in the preceding paragraph imply that, for all i and j in Q, $\mathbf{z}^{*i\prime}\mathbf{w}(\mathbf{z}^{j^*}) \geq \mathbf{y}^{*i\prime}\mathbf{w}(\mathbf{y}^{j^*})$ with strict inequality holding for all i such that d_i, the amount of transfer of attribute i, is positive. Thus, $Z^{*\prime}W(Z^*) \geq Y^{*\prime}W(Y^*)$ and $Z^{*\prime}W(Z^*) \neq Y^{*\prime}W(Y^*)$ so that $M^G(Y) > M^G(Z)$.

To see that M^G satisfies **CM**, let Y and Z in **Y** be such that Z is a comonotonic rearrangement of Y. If $Y \neq Z$ and Y is not a row permutation of Z, then an argument analogous to the one used in the preceding paragraph establishes that $G^M(Z) > G^M(Y)$.

This completes the proof of the fact that M^G is an MII as per Definition 5.4.4. Proof of the proposition is completed by noting that if $q = 1$, M^G coincides with G^1, the unidimensional Gini. □

The index M^G, derived in this paper, is thus seen to satisfy the economic properties that one would intuitively demand of a multidimensional Gini index. It is also defined on the space of non-negative distribution matrices. One potential criticism of the index, however, is that, as can be checked, for any Y in $\mathbf{Y}$, $M^G(Y)$ is invariant with respect to permutations of the columns of Y. Thus, there seems to be an implicit assumption that, in this sense, all attributes are accorded equal importance. A few remarks in this connection seem to be in order.

Researchers in the field of multidimensional inequality measurement have paid much attention to the question of determination of the relative weights on the various dimensions. It seems that once these weights have been obtained, these can be used to reduce the multidimensional problem to a unidimensional one. In the context of MGIs, the axiomatic literature has sought to derive these weights from axioms imposed either on the MGIs directly or on the social welfare functions underlying them. However, more often than not, the axioms do not identify the weights uniquely. What is characterised is a set of alternative weight vectors. To add to the problem, the ranking between the degrees of inequality in two economies (or between those in the same economy at two different points of time) is *not* invariant with respect to the choice between the alternative weight vectors. The problem ultimately has to be solved by somehow choosing a specific weight vector from the axiomatically characterised set of weights. The assumption (often implicit) is that this final choice will be made through broad-based social discourses and will be known to the researcher who is interested in measuring multidimensional inequality in any actual situation.

It is our opinion that if it is ultimately necessary to specify the weights exogenously, they might as well be assumed to be given to start with. It is for this reason that we have not entered into a discussion of the process of determination of these weights.

Obviously, however, there is no guarantee that the exogenously given vector of attribute weights would happen to specify *equal* weights. On this issue, we proffer the following two remarks.

First, the 'equal importance' assumption seems to be widely used in empirical work. Moreover, there seems to be some support for this assumption in the writings of some of the pioneering contributors to the normative economic theory of inequality measurement. For instance, in a related context, Atkinson et al. (2002, p. 25) observes, '… The interpretation of the set of indicators is greatly eased where the individual components have degrees of importance which, while not necessarily exactly equal, are not grossly different.'

Second, if the society does specify a vector of *unequal* weights, it can be easily accommodated into our proposed index by using these weights on the columns of the matrix Y* before proceeding to apply the M^G formula. It can be checked that the proof of the Proposition 5.4.1 above would remain exactly analogous if the index is amended in this way, subject only to some very mild additional

assumptions. (For instance, some of the arguments in the proof would then require the assumption that all the exogenous weights are positive. This assumption, however, would be quite natural since it would not be sensible to include an attribute in the analysis if the society attaches a zero weight to it.)

5.5 Relation to Existing Literature and Concluding Remarks

In this paper we have looked for an MGI satisfying properties that would seem to be reasonable from the point of view of the economist. The existing literature contains a number of suggested MGIs. Some of these contributions derive the MGIs from conditions imposed on the underlying social evaluation. Gajdos and Weymark (2005) is an important contribution of this type.[4] A strong point of that paper is that it does not require the assumption of positive distribution matrices. However, members of the classes of indices that are characterised in the paper do not necessarily satisfy **CM**. On the other hand, the paper by Decancq and Lugo (2012) works with positive matrices only. Two different classes of MGIs are derived in this paper. One of these two classes is essentially a subclass of the class obtained by Gajdos and Weymark. These do not necessarily satisfy **CM**. Members of the other class would satisfy the condition of Unfair Rearrangements (and **CM**). However, **RBP** is not considered in this paper and, hence, it is not reported whether all members of the class would satisfy both **RBP** and **CM**. Moreover, the assumption of positive matrices plays an important role here since without this assumption all members of the proposed class of indices are not necessarily well defined.

There have also been attempts at deriving MGIs without referring to the social welfare functions. A major contribution of this type is the paper by Koshevoy and Mosler (1997) who suggest two different MGIs based on their notion of 'Lorenz zonoids' which is a generalisation of the concept of the Lorenz curve to the multidimensional context. It is not required that the distribution matrices are positive. However, the paper does not investigate whether the indices satisfy the various economic properties that we have discussed above in Sect. 5.4. It is seen, however, that they would not necessarily satisfy **CM**.

Banerjee (2010) also does not refer to any social evaluation underlying the MGI. However, the MGI suggested in that paper is mathematically quite complex. (It uses the procedure of using the first eigenvector of the matrix $Y^{*\prime}Y^{*}$ as the vector of weights used to aggregate across the attributes). Furthermore, the suggested index is introduced in an ad hoc manner without deriving it from any set of (mathematical or

[4]It may be noted that what Gajdos and Weymark (2005) seek to extend to the multidimensional context is not exactly the classical unidimensional Gini index but a set of indices (called "generalised Gini indices") that includes the classical Gini. When $q = 1$, the multidimensional Gajdos-Weymark class reduces to the unidimensioal "generalised Gini" class.

economic) conditions. Moreover, if we permit some entries in Y (and, therefore, in Y^*) to be zero, it turns out that in general, the matrix $Y^{*\prime}Y^*$ may fail to be positive. In fact, it may even fail to be an indecomposable matrix. Therefore, its first eigenvector may not be non-negative. The intuitive meaningfulness of the suggested index would then be doubtful. (To get around this problem, the paper had to introduce additional restrictions on the distribution matrices.) The MGI suggested in Banerjee (2018a) is characterised by a set of mathematical conditions. However, the question of whether it satisfies **RBP is** not addressed. On the other hand, the index suggested by Banerjee (2018b) does satisfy **RBP**. It is also characterised by mathematical conditions. However, the index formula that is suggested is, again, a complex one and, therefore, may not be suitable for wide use in practical applications.

To summarise and conclude, in this paper, we have obtained an MGI on the basis of a small number of mathematical (or statistical) conditions. We have also shown that the proposed index satisfies a number of properties that one may, from the standpoint of economic theory, desire an MGI to have. The index is defined on the set of all non-negative distribution matrices, subject only to the condition that there are a positive total amount of each of the attributes. It is also a very simple and transparent index. Just recall the unidimensional Gini index G^1: in our notations, for any distribution vector $\mathbf{y}$, $G^1(\mathbf{y}) = 1 - \mathbf{y}^{*\prime}\mathbf{w}(\mathbf{y}^*)$ where $\mathbf{y}^*$ is the (scaled) distribution vector and $\mathbf{w}$ is the Gini weight vector. In the multidimensional case, the economy is described by a distribution matrix Y (rather than by a vector). This is a problem because the expression $\mathbf{y}^{*\prime}\mathbf{w}(\mathbf{y}^*)$ which is a scalar now becomes $Y^{*\prime}W(Y^*)$ which is a matrix so that 1 minus this latter expression would not be defined. The problem is solved simply by taking the arithmetic mean of the entries in the matrix and considering the difference between 1 and this mean as the value of the proposed MGI, M^G, at Y.

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Part IV
Globalization and Financial Market Instability

Chapter 6
A Study on the Spillover of Stock Market Volatility between India and US in the Context of the Global Financial Crisis of 2007–08

Soma Das and Basabi Bhattacharya

6.1 Introduction

With the advent of globalization, as the financial rules and regulations have gradually been softened, the financial markets worldwide have become more and more interlinked. The explosion of advanced communication technology has made the rapid transmission of market information possible within and across markets of different countries all over the world in a very short span of time. This phenomenon is more prominent in the financial sector, especially in the stock market, which is very sensitive in nature being one of the most important and active components of the financial sector of any economy. Any information, originating domestically or internationally, that can make a stock market volatile, can affect investment, which in turn can lead to a sequence of reactions influencing corporate financing, market risk and ultimately financial stability of an economy. The recent global financial crisis, which actually originated in the US realty sector, gradually took a massive dimension and contaminated almost every country worldwide—either developed or emerging in different intensity and scale. This widespread crisis created massive turmoil in the stock markets through spillover of return and volatility of the US markets via different channels like trade channel, financial channels and confidence channels. Such interlinkages have drawn the interest of the researchers to explore this area to analyse the intrinsic behaviours of the stock markets.

There exist several studies addressing extensively these interrelated issues. However, very few works have focused on the intermarket relationship within the Indian financial market around the recent global financial crisis. In such a scenario,

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this study is a humble attempt to explore the dynamic pattern of interlinkages between the Indian stock market and the stock market of US in terms of volatility spillover, around the financial crisis of 2007–2008. The intrinsic nature of spillover is analysed between the two stock markets under an intercountry structure. In order to examine the impact of the crisis on the intermarket volatility spillover relationship between the two mentioned stock return series, the study intends to estimate as well as compare the nature of the stock market behaviour in terms of volatility prior to the crisis, during the crisis and after the crisis.

6.1.1 Global Financial Crisis of 2007–08

The subprime crisis, that originated in the US realty sector during 2005–06 as an isolated turbulence gradually metamorphosed to the worst recession that the world has faced since the Great Depression of the 1930s. Though the subprime crisis was caused by complex and interlinked factors, the main triggering factor was the faulty banking system offering high-risk subprime loans. This practice along with the slack monetary policy, misperception of risk and lax financial regulation formed financial bubbles in 2001–02. Low-interest rate prevailing in the housing sector drew attention of the countries like the UK, Japan and China causing a huge inflow of foreign capital. During 2005–06, the bubble burst and initiated the crisis. Gradually, the crisis spread to other countries and eventually took the shape of a global financial crisis in the last quarter of 2007 and continued for about eighteen months.

6.1.2 Impact of the Crisis on the US

The US economy had to undergo a run down with continuous fall in the value of property and increase in foreclosure and defaulter rate. The banks and top investment firms were either bankrupt or declared as ailing. With the collapse of Lehman Brothers, Bears Sterns and the others during 2008, the situation worsened. Confidence of the investors on the stock market dropped and the market crashed due to a huge outflow of fund. It is revealed from the data set under study that NASDAQ was crashing phenomenally and even hit a trough at around 1300 points in March 2009. US Federal Government intervened with several stabilization measures and a magnum bail-out scheme. These measures could to some extent arrest further economic and financial massacre and initiate a reverse pattern.

6.1.3 Impact of the Crisis on India

Indian financial market, though well governed and did not have much direct exposure to the US assets, it could not protect itself from the virus of the crisis.

In fact, disruptions of international money markets, turmoil in stock markets across the globe and severe investor pressures impacted the Indian money, forex and stock market. The stock market experienced a severe and rapid downfall, which gradually created a panic in the market. On 24th October 2008, Sensex lost 1000 points as Rs. 250,000 crores was withdrawn from the share market on a single day. FIIs made a withdrawal of 5.5 billion US dollar during April–September 2008. Indian rupee depreciated approximately by 20% against US dollar. Export dropped to 1.5 billion dollar in November, 2008 from 12.7 billion dollars in the previous year causing an intense trade deficit. RBI intervened to maintain orderly conditions in the foreign exchange market and to address the liquidity pressures through a variety of measures like reducing repo rate, reverse repo rate, Cash Reserve Ratio, Statutory Liquidity Ratio, etc. (Thorat 2009). The positive impact of all these measures was reflected in the Indian stock market returns as well.

This paper focuses on the interaction between the stock markets of US and India in terms of volatility spillover covering the period of the 2007–08 financial crisis episode. The results of empirical estimation on market behavioural changes are discussed with intuitive interpretation in the backdrop of the market functionalities and profiles of the countries concerned. Rest of the paper is organized as follows. Section 6.2 documents a brief overview of the existing literature on this issue. Section 6.3 explains the methodology applied for investigating stock market volatility spillover. Section 6.4 analyses and discusses the empirical results estimated and finally, Sect. 6.5 concludes the study.

6.2 Literature Review

With growing international financial transactions and capital flows across financial markets, transmission of information generating probabilities of unpredictable shock and creating heightened market sensitivities became a major cause of concern. Relatively earlier studies mostly discuss interaction and co-movement among the markets while spillover of market volatility gained more importance later.

On the interaction and co-movement among the markets, Becker et al. (1990) observed significant influence of the performance of the US stock market on the Japanese stock market whereas the reverse impact was negligible as expected. Karolyi and Stulz (1996) exhibited predictable patterns in the US and Japanese cross-country stock return covariances but did not find any evidence of either macroeconomic announcements or interest rate shocks affecting the comovements between their stock returns. Longin and Solnik (1995) investigated whether the conditional correlation in international asset returns is changed due to the progressive interdependence across markets of France, Germany, Switzerland, Canada, Japan, US and UK. Morgado and Tavares (2007) examined the consequences of real and monetary integration on the correlation of real stock returns of forty countries and found that countries with more developed and more analogous

institutions display a higher correlation of stock returns. Considerable equity market interlinkages during the 1980s are evidenced in Daniel (2000) and Robert and Luc (2002).

Including India among other countries, Rao and Naik (1990) observed that the relationship of the Indian market with international markets is not quite prominent as the Indian economy is characterized by regulations throughout the entire period of their study. Considering UK with US and India, Sharma and Kennedy (1997) concluded that stocks listed on the Bombay Stock Exchange follow a random walk. A later study observed that the Indian stock index and the matured stock indices of US, UK and Japan are found to form fractionally co-integrated relationship in the long run (Wong et al. 2005). Similarly, studies by Hansda and Ray (2003), Mishra (2002) and Nair and Ramanathan (2003) evidenced a synchronized movement of BSE and NASDAQ. The existence of only a short run comovement of prices among Indian and other national equity markets of Asia, Europe and America are observed in Mukherjee and Mishra (2005). Bose and Mukherjee (2006) examined the interlinkages of eight Asian stock markets, including India, with the US stock market during 1999–2004, highlighting the 'unique role of India' with more open capital market encouraging cross-market capital flows. However, Nath and Verma (2003) did not find any evidence of cointegration among the three major stock markets in South Asia viz. India, Singapore and Taiwan during 1994 and 2002. In another study, the stock markets of India and six other developed countries including US and Japan are found to move in tandem in post-financial liberalization era (Nath 2003). Sarkar et al. (2008) found unidirectional causality from the stock markets of US, UK, Jakarta and Argentina to India and a bidirectional causality between Brazilian and Indian stock markets.

With gradual increase in cross-country interlinkage through various channels, working of the international transmission mechanism, particularly volatility spillover, appeared more important. Studies on the spillover of market volatility are mostly empirical in nature. The countries chosen in different studies for volatility spillover are based on several aspects like whether they are trading partners, their geographical location, their development status, etc. United States having consistent dominance over others has been commonly chosen among others in most of the studies.

Hamao et al. (1990), Kee-Hong and Karolyi (1994) explored US, UK and Japan stock markets and observed that New York daytime returns significantly influence other market returns and there exists cross-market interdependence within return series in terms of spillover of volatility. A study by Li and Giles (2015) revealed significant unidirectional shock and volatility spillovers from the U.S. market to the Japanese and the Asian markets during the Asian financial crisis. Evidence of return spillover effects from both domestic and foreign market along with significant volatility spillover effects only from foreign market are found in Kumar and Mukhopadhyay (2002, 2007). Studies by Gunasinghe (2005), Mukherjee and Mishra (2006), Joshi (2011) revealed bidirectional return and volatility spillover effect among almost all Asian stock markets including India.

Literature on the recent subprime crisis of 2007–08 highlight strong evidences of stock market volatility spillover from USA on different countries. To mention a few, are the works by Olowe (2009) for Nigeria, Anaraki (2012) for Europe, Chinzara (2011) for Africa, Zhang et al. (2011) for China, Karunanayake et al. (2010) for Australia, Singapore and UK, Parsva and Lean (2011) for 6 Middle Eastern Countries. Similar result surfaces in studies by Ali and Afzal (2012), Gangadharan and Yoonus (2012) and Manda (2010) which include also India. However, studies by Chong (2011) for China and Schwert (2011) for UK and Japan observed that though the negative effect of financial crisis transmitted to other countries, the effect was short-lived.

A deeper study on the 2007–08 crisis phenomenon investigating the changing pattern of spillover of the stock market return and volatility from Pre-Crisis to In Crisis to-Post-Crisis scenario appears to be an important aspect not addressed adequately in the existing literature. The contribution of this paper harps on analysing the changing stock market behavioural patterns over the three sub-periods in the backdrop of the then existing economic scenario of the chosen countries. Market performances are investigated through own and cross means return spillover, own and cross volatility spillover and the asymmetric effects of information spillover under intercountry structural setup.

6.3 Data and Methodology

For examining the dynamic relationship in terms of volatility spillover between the stock markets of India and USA, daily closing data of BSE SENSEX and NASDAQ Composite, from Jan 1, 2004 to September 13, 2013, are selected (www.finance.yahoo.com). A total of 2189 observations are considered for which the respective close-to-close trading periods in India and the US are perfectly aligned.

Daily return series ($close_{t-1}$ to $close_t$) are derived for each stock market as the first difference between the log of closing prices on consecutive trading days, expressed in percentage terms:

$$R_t = ln\,(P_t/P_{t-1}) * 100, \text{ where}$$
$$R = > \text{ Daily return of BSE and NASDAQ;}$$
$$P = > \text{ Closing price of BSE and NASDAQ;}$$
$$t = 1, 2, 3, \ldots, N;$$
$$N = > \text{ number of observations.}$$

The stationarity of the variables is examined by performing Augmented Dickey–Fuller test (Fuller 1976; Dickey and Fuller 1979, 1981) as shown below:

$$\Delta y_t = \alpha + \varphi T + (1-\beta)\, y_{t-1} + \sum \lambda_i \Delta y_{t-j} + \varepsilon_t,$$

Where y_t is the variable tested for unit root; Δ is the first difference operator; α is the constant term and T is a time trend.

Thus, the null hypothesis to be tested is

H_0: $(1-\beta) = 0$, $\beta = 1$, i.e. series contains a unit root.

Rejection of null hypothesis implies that the time series is stationary.

To analyse the impact of financial crisis on the spillover relationship among the stock markets, the study divides the entire data set into three sub-periods, namely Pre-Crisis, In Crisis and Post-Crisis.

Pre-Crisis—from 05/01/2004 to 9/10/2007 (856 observations)

In Crisis—from 10/10/2007 to 9/3/2009 (314 observations)

Post-Crisis—from 10/3/2009 to 13/9/2013 (1019 observations)

Initially, correlation coefficients between the relevant market returns are estimated. Our study explores behaviour of each stock market under an intercountry structure. The impact of the global financial crisis in terms of volatility spillover on the return series of BSE and NASDAQ is examined under own and cross-market set up. For estimation, a Multivariate GARCH model is used. Specifically, the study applies Diagonal VECH model (DVECH model) which is an extension of the basic univariate GARCH model. Bollerslev et al. (1988) first proposed a general VECH model in which each element of H_t is a linear function of the lagged squared errors and cross products of errors and lagged values of the elements of H_t. The presentation of the general VECH model is:

$$\text{vech}\,(H_t) = M + A\ \text{vech}\,(\varepsilon_{t-1}\varepsilon'_{t-1}) + B\ \text{vech}\,(H_{t-1})$$

Where the vech(.) operator stacks the lower triangular portion of a symmetric matrix into a vector.

Here, A and B are $[(N\,(N+1)/2) \times (N\,(N+1)/2)]$ parameter matrices and M is a $[(N\,(N+1)/2) \times 1]$ vector of constants.

However, the limitation of this model is the large number of parameters that need to be estimated. The number of parameters is $[n(n+1)\ (n(n+1)+1)/2]$. Additionally, it is difficult to guarantee the positivity of H_t without imposing strong restrictions on the parameters (Gourieroux 1997). To overcome this problem, Bollerslev et al. (1988) suggested the diagonal VECH (DVECH) model in which the A and B matrices are assumed to be diagonal, and this restriction reduces the number of parameters to $[n(n+5)/2]$.

The diagonal elements of matrix A (a_{ij}, where $i = j$) represents the own market past innovation effect on current volatility, i.e. own mean spillover effect. Similarly, the off-diagonal elements a_{ij}, where $i \neq j$, measures cross mean spillover effect on current volatility, i.e. the effect of country i's (or j's) shock on country j's (or i's) volatility. On the other hand, the diagonal elements of matrix B ($b_{ij,}$ where $i = j$) explains own volatility spillover effect where the off-diagonal elements (b_{ij}, where $i \neq j$) give cross volatility spillover effects.

To capture the asymmetric news effect on volatility spillover, the model is extended by incorporating a threshold term in the variance–covariance matrix to

examine whether market volatility reacts more vigorously to a 'bad news' than to a 'good news' of same magnitude.

The specific DVECH model takes the following form:

$$\text{vech}\ (H_t) = M + A\ \text{vech}\ (\varepsilon_{t-1}\varepsilon'_{t-1}) + B\ \text{vech}\ (H_{t-1}) + D\ \text{vech}\ (\varepsilon_{t-1}\varepsilon'_{t-1})$$

D: A dummy matrix to capture the asymmetric news effect on volatility spillover

$$D = \begin{cases} 1 & \text{if } (\varepsilon_{t-1} < 0) \\ 0 & \text{otherwise} \end{cases}$$

The parameter matrix D has a similar expression to the matrix A. However, the parameters in the matrix D measure the asymmetric response to the negative shocks or 'bad news' vis-a-vis positive shocks or 'good news'.

This particular model is apt to capture the asymmetric effect of different types of information on volatility along with mean and volatility spillover. The system developed for the intercountry analysis is given as follows:

$$\text{BSE}(t) = C(1) + C(2) * \text{BSE}\ (t-1) + C(3) * \text{NAS}\ (t-1)$$
$$\text{NAS}\ (t) = C(7) + C(2) * \text{BSE}\ (t-1) + C(3) * \text{NAS}\ (t-1)$$

6.4 Findings and Discussions

6.4.1 Preliminary Tests

The results in Table 6.1 suggests that all variables are stationary of order 0, with trend as well as without trend, which confirms the applicability of the data set for analysis.

Table 6.2 which reports the descriptive statistics for the two stock returns for the three sub-periods, Pre-Crisis, In Crisis and Post-Crisis, establishes that before the advent of the crisis mean return is positive for both the stock return series which becomes negative as the crisis strikes out. Again, when the crisis is over, mean return becomes positive. The standard deviations of all the return variables almost double up during the crisis period as compared to the Pre-Crisis period, which again

Table 6.1 Stationarity test results

Return series	ADF without trend	ADF with trend	Result
BSE	−44.16942	−44.17241	Stationary
NAS	−50.61202	−50.60720	Stationary

Source Stock market data are collected from www.finance.yahoo.com. ADF test critical values are at 1% level = −3.4378, 5% level = −2.8647 and 10% level = −2.5685, *significant at level 10%, **significant at level 5%, ***significant at level 1%

Table 6.2 Descriptive statistics of the return series

	BSE SENSEX			NASDAQ		
	Pre	In	Post	Pre	In	Post
Mean	0.1342	−0.2568	0.0866	0.0362	−0.2525	0.1056
Median	0.2046	−0.3105	0.0705	0.0891	−0.1661	0.1257
Maximum	7.9310	8.6878	15.9899	3.8169	9.5744	11.6998
Minimum	−11.8091	−12.7959	−4.4456	−3.9358	−9.5877	−7.9635
Std. Dev.	1.5311	2.8817	1.4131	0.9903	2.5348	1.4076
Skewness	−0.8159	−0.1722	1.8120	−0.1809	−0.3174	0.1188
Kurtosis	9.4403	4.6788	20.912	3.7810	5.1135	10.4939
Jarque–Bera	1574.36	38.43	14181.50	26.3698	63.7135	2386.85
Probability	0.000	0.000	0.000	0.0000	0.0000	0.0000

Source Stock market data are collected from www.finance.yahoo.com. *significant at level 10%, **significant at level 5%, ***significant at level 1%

Table 6.3 Correlation coefficients of the return series

	BSE			NASDAQ		
	Pre	In	Post	Pre	In	Post
BSE	1.0000	1.0000	1.0000	0.1888	0.3602	0.3258
NASDAQ				1.0000	1.0000	1.0000

Source Stock market data are collected from www.finance.yahoo.com. *significant at level 10%, **significant at level 5%, ***significant at level 1%

decreases when the crisis is over indicating upsurge of volatility during the crisis. All series are found to be non – normal, skewed and with fat tails as kurtosis is greater than three. Further, the Jarque–Bera normality test ($p < 0.001$) reveals a statistically significant deviation of the data from normality.

In all the three sub-periods in Table 6.3 the stock return series are found to be positively correlated with each other with the coefficients increasing during crisis period for all cases confirming the fact during a panic situation markets move in tandem.

6.4.2 *Intercountry Volatility Spillover Analysis*

The impact of the global financial crisis on the BSE and NASDAQ return series are analysed simultaneously within a single structure under an intercountry set up. The study examines the effect on the volatility of return series of own mean spillover, cross mean spillover, own volatility spillover, cross volatility spillover, asymmetric own information spillover and asymmetric cross information spillover. The results for applying Multivariate VECH model is presented in Table 6.4.

Table 6.4 Results of volatility spillover analysis under the Inter Country structure

	PRE		IN		POST	
	BSE	NASDAQ	BSE	NASDAQ	BSE	NASDAQ
	Coefficients					
BSE	0.1096 (0.00)***	0.0157 (0.11)	0.6915 (0.03)**	0.2701 (0.30)	0.0193 (0.00)***	0.0113 (0.00)***
NASDAQ		0.0348 (0.00)***		0.2547 (0.04)**		0.0589 (0.00)***
	Arch effect					
BSE	0.0685 (0.01)	−0.0629 (0.00)***	0.0007 (0.96)	0.0451 (0.48)	0.0201 (0.01)**	−0.0128 (0.15)
NASDAQ		−0.0314 (0.01)**		0.0385 (0.48)		−0.041 (0.00)***
	Garch effect					
BSE	0.8380 (0.00)***	0.9018 (0.00)***	0.7949 (0.00)***	0.5988 (0.02)**	0.9410 (0.00)***	0.9432 (0.00)***
NASDAQ		0.9401 (0.00)***		0.8518 (0.00)***		0.9039 (0.00)***
	Asymmetric news effect					
BSE	0.0707 (0.04)**	0.0760 (0.02)**	0.2254 (0.00)***	0.1822 (0.17)	0.0524 (0.00)***	0.0337 (0.00)***
NASDAQ		0.1068 (0.00)***		0.1337 (0.08)*		0.1711 (0.00)***

Source Stock market data are collected from www.finance.yahoo.com. *significant at level 10%, **significant at level 5%, ***significant at level 1%

6.4.2.1 Own Mean Spillover Effect on Volatility of Return Series

BSE Return Series

During the Pre-Crisis and the In Crisis periods, no observable significant mean spillover effect is found in BSE return series volatility in the intercountry structure. Hence, past return values of BSE are not sufficient to explain own volatility during these two periods. The total effect coming from the sources other than BSE return series has become so significant that it has perhaps outweighed the own return spillover effect on volatility. During the In Crisis period also, the massive impact of the crisis has overshadowed the influence of the previous return values of BSE to determine its current volatility.

However, as the period of the crisis was over, past return values of the BSE return series became significant at 5% level to determine current volatility. During this period, the policy packages undertaken to stabilize the economy came into operation. These were credit easing and 'actual/potential liquidity augmentation' (Thorat 2009) and other measures which worked towards invigorating the financial market. The market players were regaining their confidence on the Indian financial

markets and financial portfolios of the investors were being rearranged. Interdependence between the past return values of BSE with own present volatility reappeared in the intercountry model. Hence as the analysis gradually advances from the Pre-Crisis to the In Crisis and then to the Post-Crisis period, nature of BSE own mean spillover changes noticeably in the intercountry set up.

NASDAQ Return Series

The role of the past return values of NASDAQ to determine its current volatility varied noticeably over the different phases of the crisis in the intercountry structure. Before the advent of the crisis, past return values emerged as a significant factor to explain current volatility but it became insignificant during the In Crisis period. Again, in the Post-Crisis period, as the crisis started to subside, own mean spillover effect became significant like the Pre-Crisis period. The vast investor base of the NASDAQ stock index, the composition of this stock index with foreign enlisted companies and its interconnectedness with other markets are the factors operating behind these. Thus, the market players were so concerned about the performance of NASDAQ market that its past return values were considered with importance in the Pre-Crisis period.

With the breakout of the crisis, this mean-volatility relationship no more remained self-explanatory. The huge and severe impact of the crisis created panic in the minds of the market players in such a way that the impact of the previous values of the return series on the volatility of NASDAQ became blurred.

During the period, the US Government took several stabilizing policies to rescue the economy from the adverse effects of the crisis. In 2008, the Troubled Asset Relief Programme (TARP) was undertaken to purchase assets and equities from the ailing institutions, which saved General Motors and Chryslers from bankruptcy. The American Recovery and Reinvestment Act (ARRA 2009) helped to create new jobs and boosted the economic growth. A financial Regulation Bill was passed in 2010 along with restoring the American Financial Stability Act addressing the risky behaviour and the regulatory failures of the Federal economy. Thus, the immediate intervention of the Federal Government in the form of 700-billion-dollar bailout package could rescue the Citi Group, JP Morgan and other ailing investment firms. NASDAQ gradually started to recover and in May 2013 it touched a record high at around 3000 basic points. The impact of the global financial crisis on the US foreign exchange market was varying. From 2007 to the middle of 2008, the demand for US currency decreased which started to increase thereafter (www.federalreserve.org/).

The results of these policies were being realized during the Post-Crisis period. The US financial market started to regain its lost confidence. The national and international market participants started to depend on the past values of the NASDAQ return series to explain its current return volatility. Hence, significant mean spillover is observed in our study during this Post-Crisis period.

6.4.2.2 Cross Mean Spillover Effect on Volatility of Return Series

BSE versus NASDAQ Return Series

The estimated result indicates the presence of significant cross return spillover of the volatility between BSE and NASDAQ during the Pre-Crisis period only. During the In Crisis and the Post-Crisis periods, this effect is found to be insignificant. As NASDAQ is one of the most active stock markets of the world and has market interaction with India, the performance of NASDAQ in the Pre-Crisis period had influenced the sensitivity of the market players of BSE.

Interestingly, when the crisis hit the global economy and disrupted other economies through trade, financial and confidence channels, the international financial market players lost the confidence on the market and were driven by the crisis panic. The interlinkage between the stock markets through the mean spillover channel thus broke down temporarily as the panic factor dominated the normal market activities.

As revealed in the In Crisis case, no evidence of cross mean spillover effect between BSE and NASDAQ is noticed during the Post-Crisis period also. The US being the epicentre of the crisis, it took time to normalize the situation there completely. Though the countries started to regain their regular pace in every sector, the interaction between NASDAQ and BSE could not become strong enough to reflect the mean—volatility relationship between these two markets in this period.

6.4.2.3 Own Volatility Spillover Effect on Volatility of Return Series

BSE and NASDAQ Return Series

During all the three periods under study, the presence of significant own volatility spillover in both BSE and NASDAQ return series is revealed which indicates that volatility of each return series is reflected in the following period's volatility. As the period of study covers the financial crisis episode, panic created in the market is seen to be reflected in the own volatility spillover of the return series.

6.4.2.4 Cross Volatility Spillover Effect on Volatility of Return Series

BSE versus NASDAQ Return Series

For all the cases considered, the results reveal that there exists a significant cross volatility spillover between BSE and NASDAQ. Following financial globalization, cross-market interlinkages being already in operation for quite some time expressed itself during the crisis episode in the form of pronounced volatility spillover across markets.

6.4.2.5 Asymmetric Own Information Spillover Effect on Volatility of Return Series

BSE Return Series

The study observes evidence of significant asymmetric information spillover effect in the volatility of the BSE return series during all the three periods—Pre-Crisis, In Crisis and Post-Crisis. The sign of asymmetry is found to be positive, which implies that, significant leverage effect existed in the BSE return series over the study period, where bad news or negative information increased the volatility of BSE return series more as compared to the rise in the volatility due to a good news or positive information of the same magnitude.

India is fundamentally a strong country with regulated financial markets and BSE is also a well-functioning stock index. Without any severe economic abnormality, the market participants have confidence on this market and they adjust their financial position according to the available information. Therefore, under the normal market conditions, bad news had more impact on the volatility of the BSE return series compared to good news during the Pre-Crisis period.

The information of the crisis made the volatility of BSE more vulnerable to bad news as significance level increased from 5% level to 1% level from Pre-Crisis to In Crisis period. In a panicked situation, the market participants became more sensitive to the bad news arriving in the market. So, the asymmetric effect of white noise to the BSE return series is found to be more significant during the In Crisis Period.

During the Post-Crisis period, the stabilizing measures and policies adopted by the Indian authorities helped the market to overcome the adverse impacts of the crisis. The market participants started to regain their confidence on BSE soon. However, under the open system, world information in the aftermath of the crisis had a greater role to play. For this reason, in this Post-Crisis period also the asymmetric effect of white noise to BSE return series is found to be highly significant.

NASDAQ Return Series

In the intercountry structure, significant asymmetric information spillover effect is found on the volatility of NASDAQ and the sign is positive during all the three sub-periods under study.

NASDAQ being a strong and active stock exchange linked with several other national and international financial markets, it is highly influenced by new news or any random shock. Thus, in the Pre-Crisis period, the asymmetric news spillover effect to the volatility of NASDAQ return series is found to be significant and positive.

As the crisis hit the US economy, the US financial market was flooded with loads of information related to the crisis sourced from the domestic economy as well as from the reaction of the markets of other countries to this event. The internal information like bankruptcy of Lehmann Brothers, etc. adversely affected the

sentiments and confidence of the market players and made them panicked. Along with this, the panic reaction of other countries was also important. As any new information was considered with awareness in a state of panic, the level of significance of negative news on the volatility of NASDAQ decreased from 1% during the Pre-Crisis period to 10% during the In Crisis period.

During the Post-Crisis period, the US Government was implementing recovery measures to bring back stability in the economy. The market players started to regain their lost confidence. However, the market remained more sensitive to bad news in the open system and paid more attention to the negative news compared to the positive news of the same magnitude to cover the losses made during the crisis. This is reflected through significant asymmetric information spillover effect during this time.

6.4.2.6 Asymmetric Cross Information Spillover Effect on Volatility of Return Series

BSE versus NASDAQ Return Series

In the Pre-Crisis period, there existed significant asymmetric cross information spillover between the volatility of BSE and NASDAQ return series, i.e. any bad news from one return series affected the volatility of the other return series significantly more as compared to the effect of good news of similar magnitude.

During the In Crisis period, the crisis panic made the market players too responsive to any new information irrespective of the nature of the information—good or bad, resulting in the increased market volatility. Therefore, significance of the asymmetric effect faded out.

When the crisis was over, the cross-asymmetric information spillover became significant again like the Pre-Crisis period as the market relations were tending to return to the normal situation.

Thus, the significance of the cross information spillover between the return series of BSE and NASDAQ is found to be varying through different stages of the crisis.

6.5 Concluding Observations

This paper examines the dynamics of volatility spillover of the selected return series of the stock indices of India and US in an intercountry analytical set up around the global financial crisis of 2007–08 applying the multivariate Diagonal VECH Methodology. The econometric results are explained considering the economic profiles of the concerned countries and interlinkage among the concerned stock markets. In general, both the markets are found to experience significant own and

cross volatility spillover effect during all the three sub-periods, which implies that volatility spillover across markets is quite prominent, compared to return spillover. In addition, the significant cross volatility spillover in all the cases considered indicates the global feature of financial market volatility spread. The onset of financial crisis of 2007–2008 is the main catalyst behind such outcome. The study finds strong evidence of news asymmetry contributing significantly to the volatility spillovers both within and among BSE and NASDAQ stock returns during all the three periods. Thus, this research observes that the crisis panic disrupted the usual stock market activities of the two countries studied here and affected their stock market relationships through interaction among the financial markets and their responses to the changing global scenario. The nature of market interaction has considerable bearing upon the economic and financial planning of any economy, framing of corporate strategies and investors' decision making.

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Chapter 7
Globalization, Crisis and Forex Exposure: Indian Evidence

Soumya Saha and Gagari Chakrabarti

7.1 Introduction

In the aftermath of 1992, i.e. after LPG (Liberalization, Privatization and Globalization) India has evolved as a matured economy with sustainable growth prospects. The same is manifested in her capital markets including the stock markets and her foreign exchange markets as well. As in most mature economies of the world, a dynamic relation is highly likely to exist between her stock prices and exchange rates. With the breakdown of the Bretton Wood system in 1973, this interdependence between stock market and the foreign exchange markets has attracted the researchers and market analysts worldwide. With the eventual rise in the extent and intensity of global integration in most markets, this area of research gathered greater relevance. This fact is manifested in the development of voluminous literature extensively investigating into the Asian Crisis of 1997–97. More and more researchers eventually would express further interest in these issues during the initial years of the first decade in the current century, and particularly during the global financial crisis of 2007–08, because of excessively increasing surge in cross-border transactions.

Majority of the previous literature extensively focussing on the dynamic inter linkages between stock market and foreign exchange market at macro level (i.e. market and industry level), however, at micro level, exchange rate risks also have significant inferences for financial decision-making and for firm profitability. The firm's currency exposure refers to its 'economic exposure to exchange rate risk'

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(Adler and Dumas 1984) or 'the sensitivity of [its] economic value, or stock price, to exchange rate changes' (Hekman 1985). But do exchange rate changes have reckonable effects on firm returns? The ever mounting emphasis on exchange rate risk management, the widespread use of foreign currency derivatives and other apposite hedging tools by firms to shield their foreign currency denominated cash flows from unforeseen exchange rate movements, denotes that the market value of the firm is sensitive to exchange rate uncertainty (Nance et al. 1993; Bodnar et al. 1996). It is evident that firms can be exposed to exchange rate risk through numerous channels. For instance, either it might be due to the consolidation of financial statements of different sister concerns by the parent company or foreign exchange loss or gain on foreign currency denominated transactions as an outcome of changes in exchange rate or due to alteration of company's future revenue and cost stream as the result of changes in exchange rates together with inflation rate. Thus, the knowledge of foreign exchange rate exposure on individual firms can help the managers to hedge the foreign currency risk, control the profitability and, in turn, influence the stock price movement of individual firm.

A thorough evaluation of the character of the prevailing studies, also yields a motivating aspect of the level of association between stock and foreign exchange market. It has been established that the impacts of fluctuation of foreign exchange are significant but different for market level (Choi et al. 1992; De Santis and Gerard 1998; Dumas and Solnik 1995), than that of industry and individual firm level (He and Ng 1998; Koutmos and Martin 2003a, b; Patro et al. 2002; Williamson 2001). Thus, it is apparent that exchange rate exposure on stock returns is an inevitable source of information to the portfolio managers, investors, etc., in their hedging and investment decisions. But to take a useful decision, they have to employ more reliable estimates of exchange rate exposure. In this regard, estimates of exchange rate exposure of individual firms' stocks are more useful than that of aggregate indexes of industries, sectors or countries.

With this backdrop, the present study has been initiated to capture the foreign exposure effect at firm and industry level around the two difference crisis period, i.e. Dot-Com crisis in 2001 and Sub-Prime crisis in 2008 with respect to India. Whether and how the nature and magnitude of such exposure depends on the movements and particularly on the crises in the economy; such exploration is important because, if the nature and magnitude of such exposure depends on the cycles of the economy; or it changes as the economy approaches a peak, plunges into a crisis and then recovers, and if the nature of such change differs from one cycle to another, additional risks may be imparted on the economy. Hence, the study explores the possible presence of exposure and compares the nature of it around two crisis periods of the recent past, namely; Dot-Com Crisis of 2001 (which is more industry specific in nature) and the truly global Sub-Prime Crisis of 2008.

Specifically, the present study intends to examine, whether contemporaneous exchange rate exposure arising out of bilateral nominal foreign exchange on stock returns of four different types of firms, viz., Domestic Firms (non-financial), Domestic Firms (financial), High Export Firms, Low Export Firms and Multinational Corporations of India around the two different crisis periods, namely Dot-Com Crisis

of 2001 and Sub-Prime Crisis of 2008; whether the current stock price adjustments are influenced only by lagged exchange rate movements; and whether the corporate exposure to exchange rate movement uniform across firms and industries in India around the crisis period.

The remainder of this chapter is organized as follows. Section 7.2 presents the review of the existing literature; Sects. 7.3 and 7.4 provide a brief discussion on methodology and data, respectively; Sect. 7.5 presents a brief Results and Discussions of Contemporaneous Foreign Currency Exposure at Firm Level; Sect. 7.6 provides a brief Results and Discussions of non-contemporaneous Foreign Currency Exposure at Firm Level; Sect. 7.7 provides a brief Results and Discussions of Contemporaneous Foreign Currency Exposure at Industry Level and finally, Sect. 7.8 concludes the study.

7.2 Literature Review

The major thrust area of maximum number of research studies during the post-liberalization era were focussed on USA Multinationals (Jorion 1990; Choi and Prasad 1995; Bartov and Bodnar 1994; Amihud 1993) or other developed countries (He and Ng 1998; Dominguez and Tesar 2001; Glaum et al. 2000; Nydahl 2001). Later, the focus was shifted towards the developing nations. Erb et al. (1998) revealed that the 1997 Asian crisis had extensive impact on currency valuation. A large number of research studies was initiated to assess the dynamic impact of changes in exchange rates on the firm value and to identify its determinants specifically for the emerging market firms since the findings of developed economies could not be generalized for emerging economies.

Even if there exists enormous literature on this area, the empirical findings are somewhat mixed. Majority of the literature failed to provide a strong association between variability of exchange rate and value of the firm. Amongst them, few studies reveal that only small number of firms has been significantly affected by exchange rate changes in developed markets (Jorion 1990; Amihud 1993; Bartov and Bodnar 1994) and emerging markets (Lin 2011). Other studies reveal significant number of firms facing currency exposure (He and Ng 1998; Choi and Prasad 1995; Bodnar and Gentry 1993).

Motivation of most of the studies in emerging markets are either at market level (Abdalla and Murinde 1997; Parsley and Popper 2006; Saha and Chakrabarti 2011) or industry level (Kho and Stulz 2001; Dominguez and Tesar 2001). The studies on firm-level analysis of foreign exchange exposure for emerging markets are quite few and mostly focussed around East Asian countries (Muller and Verschoor 2007; Dominguez and Tesar 2001).

Former empirical works related to foreign exchange exposure on stock return primarily focussed on two issues; first, measuring the currency exposure and second, identifying the theoretical determinants of exposure.

According to Jorion (1990), the foreign exchange rate exposure has significant impact on US multinational. He also shows that the level of foreign sales is the key determinant of exchange rate exposure. However, according to Amihud (1993) and Bartov and Bodnar (1994), US multinational firms have no significant contemporaneous exchange rate exposure. But Bartov and Bodnar (1994) also finds that past quarterly exchange rate movements has significant impact on US Multinationals. Strong contemporaneous relation between foreign sales and exchange rate exposure has been found by He and Ng (1998), but evidence of a lagged relation is not present.

Dominguez and Tesar (2001) find no relation between foreign sales and exposure in a sample of firms from eight non-US countries, including Japan. Choi and Prasad (1995) have established that cross-sectional differences in exchange rate risk sensitivity are linked to key firm-specific variables like foreign operating profits, sales and asset. Miller and Reuer (1998) explore the effects of strategy and industry structure on economic exposure and they conclude that although increased FDI activity lead to a reduction of exposure, export intensity does not significantly affect the exposure. Further, they argue that firms invested in product differentiation strategies achieve no reduction in foreign exchange risk.

More importantly, as we discuss below, our approach differs substantially from prior studies. One problem in modelling the relation between exchange rates and firm value is that perhaps it is too simplistic to assume that exchange rate changes have a linear and constant impact on firm value. Only in simplified situations does the theoretical literature predict a linear relation and these methodological issues may mask exposure. Even if the exposure-return relation is linear, but varies through time (Allayannis 1997), an exposure regression will be mis-specified if an imperfect proxy is used to capture the time-variation in exposure. To address these concerns, in addition to tabulating results based on standard regression approaches, we propose a different method to examine exposure.

7.3 Methodology

Daily closing data of stock prices and exchange rates has been used to calculate the stock return and appreciation/depreciation series as

$$R_{it} = [\ln(P_{it}) - \ln(P_{it} - 1)]. \tag{7.1}$$

Exchange rates are expressed as the foreign currency price of local currency: i.e. an increase in the index shows depreciation of local currency. The study used nominal exchange rates. The rationale of using nominal exchange rates are as follows: (i) 'using the real exchange rates would assume that financial markets instantaneously observe the inflation rates that are necessary for calculating the real exchange rate' (Bodnar and Gentry 1993); (ii) it is a well-established observation that there exists a high correlation between the changes in nominal and real

exchange rates (Bodnar and Gentry 1993). Daily data of foreign exchange rates have been used in this study. Some authors argue that exchange rate exposure is not well reflected in daily returns as infrequent trading, bid–ask spread, and asynchronous pricing may influence exposure coefficient estimates (Patro et al. 2002). However, it has been somewhat resolved to discuss all possible scenarios including daily data as GARCH family models are good at capturing volatility associated with high-frequency data. It has also been noticed that there are some previous studies in exposure literature that use daily data (see Chamberlain et al. 1997; Koutmos and Martin 2003b).

Based on the following important reasons, the study chooses individual firm as the unit of analysis. First, the general notion is that firms within an industry are not homogeneous; therefore, the exposure coefficient may differ. In simple words, different firms under different industries exposed to foreign currency in different ways. Thus, even though the industry-wide exposure is really high, individual exposure effects may be averaged out with the aggregation of the firms' returns (Dominguez and Tesar 2001).

Second, asymmetry of the second moment of stock returns associated with exchange rate changes may also be averaged out at industry level because within an industry both importers and exporters exits. So, the asymmetry, if at all, can best be captured at the firm level. Finally, the aim of the study is to suggest a means to find more realistic and reliable estimates that are useful in risk management/hedging decisions of firms, an area where the key institution in question is the firm.

The study starts by exploring the sub-periods in Indian financial market through an exploration of presence of endogenous breaks in financial market returns. Specifically, the study uses the test for changes in the unconditional variance of a stochastic process proposed by Inclan and Tiao (1994). This test is capable of identifying breaks in volatility endogenously for any given financial time series. This study follows the methodology introduced by Inclan and Tiao as used by Chakrabarti and Sen (2011) to explore the different phases of volatility and to relate those to the past crisis periods in the Indian stock market.

The study applies the modified ICSS test to isolate possible break dates, if any, in terms of the volatility in the Indian stock market over the period of January 2000 to March 2013. The test identifies six such break dates that allow one to isolate two broad phases around the two crises faced by the Indian stock market over this period. Specifically, such dates are (i) 4 October, 2000, (ii) 29 September 2003, (iii) 2 December 2004, (iv) 17 January 2008, (v) 20 July 2009 and (vi) 28 March 2013. These breakpoints help us define six phases, namely (i) Period 1 (Pre-crisis period; 4 January 2000 to 4 October 2000), (ii) Period 2 (In-crisis period, 6 October 2000 to 29 September 2003) and (iii) Period 3 (Post-crisis period; 1 October 2003 to 2 December 2004). In the same way, the study period around Sub-Prime Crisis (2008) is sub-divided into three sub-periods, i.e. (i) Period 1 (Pre-crisis period, 3 December 2004 to 17 January 2008), (ii) Period 2 (In-crisis period; 18 January 2008 to 20 July 2009) and (iii) Period 3 (Post-crisis period; 21 July 2009 to 28 March 2013). The phases (ii) and (v) are relatively more volatile. These, respectively, are the two phases when Indian stock market was passing through the phases of

Dot-Com crisis and the global financial meltdown. Hence, periods (i) and (iv) may be treated as the pre-crisis periods relating to the Dot-Com and Sub-Prime crisis, respectively; whereas periods (iii) and (vi) may be described as aftermath of those two crises, respectively. Accordingly, the present study isolates periods (i), (ii) and (iii) as the pre-crisis, in-crisis and post-crisis periods relating to the Dot-Com crisis; and (iv)–(vi) are identified as the pre-crisis, in-crisis and post-crisis periods relating to the Sub-Prime crisis.

7.3.1 Model to Identify Contemporaneous Foreign Exchange Exposure at Firm Level

Time-varying volatility and volatility persistence, presence of fat tails or leptokurtosis are clearly visible with many financial time series. Since exchange rate exposure process includes three financial time series [namely, return on the stocks of individual firms, return on the market portfolio (both local and world market) and percentage change in exchange rates] time-varying volatility argument and the presence of fat tails is applicable to the regressions used to estimate exposure coefficients as well. The study considers simple regressions with daily data related to all firms in the sample for ARCH effect. The results strongly support the notion of existence of volatility persistence and presence of fat tail. 95% of the total number of cases, regressions shows the presence of ARCH effect at 1% level of significance. The negligence of this effect in estimating exposure coefficients may surely lead to biased estimates. Koutmos and Martin (2003a) partly attribute the difficulty in detecting exchange rate exposure in earlier studies to the negligence of this time-varying volatility feature.

The original work of Engle (1982) and Bollerslev (1986) introduced that generalized autoregressive conditional heteroskedastic (GARCH) models were handy if one can model the time-varying volatility of the financial assets. The advantage of these models was that they were practically easy to estimate in addition to allow us to perform diagnostic tests. To identify the foreign exchange exposure, the study used orthogonalized GARCH (1, 1) model as it can capture the skewness and leptokurtosis (fat tails relative to the normal distribution) in the financial data.

The study uses a simple GARCH model to check for the presence of exposure in the context of the selected 273 firms around the two crises periods. Most of the financial time series are characterized by some stylized facts, namely the non-normality of returns, presence of skewness, fat tails and volatility clustering in the returns. The descriptive statistics of the returns of these 273 stocks are indeed found to be stationery that follows a non-normal distribution with significant skewness and high values of kurtosis. The returns are further characterized by volatility clustering. Hence, use of a suitable GARCH model seems to be fit for analysing the movements in such stock returns.

Use of AIC criterion suggests the use of a GARCH (1, 1) model on the chosen data. The GARCH (1, 1) is characterized by a mane equation and a variance equation as follows:

The GARCH (1, 1) Model
The study begins with the simplest GARCH (1, 1) specification:

$$\text{Mean Equation} : Y_t = x_t'\theta + \varepsilon_t. \tag{7.2}$$

$$\text{Variance Equation} : \sigma_t^2 = \omega + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2. \tag{7.3}$$

the mean equation shows Y_t as a function of exogenous variables with an error term. Since σ_t^2 is the one period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation includes (i) a constant term, (ii) news about volatility from the previous period, measured as the lag of the squared residual from the mean equation: (the ARCH term) and Last period's forecast variance (the GARCH term).

This study considers the following exogenous variables in the mean equation: (i) the returns from the local market (the return from the NSE Nifty), (ii) the return from the global market (STOXX 3000), (iii) the change in INR/USD exchange rate, (iv) the change in INR/Euro exchange rate, (v) the change in INR/GBP exchange rate and (vi) the change in INR/Yen exchange rate. While finding out exposures, the study concedes that there may be multicollinearity among the exogenous variables in the sense that the local market and the world market returns might be affected by appreciation or depreciation in the chosen exchange rates. Or, they may be related significantly among themselves. Similarly, exchange rate changes might be related among themselves. To solve the problem, the study uses only that part of the explanatory variable which is not affected by other exogenous variables selected in the model. In other words, the study used the orthogonalized values of the explanatory variable.

7.3.2 Model to Identify Lagged (Non-contemporaneous) Foreign Exchange Exposure at Firm Level

The literature on lagged exposure provides a mixed result. Previous research (Amihud 1993; Bartov and Bodnar 1994) provides evidence of the presence of significant lagged exchange rate exposure of stock returns in the developed market like US. The US evidence of lagged foreign currency exposure is virtually not found in Japanese market (He and Ng 1998). The results of the lagged exposure are consistent with the view that investors require time to assess the complex relationship between exchange rate changes and firm value. The study intends to examine whether such an effect is only limited to developed market, or to

multinational firms or if the effect also extends to Indian firms around the two different crisis periods.

To identify the lagged foreign exchange exposure on firm returns, the study started using the orthogonalized GARCH (1, 1) model:

$$\text{Mean Equation}: Y_t = x_t'\theta + x_{t-1}'\theta + \varepsilon_t. \tag{7.4}$$

$$\text{Variance Equation}: \sigma_t^2 = \omega + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2. \tag{7.5}$$

The mean equation shows Y_t as a function of exogenous variables with an error term. Since σ_t^2 is the one period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation includes (i) a constant term, (ii) news about volatility from the previous period, measured as the lag of the squared residual from the mean equation: (the ARCH term) and Last period's forecast variance (the GARCH term).

This study considers the following exogenous variables in the mean equation: (i) the returns from the local market (the return from the NSE Nifty), (ii) the return from the global market (STOXX 3000), (iii) the change in INR/USD exchange rate, (iv) the change in INR/Euro exchange rate, (v) the change in INR/GBP exchange rate and (vi) the change in INR/Yen exchange rate, (vii) the lagged returns from the local market (the return from the NSE Nifty), (viii) the lagged return from the global market (STOXX 3000), (ix) the lagged value of change in INR/USD exchange rate, (x) the lagged value of change in INR/Euro exchange rate, (xi) the lagged value of change in INR/GBP exchange rate and (xii) the lagged value of change in INR/Yen exchange rate. Here, lag value has been considered as one based on the SIC criterion. The study used the orthogonalized values of the explanatory variable similarly as used to identify the contemporaneous exchange rate exposure.

7.3.3 *Model to Identify Contemporaneous Foreign Exchange Exposure at Industry Level*

In this section, the study tries to examine the cross-sectional patterns of exchange rate exposure. Earlier literature, in this field, predominantly focuses on aggregate industry portfolios (Jorion 1990; Bodnar and Gentry 1993) which fails to consider the nature and characteristics of constituent firms in each industry. Thus, the present study tries to identify the exchange rate exposure of individual firms in different industries. Along with, the study also examines the exchange rate exposure on aggregate industry level. To start with, the study first builds equal weighted portfolios for all 22 selected industries and in the next step, to identify the foreign exchange rate exposure GARCH (1, 1) model has been used.

The simplest GARCH (1, 1) specification is as under:

$$\text{Mean Equation} : Y_t = x_t'\theta + \varepsilon_t. \tag{7.6}$$

$$\text{Variance Equation} : \sigma_t^2 = \omega + \alpha \cdot \varepsilon_{t-1}^2 + \beta \cdot \sigma_{t-1}^2. \tag{7.7}$$

where Y_t is the rate of return on the industry portfolio.

This study considers the following exogenous variables in the mean equation: (i) the returns from the local market (the return from the NSE Nifty), (ii) the return from the global market (STOXX 3000), (iii) the change in INR/USD exchange rate, (iv) the change in INR/Euro exchange rate, (v) the change in INR/GBP exchange rate and (vi) the change in INR/Yen exchange rate. The study used the orthogonalized values of the explanatory variable similarly as used to identify the contemporaneous exchange rate exposure.

7.4 Data

The study picks up 273 firms belong to 22 different industries from the CNX 500 index of NSE of India from 2000 to 2013 based on data availability. So far as the exchange rates are concerned, the study considers four of them namely, INR/USD, INR/Pound, INR/Yen and INR/Euro. More specifically, the sample is divided into four groups which is based first on the multinational status of the firm and then on size of its foreign sales. The remaining non-MNC firms have been sorted into three samples according to their foreign to total sales ratios. They are high-exporting firms (foreign sales to total sales in excess of 20%), low exporting firms (foreign to total sales in excess of 0%, but less than 20%) and domestic firms (no foreign sales). After classification, the total sample of 273 firms into 4 groups, each one consists of the following number of firms, viz., 33 firms belong to MNC group; 54 firms belong to Domestic group (out of 54, 25 non-financial and 29 financial firms); 117 firms belong to low export and the remaining firms, i.e. 69 firms belong to high export category. CNX Nifty 50 indices and The STOXX Global 3000 indices have been used as a proxy for the local and global market, respectively. Daily closing data of stock price and exchange rates (RBI reference rates) from January 2000 to March 2013 has been collected from prowess database and RBI website for this study.

While analysing the exchange rate exposure at firm level across different industries and time, the study picks up 273 companies from National Stock Exchange of India belongs to 22 different sectors The 22 selected sectors and the number of firms considered under each category are: Automobiles and Components (17 firms from 27 members), Banks (24 from 42 members), Capital Goods (45 from 79 members), Commercial and Professional Services (from 1 member), Consumer Services (4 from 10 members), Consumer Durables and Apparel (14 from 27 members), Consumer Services (4 from 10 members), Diversified Financials (11 from 33 members), Energy (12 from 17 members), Food Beverage and Tobacco

(14 from 24 members), Health Care Equipment and Services (2 from 3 members), Household and Personal Products (6 from 10 members), Insurance (2 from 2 members), Materials (64 from 80 members), Media (1 from 17 members), Pharmaceuticals, Biotechnology and Life Sciences (25 from 30 members), Real Estate (2 from 24 members), Retailing (1 from 4 members), Software and Services (14 from 28 members), Technology Hardware and Equipment (1 from 2 members), Telecommunication Services (2 from 7 members), Transportation (4 from 13 members) and Utilities (7 from 20 members).

These 22 sectors cover almost all the important sectors of Indian economy. Within each group, the study has not been able to consider all the firms that come under it. This is particularly because all the firms do not have price data for the entire period of 2000–2013. Therefore, the study has selected only those firms that have remained active for the entire period of 2000–2013, so that all price information about them are available. This, of course, involves a relatively smaller data set (than that would have been obtained had it been considered all firms) but incorporating firms with missing price data would have a greater possibility of producing less reliable results.

7.5 Results and Discussions of Contemporaneous Foreign Currency Exposure at Firm Level

7.5.1 Around Dot-Com Crisis

Tables 7.1, 7.2 and 7.3 represent the results for Foreign Exchange Exposure on Multinational Corporations, High Export Firms, Low Export Firms, Domestic Firms (non-financial) and Domestic Firms (Financial), respectively, during pre-Dot-Com, in-Dot-Com and post-Dot-Com crisis period.

The outcomes of the study reveal that all four selected currency has significant exposure both 5 and 10% level of significance but the nature and magnitude of the exposure varies across time. It has been observed that around Dot-Com crisis period number of MNCs exposed increased from pre-crisis to crisis, but then does not fall at all as economy recovers. It can be inferred once risk increases it does not subside. The number of high-exporting non-MNCs exposed increased from pre-Dot-Com crisis to in-Dot-Com crisis, and then falls but does not reach the pre-crisis level. It may be inferred that once risk increases it subsides, but not fully. The number of low exporting non-MNCs exposed increased from pre-Dot-Com crisis to in-Dot-Com crisis, and then falls but does not reach the pre-crisis level. It may be inferred that once risk increases, it subsides, but not completely. The number of domestic firms exposed increased from pre-crisis to crisis, and then falls but does not reach the pre-crisis level. Once risk increases, it subsides, but not completely. The number of domestic non-financial firms remains unchanged as economy moves towards crisis and then falls. The number of domestic financial firms increases as

Table 7.1 Foreign exchange exposure during pre-dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	16	33	7%	10%	10%	16%	8 (25%)
Ave. Exp. Coeff.			0.62311	0.213694	−0.2100	0.059008	
Non-MNC, high export	34	69	9%	16%	11%	15%	30 (44%)
Ave. Exp. Coeff.			1.086495	0.169177	−0.5188	0.35925	
Non-MNC, low export	57	117	12%	15%	12%	11%	37 (32%)
Ave. Exp. Coeff.			0.457715	−0.01939	−0.2003	−0.09029	
Domestic	35	54					
Non-financial	18		21%	21%	17%	17%	13 (52%)
Ave. Exp. Coeff.			−2.30812	0.416619	−0.1609	0.71628	
Financial	17		10%	14%	7%	28%	13 (45%)
Ave. Exp. Coeff.			−0.91	0.048	0.14	0.69	

economy moves towards crisis and then remains unchanged. Based on the above analysis, it may be concluded that risk of exposure is to some extent depends on nature of the firm.

Risk arising from USD movements has been the maximum for all types of firms' around the Dot-Com crisis period. The dispersion, more specifically the standard deviation of the coefficients are higher for the USD than for EURO, GBP and YEN around this period shows the vulnerability of the firm's value due to fluctuation of USD. This confirms not only USA's importance as a major trading partner also the strength of the strong currency like USD over the other exchange rates in sample.

During pre- and post-Dot-Com crisis period, USD and EURO exposure coefficients for MNCs and high export firms have been positive. Hence, in such periods, they gain from depreciation of the home currency (i.e. rupee). Both MNCs and high export firms, however, gain from appreciation domestic currency during crisis. Exactly the opposite is the case for MNCs and exporters under GBP changes. No discernable patterns for domestic firms have been observed around the Dot-Com crisis period. Low exporters gain from appreciation during post and in-crisis, and gain from depreciation in the pre-crisis period. Domestic financial firms always gain from depreciation of USD while the same is just the opposite for EURO. High export firms and non-financial domestic firms always gain from appreciation in Yen whereas financial domestic firms gain from appreciation of YEN in the pre-crisis

Table 7.2 Foreign exchange exposure during in-dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	21	33	28%	13%	10%	16%	13 (40%)
Ave. Exp. Coeff.			−1.3993	−0.2316	0.378596	−0.01319	
Non-MNC, high export	68	69	38%	24%	16%	22%	35 (51%)
Ave. Exp. Coeff.			−1.7030	−0.3072	0.0612	0.10714	
Non-MNC, low export	84	117	30%	17%	13%	14%	56 (48%)
Ave. Exp. Coeff.			−1.1823	−0.0649	0.291991	0.065126	
Domestic	37	54					
Non-financial	17		25%	17%	17%	13%	11 (44%)
Ave. Exp. Coeff.			−1.34	0.072	0.11	0.98	
Financial	20		24%	17%	14%	14%	14 (49%)
Ave. Exp. Coeff.			−1.72	0.21	−0.48	−0.18	

period only. Low export and domestic firms have much lower exchange rate exposure than that of the other two categories of firms during both crisis periods. These empirical findings strengthen the theoretical belief that the degree of exposure increases with more internalization of firms.

Regarding the results about the magnitude of exposure, the results of the previous studies is somewhat mixed. The results of this study is in sharp contrast with some of the existing literature on developed nation (Jorion 1990; Amihud 1993; Bartov and Bodnar 1994) which depicted a weak relationship between contemporaneous exchange rate exposure and firms value. This study reveals somewhat mixed results for four different bilateral nominal exchange rates around Dot-Com crisis period. For USD and GBP, firms belong to all the five segments on an average have negative exposure. For Euro and Yen, the exposure is positive which confirms by Choi and Prasad's (39 firms with significantly positive coefficients versus 22 negative), He and Ng's (43 positive and 2 negative).

The study incorporates the Arch-LM test to check the robustness of the results. More specifically, whether there exist any arch effects on residuals after running GARCH (1, 1) model during the three sub-periods around Dot-Com crisis. The study reveals that there exists no arch effect at 5% level of significance infers the model provides no spurious results.

Table 7.3 Foreign exchange exposure during post-dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	21	33	10%	25%	19%	13%	14 (43%)
Ave. Exp. Coeff.			0.234732	0.094058	−0.7740	0.106079	
Non-MNC, high export	56	69	22%	15%	24%	22%	21 (31%)
Ave. Exp. Coeff.			0.549453	0.123586	−0.6874	0.22224	
Non-MNC, low export	65	117	13%	12%	19%	13%	47 (41%)
Ave. Exp. Coeff.			−0.06825	0.117237	−0.7527	0.326836	
Domestic	33	54					
Non-financial	13		8%	12%	28%	4%	9 (36%)
Ave. Exp. Coeff.			1.709189	0.58141	−0.8543	0.684071	
Financial	20		21%	10%	21%	17%	15 (52%)
Ave. Exp. Coeff.			−1.37	0.85	−0.7	−0.42	

7.5.2 Around Sub-prime Crisis

Tables 7.4, 7.5 and 7.6 represent the results for Foreign Exchange Exposure on Multinational Corporations, High Export Firms, Low Export Firms, Domestic Firms (non-financial) and Domestic Firms (Financial) respectively during pre-Sub-Prime, in-Sub-Prime and post-Sub-Prime crisis Period.

During Sub-Prime crisis period, the number of MNCs exposed increased from pre-crisis to crisis, but then fell as economy recovers. Thus, it may be inferred that risk increases but subside. The number of high-exporting non-MNCs exposed fell from pre-crisis to crisis, and then rises to reach the pre-crisis level of 100% (approx.). The number of low exporting non-MNCs exposed increased from pre-crisis to crisis, and then further to the post-crisis period. Once risk increases, it increases continuously. The number of domestic firms exposed reduced from pre-crisis to crisis, and then increase slightly. They could avoid the risk somehow. The number of domestic non-financial firms falls as economy moves towards crisis and then rises. The number of domestic financial firms decreases as economy moves towards crisis and then remains constant. Comparing the exposure results during the two crisis periods, it may be concluded that risk of contemporaneous exchange rate exposure not only depends on nature of the firm but also on nature of crisis.

Table 7.4 Foreign exchange exposure during pre-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	27	33	19%	25%	16%	25%	15 (46%)
Ave. Exp. Coeff.			0.120963	−0.4514	0.030414	0.212187	
Non-MNC, high export	69	69	25%	28%	27%	22%	33 (48%)
Ave. Exp. Coeff.			0.026586	−0.0231	0.168224	−0.23943	
Non-MNC, low export	87	117	19%	21%	14%	22%	52 (43%)
Ave. Exp. Coeff.			−0.63456	−0.0047	0.010159	0.061724	
Domestic	50	54					
Non-financial	23		32%	12%	20%	28%	10 (40%)
Ave. Exp. Coeff.			−0.34	−0.52	0.41	0.11	
Financial	27		38%	18%	14%	25%	16 (56%)
Ave. Exp. Coeff.			−0.56286	−0.1955	0.05536	0.16148	

During pre-, in- and post-Sub-Prime crisis Euro exposure on MNCs, High Export, Low Export and Domestic non-financial firms have been negative. Hence, in such periods, they gain from appreciation of the home currency (i.e. rupee). During the crisis period most of the firms have negative exposure due to all four exchange rates infers appreciation/(depreciation) of home currency is beneficial/(unfavourable) for the value of the firm. The Sub-Prime crisis is more vulnerable and global in nature and which impacted all four exchange rate to a great extent. During the crisis, in absolute term, USD appreciated from INR 39.27 to INR 52.06; EURO appreciated from INR 57.27 to INR 69.17; GBP appreciates from INR 67.6067 to INR 86.53 and YEN appreciates from INR 36.64 to INR 55.58. All the four currencies have appreciated and thus, justified the negative exposure. In other words, during the in-Sub-Prime crisis most of the firms have adverse valuation impact. Apart from this, no such discernable impact related to individual currency movement has been found around the Sub-Prime crisis.

The study incorporates the Arch-LM test to check the robustness of the results. More specifically, whether there exist any arch effects on residuals after running GARCH (1, 1) model during the three sub-periods around Sub-Prime crisis. The study reveals that there exists no arch effect at 5% level of significance infers the model provides no spurious results.

Table 7.5 Foreign exchange exposure during in-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	30	33	31%	13%	19%	31%	18 (55%)
Ave. Exp. Coeff.			0.364629	−0.2624	−0.2479	−0.3409	
Non-MNC, high export	50	69	18%	19%	18%	19%	34 (50%)
Ave. Exp. Coeff.			−0.10591	−0.09004	−0.23094	−0.29912	
Non-MNC, low export	100	117	16%	16%	21%	35%	66 (57%)
Ave. Exp. Coeff.			−0.0298	−0.15182	−3.2E −05	−0.18594	
Domestic	40	54					
Non-financial	19		28%	12%	12%	24%	14 (56%)
Ave. Exp. Coeff.			−0.48729	0.088061	-0.0878	−0.21777	
Financial	21		18%	11%	7%	38%	15 (52%)
Ave. Exp. Coeff.			−0.61616	−0.13279	−0.2272	−0.08685	

7.5.3 Discussions

When comparing two crisis periods, it has been observed that the dispersion, more specifically the standard deviation of the coefficients are higher for the USD than for EURO, GBP and YEN around this period for only low export firms. For other types of firms, the dispersion is somewhat mixed. For MNCs the dispersion is more for YEN and the second position held by EURO. For high export firms, the same is maximum for GBP. The results shows the vulnerability of the firm's value due to fluctuation of all the currencies justifies not only the diversified export basket for India, as an emerging economy as compare to Dot-Com crisis but also the global and more vulnerability of the Sub-Prime crisis.

Thus far, the study exhibited that firms seem to be exposed to fluctuations of the four major currencies. However, till now, the study only discussed the results for one currency at a time. A more common question is to what extent firms are exposed to exchange rate fluctuations at all, in other words, to at least one currency. The study finds that almost 36% MNCs; 42% high export firms; 40% low export firms; 44% domestic non-financial firms and 49% domestic financial firms have one coefficient statistically different from zero on an average around Dot-Com crisis. During Sub-Prime crisis, the exposure is even higher. The study finds that almost

Table 7.6 Foreign exchange exposure during post-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	20	33	13%	13%	13%	13%	13 (40%)
Ave. Exp. Coeff.			−0.0169	−0.2152	0.090228	−0.1051	
Non-MNC, high export	68	69	31%	25%	19%	26%	35 (51%)
Ave. Exp. Coeff.			0.227361	−0.0519	−0.02071	−0.2291	
Non-MNC, low export	118	117	33%	26%	21%	23%	60 (52%)
Ave. Exp. Coeff.			−0.30693	−0.2791	0.326783	−0.0035	
Domestic	44	54					
Non-financial	23		28%	32%	16%	28%	15 (60%)
Ave. Exp. Coeff.			−0.3457	−0.0839	0.02038	−0.0909	
Financial	21		32%	25%	11%	7%	28 (97%)
Ave. Exp. Coeff.			−0.26	−0.29	0.33	0.17	

47% MNCs; 50% high export firms; 51% low export firms; 52% domestic non-financial firms and 62% domestic financial firms have one coefficient statistically different from zero around Sub-Prime crisis. These results also showed the importance of the nature of crisis on exposure. These numbers are noticeably higher than those reported in prior empirical research on exchange rate exposure signifies the importance of contemporaneous exchange rate exposure on value of the firm.

The exposure coefficients (both positive and negative) will vary across time infers that the exposure arising out of fluctuations in foreign currency is time varying. Moreover, it has been found that the exposure arising out of local and world market is vary over time for all types of firm around all the six different subsample periods. The degree of exposure arising out of foreign exchange rates during In-Dot-Com crisis, period are different in sign and magnitude for all types of firms as compare to the pre and post-Dot-Com crisis period. The same is also true during the Sub-Prime crisis period. While comparing the results with the previous studies, it has been found the Indian firms are mostly exposed to foreign exchange rate fluctuations. For example Jorion (1990) finds only 5% of the US firms to be exposed, while He and Ng (1998) find that 26% of the Japanese firms exhibit significant exchange rate exposure. While comparing the results of this study with European studies, it has also been found that Dutch firms are more exposed. For

instance, for Swedish firms Nydahl (2001) finds 26% of the firms to be significantly exposed. The nature of exposure faced by the different group of companies is somewhat different around the two different crisis periods infers that the nature of crisis may have a significant impact on the foreign exchange exposure on stock return for firms.

7.6 Results and Discussions of Non-contemporaneous (Lagged) Foreign Currency Exposure at Firm Level

In the previous section of the study, it has been observed that there exists enough evidence of the presence of contemporaneous exchange rate exposure on firm value and its changing nature around the two different crisis period. It has also been found that the contemporaneous exchange rate exposures not only depend on the nature of the firms but also the magnitude and sign of such exposure vary across firms and time. Based on the rich body of literature, the question thus arose, in Indian context, whether the exchange rate exposure on value of the firm has only contemporaneous impact or there may be a chance of lagged exchange rate exposure. According to Bartov and Bodnar (1994), the reasons of the presence of lagged exchange rate exposure are two folds. First, it is because of the complex relationship between firm value and exchange rate. Second, firms usually hedge the exposure in near future. To test this hypothesis, the study incorporates lagged exchange rate exposure along with contemporaneous exchange rate exposure in Eq. (7.4). The lag length of one period (i.e. one day in this case) has been chosen based on AIC and SIC criterion.

7.6.1 Around Dot-Com Crisis

Tables 7.7, 7.8 and 7.9 represent the results for lagged Foreign Exchange Exposure on Multinational Corporations, High Export Firms, Low Export Firms, Domestic Firms (non-financial) and Domestic Firms (Financial), respectively, during pre-Dot-Com, in-Dot-Com and post-Dot-Com crisis period.

The study found the presence of statistically significant lagged exposure at 5 and 10% level of significance. It is interesting to note that the sign and significance of the coefficients of the contemporaneous exposure remain unchanged. It has been observed that on an average 41% MNCs; 35% high export firms; 39% low export firms; 51% domestic non-financial firms and 37% domestic financial firms have one coefficient statistically different from zero around Dot-Com crisis.

The study incorporates the Arch-LM test to check the robustness of the results. More specifically, whether there exist any arch effects on residuals after running GARCH (1, 1) model during the three sub-periods around Dot-Com crisis. The

Table 7.7 Lagged foreign exchange exposure during pre-dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	20	33	13%	13%	19%	19%	43% (14)
Ave. Exp. Coeff.			−3.52084	−0.4172	1.127863	−0.4506	
Non-MNC, high export	27	69	12%	8%	8%	14%	29% (20)
Ave. Exp. Coeff.			−1.34944	0.602264	−0.28801	−0.4733	
Non-MNC, low export	60	117	18%	13%	8%	14%	37% (43)
Ave. Exp. Coeff.			−0.10019	0.01744	−0.57024	−0.6126	
Domestic	23	54					
Non-financial	11		16%	4%	12%	12%	36% (9)
Ave. Exp. Coeff.			−0.99535	1.008141	−0.4884	−3.3103	
Financial	12		11%	11%	4%	18%	35% (10)
Ave. Exp. Coeff.			−0.05371	0.42048	0.575102	−0.7834	

study reveals that there exists no arch effect at 5% level of significance infers the model provides no spurious results.

7.6.2 Around Sub-prime Crisis

Tables 7.10, 7.11 and 7.12 represent the results for lagged Foreign Exchange Exposure on Multinational Corporations, High Export Firms, Low Export Firms, Domestic Firms (non-financial) and Domestic Firms (Financial), respectively, during pre-Sub-Prime, in-Sub-Prime and post-Sub-Prime crisis period (Table 7.13).

During Sub-Prime crisis on an average 66% MNCs; 56% high export firms; 52% low export firms; 51% domestic non-financial firms and 58% domestic financial firms have one coefficient statistically significant and different from zero. The number of firms exposed to at least a single currency increased during the Sub-Prime crisis period over Dot-Com crisis infers the widespread impact of the financial meltdown. This result is in line with the evidence presented by Bartov and Bodnar (1994), Amihud (1993) and Tai (2005) but it contradicts the evidence as presented by Koutmos and Martin (2003b), and He and Ng (1998).

Table 7.8 Lagged foreign exchange exposure during in dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	23	33	16%	25%	16%	16%	43% (14)
Ave. Exp. Coeff.			−0.11623	0.007406	0.560784	0.139727	
Non-MNC, high export	57	69	14%	22%	19%	29%	48% (33)
Ave. Exp. Coeff.			2.071894	−0.15331	0.244522	0.41915	
Non-MNC, low export	63	117	10%	18%	13%	15%	39% (45)
Ave. Exp. Coeff.			1.249914	−0.04047	0.338147	0.421153	
Domestic	30	54					
Non-financial	22		48%	16%	8%	16%	64% (16)
Ave. Exp. Coeff.			0.627835	0.016829	0.672035	0.278489	
Financial	8		11%	7%	0%	11%	25% (7)
Ave. Exp. Coeff.			0.909788	0.379495	0	0.440214	

The study incorporates the Arch-LM test to check the robustness of the results. More specifically, whether there exists any arch effect on residuals after running GARCH (1, 1) model during the three sub-periods around Sub-Prime crisis. The study reveals that there exists no arch effect at 5% level of significance infers the model provides no spurious results.

7.6.3 Discussions

It is quite interesting to note that the most of the firms which are exposed to contemporaneous exchange rate exposure are not exposed to lagged exchange rate exposure and vice versa. In addition, the sign and magnitude of exposure, while comparing the lagged exposure with contemporaneous exposure, is same and sometimes opposite during the two different crisis period. Thus, it may be concluded that the firms are prone to more risk if they are exposed to both contemporaneous and lagged exposure. If the sign of both contemporaneous and lagged exposure are same, the firms are comparatively less risky towards the investors than those firms which have exposure coefficient with different sign. Few MNCs (e.g. Ingersoll-Rand (India) Ltd., AstraZeneca Pharma India Ltd., Bata India Ltd.,

Table 7.9 Lagged foreign exchange exposure during post-dot-com crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	15	33	19%	7%	10%	13%	37% (12)
Ave. Exp. Coeff.			−1.08462	−0.38053	0.202919	0.363172	
Non-MNC, high export	28	69	6%	8%	14%	15%	27% (18)
Ave. Exp. Coeff.			−0.07159	0.277626	−0.72752	0.379253	
Non-MNC, low export	75	117	12%	15%	20%	18%	42% (48)
Ave. Exp. Coeff.			−1.2726	0.415708	−0.55723	0.505484	
Domestic	43	54					
Non-financial	20		16%	20%	20%	24%	52% (13)
Ave. Exp. Coeff.			2.660676	3.575478	2.927978	3.956755	
Financial	23		25%	7%	25%	25%	52% (15)
Ave. Exp. Coeff.			−1.11695	0.952097	−1.07601	0.554071	

Monsanto India Ltd., Blue Dart Express Ltd., Colgate-Palmolive (India) Ltd., Procter & Gamble Hygiene & Health Care Ltd., Cummins India Ltd. and GlaxoSmithKline Consumer Healthcare Ltd.) have exposure coefficients with different sign and magnitude for both contemporaneous and lagged exposure around both the crisis periods. Few High export firms (e.g. Aurobindo Pharma Ltd., Bhushan Steel Ltd., Godrej Industries Ltd., Shasun Pharmaceuticals Ltd., H E G Ltd., Sun Pharmaceutical Inds. Ltd., Supreme Petrochem Ltd., Tata Communications Ltd., Infosys Ltd. and Jindal Saw Ltd.) have exposure coefficients with different sign and magnitude for both contemporaneous and lagged exposure around both the crisis periods. Few low export firms (e.g. Apollo Tyres Ltd., Asahi India Glass Ltd., Blue Star Ltd., Dabur India Ltd., ElgiEquipments Ltd., Gujarat Alkalies and Chemicals Ltd., HCL Infosystems Ltd., HSIL Ltd., JSW Steel Ltd., KCP Ltd., Pidilite Industries Ltd., Tata Power Co. Ltd. and VIP Industries Ltd.) have exposure coefficients with different sign and magnitude for both contemporaneous and lagged exposure around both the crisis periods. And also few domestic financial firms (e.g. ICICI bank, Cholamandalam Investment and Finance Co. Ltd.), as well as domestic non-financial firms (e.g. Madras Cements Ltd., Zodiac Clothing Co. Ltd., Bannari Amman Sugars Ltd.), are exposed both to contemporaneous and non-contemporaneous exchange rate exposure during Dot-Com crisis and Sub-Prime crisis period. Another interesting fact, based on the results achieved, is

Table 7.10 Lagged foreign exchange exposure during pre-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	34	33	13%	43%	31%	19%	70% (23)
Ave. Exp. Coeff.			0.067545	0.230429	−0.5854	0.331538	
Non-MNC, high export	80	69	28%	29%	32%	28%	64% (44)
Ave. Exp. Coeff.			0.693654	0.5364	−0.5405	0.028127	
Non-MNC, low export	130	117	15%	41%	43%	14%	59% (68)
Ave. Exp. Coeff.			0.449038	0.43744	−0.4912	−0.01853	
Domestic	51	54					
Non-financial	22		12%	28%	24%	24%	56% (14)
Ave. Exp. Coeff.			−0.6841	−0.09099	−0.0960	0.281592	
Financial	29		11%	32%	25%	35%	66% (19)
Ave. Exp. Coeff.			0.592554	−0.28125	−0.5302	0.291383	

that the number of firms impacted due to lagged exposure is more than the number of firms exposed to contemporaneous exchange rate exposure which is contradicting the lagged hypothesis literature conducted in the developed nation; Tai (2005). The inefficiency of the emerging market like India as compare to the developed market, may be taken as the cause for such results. Thus, the analysis, therefore, gives enough evidence to support the mispricing hypothesis. In other words, the results are consistent with the view that it is difficult for investors to understand the complex and dynamic behaviour of firm's value and exchange rate.

7.7 Results and Discussions on Contemporaneous Foreign Currency Exposure at Industry Level

Moreover, the present study also examines the foreign exchange exposure at industry level around the two different crises periods. The results of the exposure at industry level presented below.

Table 7.11 Lagged foreign exchange exposure during in-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	29	33	22%	28%	19%	22%	58% (19)
Ave. Exp. Coeff.			−0.2302	0.311866	−0.33075	−0.15589	
Non-MNC, high export	62	69	11%	43%	16%	22%	51% (35)
Ave. Exp. Coeff.			−0.58041	0.568779	−0.42046	−0.33862	
Non-MNC, low export	86	117	8%	25%	21%	21%	49% (57)
Ave. Exp. Coeff.			−0.34396	0.596809	−0.31936	−0.37457	
Domestic	31	54					
Non-financial	13		16%	20%	4%	12%	36% (9)
Ave. Exp. Coeff.			−0.09927	0.687399	0.390003	−0.47503	
Financial	18		0%	32%	4%	28%	49% (14)
Ave. Exp. Coeff.			0	0.452926	−0.40066	−0.31998	

7.7.1 Around Dot-Com Crisis

At an aggregate portfolio level, during pre-Dot-Com crisis period only one industry (i.e. Insurance) is exposed to three different exchange rates (e.g. Euro, GBP and Yen). Retail industry is exposed to Euro and GBP, while Banks, Capital Goods, Consumer Durable, Diversified Financials, Energy, Food and Beverages, Healthcare Equipments, Household and Personal, Materials, Pharmaceuticals, Real Estate, Software, Tech Hardware, Telecom and Utilities industries do not seem to be affected by any of the currency movements at an aggregate level during the pre-Dot-Com crisis period. But individual companies under these industries shows significant exchange rate exposure from at least one of the single currencies, signifies the problem of aggregation at industry level. All firms belong to Commercial and Professional Service, Media and Retail industries are affected by at least one of the single currencies. 67% of the individual Household and Personal care firms are affected by at least one of the single currencies. 50% of the individual Energy, Telecom and Transportation firms are affected by at least one of the single currencies. Only 32% (7) industries have showed a significant exchange rate exposure to at least any one currency while the remaining 68% (15) industries have no exposure at an aggregate level during the pre-Dot-Com crisis period. The firms

Table 7.12 Lagged foreign exchange exposure during post-sub-prime crisis

Firm type	Total no. of firms exposed	Group total	% of firms exposed to USD	% of firms exposed to Euro	% of firms exposed to GBP	% of firms exposed to Yen	No. and % of companies exposed to at least single currency
MNC	34	33	19%	31%	25%	31%	70% (23)
Ave. Exp. Coeff.			0.274723	−0.15608	−0.2243	0.041606	
Non-MNC, high export	56	69	18%	22%	12%	31%	54% (37)
Ave. Exp. Coeff.			0.016863	−0.25461	−0.2022	0.228314	
Non-MNC, low export	97	117	19%	24%	21%	21%	48% (50)
Ave. Exp. Coeff.			0.037903	−0.22957	−0.0169	0.208289	
Domestic	53	54					
Non-financial	23		12%	32%	24%	24%	60% (15)
Ave. Exp. Coeff.			−0.6841	−0.05631	−0.2109	0.281592	
Financial	30		11%	32%	28%	35%	59% (17)
Ave. Exp. Coeff.			0.592554	−0.28125	−0.4978	0.291383	

belong to those industries, which failed to exhibit any significant exposure at an aggregate level, are exposed to at least to a single currency and are ranging from 25 to 100%.

During In-Dot-Com crisis (Results represented in Table 7.14), at an aggregate level, only one industry (i.e. Commercial and Professional Service) is exposed to all four exchange rates (e.g. USD, Euro, GBP and Yen). Transportation industry is significantly exposed to USD and YEN while Automobile, Materials Pharmaceutical, and Real Estate and Telecom industries at an aggregate level only affected by USD. Only 37% (8) industries have showed a significant exchange rate exposure to at least any one currency while the remaining 63% (14) industries (e.g. Banks, Capital Goods, Consumer Durable, Consumer Services, Diversified Financials, Energy, Food and Beverages, Healthcare Equipments, Household and Personal, Insurance, Media, Software, Tech Hardware and Utilities) have no exposure at an aggregate level during the In-Dot-Com crisis period. The firms belong to those industries, which failed to exhibit any significant exposure at an aggregate level, exposed to at least to a single currency and are ranging from 19 to 100%.

During post-Dot-Com crisis (Results represented in Table 7.15), at an aggregate level, only three industries (i.e. Diversified Financials, Household and Personal Care and Media) are exposed to three exchange rates. Consumer Durable industry is the only industry which significantly exposed at an aggregate level to GBP and

Table 7.13 Foreign exchange exposure at aggregate industry level during pre-dot-com crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.452011*	0.101246**	−0.36931	0.180255	−0.36057*	−0.05834	24% (4)
2	Banks	24	0.470968*	0.136312*	0.253349	−0.08774	−0.07113	0.143302	46% (11)
3	Capital goods	45	0.53542*	0.039059	0.165345	−0.04422	0.129501	0.03088	38% (17)
4	Commercial and professional service	1	0.405415*	−0.0454	−0.82815	0.67331**	−0.03861	0.315345	100% (1)
5	Consumer durable	14	0.443848*	0.025633	−0.11434	−0.05443	0.010962	0.193334	43% (6)
6	Consumer services	4	0.479876*	−0.01855	−0.66995	−0.35722**	0.307373	−0.04422	25% (1)
7	Diversified financials	11	0.657596*	0.098043	0.141186	0.024618	−0.19453	0.051657	46% (5)
8	Energy	12	0.675801*	−0.10856	−1.02341	0.09774	0.266026	0.334281	50% (6)
9	Food and beverages	14	0.6682*	0.097653	−0.87625	0.221811	−0.03518	0.016464	36% (5)
10	Healthcare equipments	2	0.344489*	−0.11646	1.645947	−0.21689	0.038203	−0.42582	None
11	Household and personal	6	0.376567*	0.0753	−0.44421	0.051167	−0.19527	−0.01589	67% (1)
12	Insurance	2	0.768846*	0.056552	−0.9091	−0.39776**	0.687055**	0.477217*	None
13	Materials	64	0.564135*	0.086754	−0.37355	0.051538	−0.04516	0.098102	40% (25)
14	Media	1	1.549706*	0.237107	−2.96867	0.296061	−0.02738	0.939802**	100% (1)
15	Pharma	25	0.568334*	−0.13222*	0.356084	−0.16414	0.201232	0.045487	25% (6)

(continued)

Table 7.13 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
16	Real estate	2	0.532035*	−0.18549	0.86083	−0.32363	0.716337	0.127765	None
17	Retail	1	0.595422*	−0.08236	0.643631	−0.46519**	0.840504*	0.420181	100% (1)
18	Software	14	0.478689*	0.076033	−0.63568	−0.20698	−0.11982	0.426839	22% (3)
19	Tech hardware	1	0.822218*	0.0714	−1.57263	0.371217	0.410132	0.370065	None
20	Telecom	2	0.85151*	0.419417*	−0.06125	0.482332	−0.3408	0.105327	50% (1)
21	Transportation	4	0.071915	−0.08641	0.818942**	−0.00689	−0.01955	0.007337	50% (2)
22	Utilities	7	0.535847*	−0.17836	−0.78675	0.278861	0.118723	0.137172	29% (2)

*Significant at 5% level of significance; **significant at 10% level of significance; *LM* local market risk coefficient; *WM* world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient; *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

YEN. A large proportion, i.e. 63% (14) industries have showed a significant exchange rate exposure to at least any one currency while the remaining 37% (8) industries (e.g. Automobile, Commercial and Professional Service, Healthcare Equipments, Software, Tech Hardware, Telecom, Transportation and Utilities) have no exposure at an aggregate level during the post-Dot-Com crisis period. The firms belong to those industries, which failed to exhibit any significant exposure at an aggregate level, exposed to at least to a single currency and are ranging from 25 to 100%.

7.7.2 Around Sub-prime Crisis

At an aggregate portfolio level, during pre-Sub-Prime crisis period (Results represented in Table 7.16), only two industries (i.e. Automobile and Capital Goods) is exposed to three different exchange rates (e.g. USD, GBP and Yen). 23% (5) industries (e.g. Diversified Financials, Insurance, Media, Real Estate and Utilities) are exposed to any two currencies at an aggregate level during this period, while industries, such as, Commercial and Professional Service, Consumer Durable, Consumer Services, Healthcare Equipments, Pharmaceuticals, Retail, Tech Hardware and Telecom do not seem to be affected by any of the currency movements at an aggregate level during the pre-Sub-Prime crisis period. But individual companies under these industries shows significant exchange rate exposure from at least one of the single currencies, signifies the problem of aggregation at industry level. Only 63% (14) industries have showed a significant exchange rate exposure to at least any one currency while the remaining 37% (8) industries have no exposure at an aggregate level during the pre- Sub-Prime crisis period. The firms belong to those industries, which failed to exhibit any significant exposure at an aggregate level, exposed to at least to a single currency and are ranging from 0 to 50%.

During in-Sub-Prime crisis (results represented in Table 7.17), at an aggregate level, no industry is exposed to all four or any three of the exchange rates. Only 23% (5) industries (e.g. Automobile, Capital Goods, Food and Beverages, Healthcare Equipments and Household and Personal) are affected to any two currencies at an aggregate level during this period. Only 41% (9) industries have showed a significant exchange rate exposure to at least any one currency while the remaining 59% (13) industries (e.g. Banks, Consumer Durable, Consumer Services, Energy, Insurance, Media, Real Estate, Telecom and Utilities) have no exposure at an aggregate level during the in-Sub-Prime crisis period. The firms belong to those industries, which failed to exhibit any significant exposure at an aggregate level, exposed to at least to a single currency and are ranging from 0 to 100%.

During post-Sub-Prime crisis (Results represented in Table 7.18), at an aggregate level, only one industry (i.e. Food and Beverages) is exposed to four exchange rates. 18% (4) industries (e.g. Consumer Durable, Energy, Software and Telecom) are affected to any two currencies at an aggregate level during this period. A large proportion, i.e. 63% (14) industries have showed a significant exchange rate

Table 7.14 Foreign exchange exposure at aggregate industry level during in dot-com crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.637585*	0.030911	−0.73278**	−0.03397	0.115069	0.048545	65% (11)
2	Banks	24	0.647771*	−0.00231	−0.39314	0.088692	−0.10361	−0.04855	63%(15)
3	Capital goods	45	0.760874*	0.033197	−0.25026	−0.04159	0.044179	0.026427	47% (21)
4	Commercial and professional service	1	0.49222*	0.046973	−1.04547**	−0.25826**	0.404909*	0.233237**	100% (1)
5	Consumer durable	14	0.713039*	0.044333	−0.02691	−0.07222	0.052231	−0.00732	29% (4)
6	Consumer services	4	0.86057*	−0.03997	−1.75371	−0.20448	0.381203	−0.04225	100% (4)
7	Diversified financials	11	0.90626*	0.002303	−0.36932	0.007924	0.04955	0.111287	19% (2)
8	Energy	12	0.784509*	0.054602	−0.67807	0.092808	−0.01542	0.009691	59% (7)
9	Food and beverages	14	1.003705*	−0.0074	−0.80349	−0.0428	−0.02432	−0.01589	43% (6)
10	Healthcare equipments	2	0.347811*	−0.08812	−0.53911	0.188242	−0.10358	−0.03141	None
11	Household and personal	6	0.539972*	0.080923	0.045888	0.291284	−0.35204	0.099391	34% (2)
12	Insurance	2	0.8981*	−0.01378	−0.41329	−0.06512	0.197994	0.12261	None
13	Materials	64	0.81282*	0.017505	−1.04258*	−0.03544	0.045887	0.057119	57% (36)
14	Media	1	1.781187*	0.048774	0.766484	−0.33331	0.005798	0.284285	None
15	Pharma	25	0.686902*	−0.0129	−0.55626**	−0.0243	0.067448	0.057426	63%(15)
16	Real estate	2	0.80394*	−0.07607	−1.27721*	0.10322	−0.0399	0.121712	50% (1)

(continued)

Table 7.14 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
17	Retail	1	0.647852*	0.030373	−0.63148	−0.27292	0.358989	−0.25596**	100% (1)
18	Software	14	1.000405*	−0.00689	−0.12835	−0.0118	0.010011	−0.02672	58% (8)
19	Tech hardware	1	0.835724*	0.105727	1.266003	0.234342	−0.43339	0.259347	None
20	Telecom	2	0.424762*	−0.01908	−1.17437*	−0.02181	0.130661	−0.06639	100% (2)
21	Transportation	4	0.743913*	−0.02188	−0.61907*	0.062593	0.177816	0.207171*	25% (1)
22	Utilities	7	0.830191*	0.025107	−0.30755	−0.02573	0.041928	−0.10261	29% (2)

*Significant at 5% level of significance; **significant at 10% level of significance; *LM* local market risk coefficient; *WM* world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient; *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

Table 7.15 Foreign exchange exposure at aggregate industry level during post-dot-com crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.809135*	0.347984*	−0.17319	−0.24124	−0.23601	−0.19619	30% (5)
2	Banks	24	1.056987*	0.536993*	−0.67937	0.223359	−0.28141	−0.00523	46% (11)
3	Capital goods	45	0.91969*	0.50784*	0.068267	0.097111	−0.39181*	0.057793	34% (15)
4	Commercial and professional service	1	0.542086*	0.234213**	0.595857	0.054368	−0.13685	−0.01398	100% (1)
5	Consumer durable	14	0.868344*	0.466431*	−0.12276	0.236953	−0.35713*	0.223516*	50% (7)
6	Consumer services	4	0.889785*	0.602011*	0.594399**	0.078533	−0.21135	0.055076	50% (2)
7	Diversified financials	11	0.935052*	0.624967*	−0.68855	0.889296*	−0.95505*	−0.09122	55% (6)
8	Energy	12	1.057818*	0.505123*	−0.08098	0.237942	−0.44808*	0.194708	34% (4)
9	Food and beverages	14	0.987469*	0.492676*	0.041664	0.305863	−0.46827*	−0.2065	36% (5)
10	Healthcare equipments	2	0.550732*	0.478219	0.658378	0.243608	−0.3588	−0.13844	50% (2)
11	Household and personal	6	0.919417*	0.646048*	0.903055*	0.737328*	−1.19549*	0.157829	17% (1)
12	Insurance	2	1.145565*	0.576602*	0.384566	0.181073	−0.83485**	0.134066	None
13	Materials	64	0.826904*	0.457527*	−0.11809	0.044761	−0.27148*	0.104909	40% (25)
14	Media	1	0.600198*	0.240778	0.000134	−1.16605*	0.825352*	0.830477*	100% (1)
15	Pharma	25	0.859842*	0.345512*	0.267594	0.196782	−0.50439*	0.060448	67% (16)
16	Real estate	2	0.720316*	0.308616*	−0.11677	0.224121	−0.47192*	0.185439	50% (1)

(continued)

Table 7.15 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
17	Retail	1	0.745316*	−0.08923	−0.47871	0.19118	−0.05549	0.739046*	100% (1)
18	Software	14	1.078166*	0.576633*	0.276454	0.004467	−0.18879	0.081776	50% (7)
19	Tech hardware	1	0.705834*	0.346958*	0.049864	−0.51603	0.304126	0.219612	None
20	Telecom	2	0.483485*	1.163047*	0.078628	−0.20967	0.070279	0.131134	100% (2)
21	Transportation	4	0.773678*	0.255814*	0.017648	0.230215	−0.19618	−0.0337	25% (1)
22	Utilities	7	0.829912*	0.470319*	0.372899	0.081005	−0.27127	−0.06669	58% (4)

*Significant at 5% level of significance; **significant at 10% level of significance; *LM* local market risk coefficient; *WM* = world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient, *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

Table 7.16 Foreign exchange exposure at aggregate industry level during pre-sub-prime crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.719288*	0.389199*	−0.32342*	−0.04341	0.549718*	−0.20724*	53% (9)
2	Banks	24	0.904376*	0.542991*	−0.38936*	−0.11515	0.103923	0.10821	63% (15)
3	Capital goods	45	0.751593*	0.435219*	−0.29407*	0.137134	−0.03507*	−0.01559*	47% (21)
4	Commercial and professional service	1	0.600024*	0.439683*	0.402755	−0.12819	−0.29644	−0.08822	None
5	Consumer durable	14	0.746283*	0.429083*	−0.03215	−0.05776	0.011786	−0.01168	43% (6)
6	Consumer services	4	0.528559*	0.315791	0.466481	−0.16484	0.431142	0.020916	50% (2)
7	Diversified financials	11	0.781599*	0.405716*	−0.0067	0.206422*	−0.16255**	−0.03357	19% (2)
8	Energy	12	0.893796*	0.492462*	−0.25626	−0.2001	−0.12916	0.147948**	59% (7)
9	Food and beverages	14	0.632927*	0.326857*	−0.42452*	−0.13602	0.00578	−0.01163	36% (5)
10	Healthcare equipments	2	0.570337*	0.316889*	−0.083	0.009243	−0.10464	0.074368	None
11	Household and personal	6	0.506415*	0.229989*	−0.03456	−0.27955*	0.18199	0.042101	17% (1)
12	Insurance	2	0.08771	−0.0527	0.492945	0.536009*	−0.77126*	0.178255	None
13	Materials	64	0.712346*	0.423798*	−0.26578*	0.048835	−0.0013	0.065641	47%(30)
14	Media	1	0.97788*	0.529507*	0.062996	−0.77093*	0.517013**	0.198071	100% (1)
15	Pharma	25	0.55102*	0.315009*	−0.03783	0.001121	0.03107	−0.04993	42% (10)
16	Real estate	2	−0.30638*	1.480454*	−0.59826	−0.92136*	−0.4975	1.511096*	None

(continued)

Table 7.16 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
17	Retail	1	0.453723*	0.15216*	0.326084	0.017183	−0.2349	0.001724	None
18	Software	14	0.678692*	0.374856*	0.04914	−0.06499	0.149614	−0.15061*	58% (8)
19	Tech hardware	1	0.534587*	0.40405*	0.106684	−0.04062	0.126909	−0.01746	None
20	Telecom	2	1.098923*	0.573136*	−0.45726	0.242163	−0.12892	0.203427	50% (1)
21	Transportation	4	0.570267*	0.308809*	0.101246	0.06507	−0.09266	−0.18692*	25% (1)
22	Utilities	7	0.870943*	0.554745*	−0.32359*	−0.22017**	0.014669	−0.06064	86% (6)

*Significant at 5% level of significance; **Significant at 10% level of significance; *LM* local market risk coefficient; *WM* world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient; *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

Table 7.17 Foreign exchange exposure at aggregate industry level during in-sub-prime crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.607182*	0.411612*	−0.0033	0.004797	−0.15916*	−0.11062**	65% (11)
2	Banks	24	0.923276*	0.619153*	−0.18033	−0.02365	−0.04834	−0.01926	42% (10)
3	Capital goods	45	0.763108*	0.497468*	−0.29953	−0.06598	−0.10474*	−0.03632*	52% (23)
4	Commercial and professional service	1	0.262743*	0.184197*	−0.56947*	0.116719	0.000768	−0.04437	100% (1)
5	Consumer durable	14	0.681588*	0.45514*	0.047729	−0.02711	−0.10653	−0.05781	50% (7)
6	Consumer services	4	0.72165*	0.478905*	−0.17316	0.070289	0.05323	−0.0764	25% (1)
7	Diversified financials	11	0.757052*	0.548788*	−0.31744**	−0.03653	−0.09832	0.061679	73% (8)
8	Energy	12	0.946603*	0.594553*	−0.13091	−0.06619	0.100651	0.003629	50% (6)
9	Food and beverages	14	0.542561*	0.382131*	0.051357	0.113985	−0.14201*	−0.12519**	50% (7)
10	Healthcare equipments	2	0.43842*	0.330195*	−0.05365	0.202137**	−0.12931	−0.16336**	100% (2)
11	Household and personal	6	0.322223*	0.190092*	0.232065*	−0.06061	−0.10014	−0.13915*	67% (4)
12	Insurance	2	0.64567*	0.486379*	−0.35042	0.079413	−0.18343	0.030872	50% (2)
13	Materials	64	0.700823*	0.467177*	0.02285	0.006518	−0.07896	−0.12902*	52% (33)
14	Media	1	0.747776*	0.436631*	−0.0018	0.018257	−0.06232	−0.24168	None
15	Pharma	25	0.485718*	0.359397*	0.032995	0.004388	−0.04319	−0.12129*	50% (12)
16	Real estate	2	1.504882*	0.946798*	0.321968	−0.25294	−0.07861	−0.02131	100% (2)

(continued)

Table 7.17 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
17	Retail	1	0.363014*	0.394155*	0.018714	0.118183	0.233823	−0.4214*	100% (1)
18	Software	14	0.678778*	0.423254*	0.144791	−0.1331	0.11728	−0.15441**	58% (8)
19	Tech hardware	1	0.408976*	0.390338*	−0.47433	0.151061	0.306017**	−0.11886	100% (1)
20	Telecom	2	0.869584*	0.543894*	−0.14854	0.00584	−0.03318	−0.09292	None
21	Transportation	4	0.51048*	0.312416*	−0.41467**	−0.18351	0.097645	0.09364	100% (4)
22	Utilities	7	0.882028*	0.627135*	−0.0332	0.028214	−0.11212	−0.02119	43% (3)

*Significant at 5% level of significance; **significant at 10% level of significance; *LM* local market risk coefficient; *WM* world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient; *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

Table 7.18 Foreign exchange exposure at aggregate industry level during post-sub-prime crisis

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
1	Automobile	17	0.756548*	0.4294*	−0.00913	−0.03888	0.029382	−0.07522*	53% (9)
2	Banks	24	1.081904*	0.487821*	−0.00386	−0.18008*	0.012931	−0.0132	46% (11)
3	Capital goods	45	0.777438*	0.457939*	−0.11163	−0.02897	−0.01369	−0.06189*	45% (20)
4	Commercial and professional service	1	0.273556*	0.281897*	−0.06031	0.044629	−0.02067	−0.06778	None
5	Consumer durable	14	0.77853*	0.434155*	−0.49738*	0.016093	0.137882	0.176944*	43% (6)
6	Consumer services	4	0.766012*	0.423871*	−0.00248	−0.0325	−0.12546	−0.02721	75% (3)
7	Diversified financials	11	0.930869*	0.630177*	−0.13619*	−0.06693	0.080679	0.010403	64% (7)
8	Energy	12	1.036065*	0.487041*	0.150662**	−0.09897	−0.04627	−0.08514**	50% (6)
9	Food and beverages	14	0.593174*	0.536966*	0.105847**	0.135931*	−0.18928*	−0.09742*	36% (5)
10	Healthcare equipments	2	0.447046*	0.267234*	−0.08463	−0.1678	0.099019	−0.16608	100% (2)
11	Household and personal	6	0.384812*	0.160049*	0.063613	0.073313	−0.08376	−0.05732	34% (2)
12	Insurance	2	0.749659*	0.351169*	−0.1273	−0.11712	−0.02302	0.008826	None
13	Materials	64	0.754896*	0.406918*	−0.11133**	−0.06531	0.063272	−0.02315	54% (34)
14	Media	1	0.745163*	0.378865	0.342458	0.249283	−0.5707	−0.07433	None
15	Pharma	25	0.578344*	0.270354*	−0.01553	0.016776	0.063899**	−0.04443	42% (10)
16	Real estate	2	1.425755*	0.651915*	−0.04119	−0.23917**	0.028796	−0.1043	50% (1)

(continued)

Table 7.18 (continued)

Sl. No.	Industry type	Total no. of firms under each industry	LM	WM	USD	EURO	GBP	YEN	No. and % of companies exposed to at least single currency
17	Retail	1	0.472921*	0.31312*	−0.20448	0.090506	−0.02165	0.031245	None
18	Software	14	0.724502*	0.398399*	0.196316*	0.002188	0.064424	−0.11125*	65% (9)
19	Tech hardware	1	0.484195*	0.40598*	−0.31548*	0.017182	0.163755	0.046881	100% (1)
20	Telecom	2	0.928362*	0.438256*	−0.11248	−0.24338*	0.254244**	0.017857	100% (2)
21	Transportation	4	0.626822*	0.382498*	−0.18026*	−0.03308	0.017663	−0.04612	75% (3)
22	Utilities	7	0.904368*	0.392259*	0.057494	0.096503	−0.17339	−0.02149	72% (5)

*Significant at 5% level of significance; **significant at 10% level of significance; *LM* local market risk coefficient; *WM* world market risk coefficient; *USD* USD exposure coefficient; *EURO* EURO exposure coefficient; *GBP* GBP exposure coefficient and *YEN* YEN exposure coefficient based on Eqs. 7.6 and 7.7

exposure to at least any one currency while the remaining 37% (8) industries (e.g. Commercial and Professional Service, Consumer Services, Healthcare Equipments, Household And Personal, Insurance, Media, Retail and Utilities) have no exposure at an aggregate level during the post- Sub-Prime crisis period. The firms belong to those industries, which failed to exhibit any significant exposure at an aggregate level, exposed to at least to a single currency and are ranging from 0 to 100%.

7.7.3 Discussions

Overall, evidence suggests that the magnitude of industry exposure is relatively large during both the crisis period, but the impact is larger during Sub-Prime crisis period as compare to Dot-Com crisis period. This result is in line with the outcome of the study by Allayannis (1997), who exhibited that US manufacturing industries at four digit (SIC) levels have significant exchange rate exposure. But the results also contradicts the findings of Bodnar and Gentry (1993), who finds that only few industries in Canada and Japan and only 9 out of 39 industries unveil significant foreign exchange rate exposure during the period 1979–1988. Majority of the Indian industries predominantly have negative currency exposure. The same (i.e. Negative exposure) is more during the Sub-Prime crisis period signifies deprecation of home currency is favourable. Moreover, firms with insignificant exposure are concentrated only in five industries namely, Healthcare Equipments, Insurance, Media, Real Estate and Tech Hardware around the Dot-Com crisis period while firms with insignificant exposure are concentrated in eight industries namely, Commercial and Professional Service, Healthcare Equipments, Insurance, Media, Real Estate, Retail, Tech Hardware and Telecom. These firms may relatively be less exposed to currency risk than other firms. The possible explanations of this insignificant exposure to exchange rate movements may be twofold. First, may be the extensive use of derivatives lead to this insignificant exposure at firm level (see for example, Allayannis and Ofek 2001; Geczy et al. 1997). The number of industries with insignificant exposure increased from Dot-Com crisis to Sub-Prime crisis also signifies the extensive use of derivatives. Lastly, few firms belong to these industries are domestic in nature which may also lead to no exchange rate exposure.

The above results once again identify the problem of aggregation across firms. In other words, it has been observed that quite a large number of industries across two different crises periods have no exposure from any of the four currencies at an aggregate level; while individual firms belong to the same industry are quite significantly exposed to at least one of the single currencies. The conceivable clarification for this is that those industries consist of reasonably heterogeneous firms and prominently affected by cancelling out effect at an aggregate level. This outcome helps to identify the nature of exposure, i.e. exposure is likely to be firm specific, and hence, it can be eliminated through diversification.

7.8 Conclusion

In one hand, globalization brings ample scope of development and prosperity to the emerging economy like India on the other the dark side of it is also very prominent. The openness of the economy, the global markets integration, contagion effect between international financial markets enhances the vulnerability of the Indian market in particular and economy in general. Financial crisis can be considered as one of the attribute of globalization. Thus, the present study has been initiated to examine how the nature and magnitude of foreign exchange exposure depends on the movements and particularly on the crises in the economy.

Overall, the results of this study provide enough evidence that exchange rate fluctuations affect firm value in Indian context which is in line with theory. Moreover, currency exposures are firm specific and have economically a huge influence on variations in average stock returns. These outcomes also help to reconcile the exposure literature with the international asset pricing literature in the sense that exposure varies across firms and industries. In addition to that exchange rate exposure on firms' value depends on nature of the crisis as the degree of exposure is comparatively less around the Dot-Com crisis period over the Sub-Prime crisis period. The policymakers also get a few useful insights from the results of this study. They may understand the nature and magnitude of currency exposure on certain sectors of the economy and how it changes across two different crisis periods. The results, thus provide potential information about currency exposure to the investors who willingly underweight or overweight large firms in their portfolios. The results of the study will not only be useful for the hedger and speculators in their decision-making processes, but also the managers can make use of the findings before hedging the foreign currency risk, specifically around the crisis periods.

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Appendix

See Tables 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.12, 7.13, 7.14, 7.15, 7.16, 7.17 and 7.18.

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Chapter 8
Agents' Behavior in Crisis: Can Quantum Decision Modeling Be a Better Answer?

Sudip Patra

8.1 Introduction

Globalization and integration of markets all over the world have brought out various challenges, and one among them is understanding and predicting investors behavior, mainly under the scenarios of ambiguity and uncertainty. With the rise of banking or financial crises which spread like contagion over the globe, there has been an unprecedented rise in the ambiguity context. Hence, in the modern age, agents basically find themselves riddled with ambiguity contexts every time. Again under such contexts neoclassical decision-making theory (expected utility theory, based on classical set theory and Boolean logic theory) fails remarkably to analyze the choices made by real agents, and it is here where we need a fundamentally new decision theory.

From the 1970s onwards, there have been a plethora of data sets provided by cognitive scientists (Haven and Khrennikov 2013) on failure of EUT or modifications of the same to explain some paradoxes/anomalies in behaviors of agents (mainly under ambiguity contexts), since such anomalies defies some basic rules of the underlying mathematical model, namely the measure theory of set (Haven and Khrennikov 2013). Such paradoxes have been given different names, for example, order effects, disjunction, and conjunction effects,[1] failure of sure thing principle, Dutch book effect, etc., and again it has also been observed that under such ambiguous contexts real behavioral data does not fit well with the most basic

[1]All of these terms are related to some violations of basic probability axioms, for example, in case of order effects P(A & B) is not equal to P(B & A), or in other effects P(A & B) > P(A or B), and so on, which are clear violations of classical probability theory.

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formula/law[2] of total probability (more on this later). Another important fact is that the Bayesian learning models which are based on classical measure theory again are at times inapt to describe the change/updation in agents belief states. For example, there is a famous/infamous zero prior trap in the Bayesian probability modeling which does not allow updation of a large posterior from a zero prior/a non-informative prior, and however, in financial markets mainly in crisis context, we normally witness such discontinuous jumps in belief states. All of these paradoxes/anomalies can be easily resolved if a new decision theory is implemented, where QDT can play a critical role.

Here, one important point is that QDT is not an equivalent of another closely related paradigm of Econophysics (Chakravorty, 2012). The latter is based on statistical mechanics models, for example, power law distribution representations of financial asset prices. QDT is rather more focused on cognitive modeling of agents, though certainly there is a strong aspect of mathematical modeling of asset markets based on quantum field theory tools (Basieva et al. 2014). Recently the new paradigm of quantum modelling in social sceince has been championed by authors like Aerts et al. (2016), Khrennikov and Haven (2009), Pothos and Busemeyer (2013), Haven and Sozzo (2016) and alike.

One possible example:

Another area in which QDT is likely to play an important role is asset misevaluation theory, which means how the diversity of opinions in an uncertain market might make the market price deviate widely from the fundamental value. Such deviations are drivers of bubbles and crashes.

The standard literature on asset misevaluation, i.e., the deviation of the asset price from the fundamental value (which is the present value of future expected dividends/cash flows), is mainly based on Bayesian probability setup. There is a very good exposition of the same in the models developed by Samuelson, to Shliefer and Vishney (Thaler 2005). The latter authors have summarized the literature of asset over or undervaluation as per the behavioral finance theory. Behavioral finance mainly models asset price misevaluations from the perspective of different biases in the investors mind, for example, overconfidence and herd behavior (a strand of literature developed initially by Shiller) generating speculative bubbles, which make the asset prices remain deviated from the fundamentals overran elongated period of time (as was shown by Shiller in his seminal model of 1983).

However, the main shortcoming of the behavioral models is that it is inapt in describing the ambiguity or uncertainty which the investors face in speculative asset markets. For example, in the well-known model of Shleifer and Vishney, the investors who are biased in their judgment of the underlying value of the asset in question, update their beliefs according to Bayesian rule, which helps the investors to form beliefs in which of the two regimes (the model is a two-regime model,

[2]LTP or the law of total probability is the most basic outcome of set-theoretic probability model which is always in use in any Bayesian model, however, in the context of uncertainties real data shows violations of such formulas with interesting terms known as interference terms which are more common in quantum physics.

where in one regime there is no upward trend in earnings, and in the other regime there is a positive upward trend in earnings) they are in. Such beliefs are again reflected in the asset prices, which make the prices deviate from the true value which is generally assumed as to be following a random walk.

However, again there are some formidable limitations of this model, or of this type of models. One, uncertainty is better described by quantum probability formulation (superposition principle, and measurements by operators for belief updates and probability calculations), and two, the modified law of total probability (for example, what is the probability that the investors are in regime 1 or regime 2 in this type of model) generates interference terms (which in principle are measurable from visible market price data) which can be used to explain market movements better.[3]

For example in the very setup, if uncertainty or ambiguity is about which specific regime the investor is in, then instead of a Bayesian formulation, we can use first of all a superposition formulation of the investors belief state (for example, a QUBIT or more complex), and then model how the belief state gets updated based when operated on by a suitable POVM (positive operators in general, which play the role of observables in any quantum model) operator (certainly here the challenge is to formulate a good operator, for example, recently creation and annihilation operators are used in modeling asset market scenarios). Mathematically, we can use trace formulation for the probability measures, and updating. We can derive the modified LTP (law of total probability) from such formulation (Basieva and Khrennikov 2017), where the interference term itself may determine whether there might be over or undervaluation of the asset prices. Interference terms are extra terms which appear in the LTP formula if the basic probability modeling is based on quantum rules (projection principle/in other words Hilbert space formulation), such interference terms are missing from the standard classical probability formulation (Pothos and Busemeyer 2009).

Here, the operator approach is motivated by the widely used operator formalism in quantum field theory, where creation operators are used to depict particle/antiparticle creation in a vacuum state for example, and the annihilation operator has the role of destroying the same. Such operators follow some important commutation rules. POVM operators are more general positive-valued operators, Hermitian operators are a special class of POVM operators.

Though there have been many studies in behavioral finance which have attempted to describe under or overvaluation of asset prices in markets under uncertainty, such models cannot predict with considerable precision of such movements. Again more fundamentally, the uncertainty description of standard models either falls back on the Kolgomorovian probability theory, or on heuristics.

[3]One of the main limitations of neoclassical finance modeling has been the ambiguity in defining uncertainty, a common ensemble representation may not work well, and the superposition representation is fundamentally different from ensemble view. More generally in quantum-like models, states are described by density matrices which are weighted averages of individual pure states.

Here, is the fundamental difference with the QP setup since uncertainty is described here by superposition of states and probability measures are non-Kolgomorovian.

The current chapter is subdivided into the following sections: emphasis is on formulating a basic model of investors' or agents belief update behavior under the context of uncertainty in the financial markets, which is very much the case during any global crisis like the last 2007–09 global financial crisis, there is also some suggestions or a basic model guideline on how the belief updations during ambiguity or uncertainty can be better modeled by using the projection rule approach of the quantum theory, which would help to avoid the zero prior problem inherent in the Bayesian updating model.

8.1.1 Classical Probability Theory and Its Failures

The history of classical probability theory can be traced back to Boole (Haven and Khrennikov 2013), who was the first logician to attempt to capture the human cognition rules, or the underlying logical or mathematical operations upon which the human decision-making is grounded. Such operations are very basic union, interaction, and distributive operations.

Here, it is also better to observe that based on the standard Boolean operations the renowned theoretical physicist John Bell (Bell) introduced the now famous Bell inequalities. The philosophy behind such inequalities is that if such inequalities are violated then the underlying logic of any decision-making based on which such violations have been achieved cannot be based on classical logic/probability theory. There have been many so-called loop hole-free test of Bells inequality, which has predicted such violations in physical systems.

Coming back to the human cognition/decision-making, in general, there have been some studies on the violation of Bell-type inequalities too (Pothos and Busemeyer 2009), which is also a strong signal that human decision-making is not based on classical logic structure.

Now, the classical probability theory, in various forms, can be summarized in the work of Kolgomorov (1933 as cited in Haven and Khrennikov 2013), which is now called as the set theory of probability or measure theory of probability. However, the basic theory is based on the classical Boolean logic as briefly discussed above. The expected utility theory, which is the basis of decision-making models in economic science is based on the measure theory. This model, or any variant of this model, for example, bounded rationality theory predicts human decision-making under given contexts. Later Savage's formulation of the expected utility model has been achieved on this line of thinking. From 1960s onwards (E), there have been a plethora of real decision-making data which demonstrates a significant deviation from the predictions of the standard theory, and also produces many paradoxes which are implausible under classical decision theory. Such paradoxes have been named as order effects, failure of sure thing principle, conjunction and disjunction fallacies, Dutch book effects, etc. (Basieva et al. 2014). All of these paradoxes actually shows

that decision-making under uncertainty context is least understood via the classical theory. Hence coming back to financial markets, mainly under the uncertainty contexts (Haven and Sozzo 2016), there have been always less consensus among the modelers on the predictions of such standard, or even behavioral finance models. For example, the behavior of investors in the context of the wide divergence of opinions of agents (which is measured by the divergence of analyst forecasts for example, as in Chatterjee et al. 2011)[4] is ill explained by standard economic models.

It is in such contexts where the alternative quantum decision theory or quantum probabilistic model emerges as more effective predictions of behavior.

8.1.2 Bayesian Probability Updating and Its Limitations

Another very strong offshoot of the classical probability theory is the Bayesian probability theory, or more specifically the Bayesian probability updating rule. There is a huge literature on the application of the BPU in various spheres, for example, in human cognition, in general, in economic theory and financial models of information updating and asset pricing (Basieva et al. 2017).

The BPU is used so extensively that it is taken as to be the standard way in which human decision makers update their beliefs or probabilities which they would assign on some events. Here, certainly the concept of probability is a subjective concept, more specifically it is the personal degree of beliefs on the future events which might occur.

However, there are fundamental limitations of BPU, one is as known as the zero prior trap (Basieva et al. 2017). According to this problem/limitation, it is impossible to update the posterior beliefs or probabilities for any event/hypothesis if the prior belief or say prior probability for such an event to occur/hypothesis to turn true is 0 (the same goes with the prior 1). Which also means that it is nearly impossible to update beliefs starting from a very low or non-informative prior.

One possible way to circumvent the problem is using the so-called Cromwell's rule (Basieva et al. 2017), which prescribes in avoiding using 0 or 1 priors altogether while formulating an updating model.

However if we turn to various managerial situations, for example, belief updating while the atmosphere is ambiguous, or decision-making during uncertain scenarios, or more specifically decision-making regarding disruptive technologies, modeling has to be based on the plausibility of updating belief states from zero or 1 priors, or at least non-informative priors.

Hence, under such scenarios BPU, which is an offshoot of Kolgomorovian theory which is again grounded in the Boolean logic, will naturally fail. Hence,

[4]Chatterjee et al. (op cit), for example, build a model where under uncertainty asset prices are rather inflated, which again goes against the earlier studies like by Miller (1977) who suggested the opposite. Hence in standard finance literature, there is hardly any consensus regarding asset prices under uncertainty.

below we describe the QPU which can bypass the updating problem. There are recent studies also which demonstrate the applicability of QPU instead of BPU in case of cognitive decision-making under uncertainty.

8.1.3 Expected Utility Theory and Its Limitations

EUT has been since the works of Savage and others the standard utility modeling. This theory is so much successful in general that the whole of neoclassical economic modeling is based on the applicability of the EUT. However, deep down the very theory is based on the deep axioms of classical probability theory.

One specific axiom is the so-called sure thing principle. Savage originally formalized the principle, and the whole EUT is based on the very principle. Sure thing principle is actually quite simple to follow, and the crux of the same is similar to the irrelevance irrelevant options while making decisions. For example, if Bob is asked whether he will buy a house if the presidential candidate A wins, and the answer is yes, and the answer remains yes even if candidate B wins, then Bob is indifferent to the both the candidates' win, and hence if he does not have any information on the win he should atill choose buy option.

However, there is a strong evidence since Kahneman that sure thing principle is regularly violated under uncertain contexts, for example, if Bob is under an ambiguity scenario regarding the wins then he might behave not according to the sure thing principle at all. The same violation of SUP (sure thing principle) is also observed in case of experimental data in prisoners dilemma scenarios, the famous game theory scenario of cooperation failure (Haven and Khrennikov 2013). In case of prisoners dilemma situation, there is a clear dominant strategy for each player, which they should play irrespective of what the other player chooses. However, there is a very strong experimental evidence that under conditions of ambiguity or uncertainty the behavior of players may not coincide with the prescribed Nash equilibrium.

8.1.4 Advent of Quantum Decision Theory

Before we have a brief exposition of the alternative probabilistic regime, i.e., the QP (quantum probability) regime its better to remind ourselves that quantum decision theory approach is not new. To begin with, one of the founding father of QM (quantum mechanics), Neils Bohr, treated QM as a potential human cognition theory (Bohr). Later David Deutsch attempted to derive quantum probabilistic rule, the celebrated, Born's square of the amplitude rule, from a general decision theory framework.[5]

[5]Here again, there is a parallel literature of quantum brain but we are at best agnostic about such a theory in this paper.

Later, we have observed many allied paradigms, for example, the QBISM (Quantum Baeysianism, which is an emerging paradigm of interpreting quantum theory results in terms of Beysian probability updates, hence providing a subjective probability interpretation to quantum mechanical probabilities obtained by Born's rule.) which attempts to conceptualize quantum probabilities as the personal degree of beliefs, hence attempts to establish a compatibility between QPU and BPU. Then there is contextual probability decision theory, which is also named as the Vaxjo representation (Haven and Khrennikov 2017).

8.1.5 Brief Introduction to Quantum Probability Modeling

QP theory, or quantum theory, which is the mathematical setup for the most successful scientific theory, QM, is basically a non-classical logic-based theory. More specifically, here the states of a system (whether physical, or in our case, the belief states of agents for example) is considered as to be a superposition of basis states, which are represented by the vectors in either finite D or infinite D Hilbert space. Hilbert space is a general complex vector space, endowed with some mathematical properties, which are as follows. State space is a complex linear vector space: Hilbert space, which can be finite/infinite dimensional. Generally symbolized as H, which in general is a complex space, but for economic science purpose, we may think of the real subspace. Some of the basic properties of such a space are as follows:

1. H is endowed with a scalar product (positive definite), norm, and an orthonormal basis, nondegenerate or degenerate, for basic modeling the latter is not chosen always, but for more comprehensive analysis such extension can be made, for example when the operators on H are simple positive operators, rather than the special class of Hermitian operators.
2. Any state can be visualized as a ray in this space, hence giving a relativlely better geometirc representation as compared to classical probability theory/CPT.
3. Superposition principle: Let the state space of some system (physical or cognitive) be represented by finite-dimensional Hilbert space H. Consider the pure state ψ[6] and the observable A, denote its eigenvalues by a1, …, am and the corresponding eigenvectors by e1, …, em. This is an orthonormal basis in H. (We again proceed under the assumption that spectrum is nondegenerate.) We expand the vector ψ with respect to this basis: $\psi = c1e1 + \cdots + cm\ em$, where (cj) are complex numbers such that the sum of their squared absolute values

[6]Ψ has a huge history in Physics, Mathematics, and Philosophy, for example, does it represent any physical state? Does it represent our state of knowledge about the world? Does it represent probability wave? It is still debated with zeal, and it is up to the readers to ponder upon which view to take while thinking in terms of economic or financial modeling. The current tendency though is to regard the wave function as just a state of the system which has an information theory perspective.

equals one (this is the coordinate expression of the normalization by one of a pure state vector): |c1|^2 + ⋯ + |cm|^2 = 1. By using the terminology of linear algebra, we say that the pure state ψ is a superposition of pure states ej. The density matrix corresponding to ψ has the elements ρij = cic*j. Hence, for the pure state ψ, the basic probabilistic postulate of quantum mechanics, (2), has the form: p(ej) = ρjj = cj c*j = |cj|^2.

4. Measurement: most of the times, projection postulate is used, which is nothing but the so-called collapse of the superposed state into a specific eigenvalue. This postulate is known as Born's postulate in Quantum Physics.
5. Measurement implies projection onto a specific Eigen subspace.
6. Probability measurement and updation follow from the collapse postulate. Hence, one can visualize basic quantum modeling as a prescription or set of rules, which gives probabilities of collapsing of the initial superposed state into one of its Eigenvalues. In decision-making models, or cognitive models, the initial belief state of agents are considered to be represented by such rays in H, which may be in a pure superposition state (for example, agents in a superposition state of belief of some asset prices going up or down), however whenever the agent faces some questions regarding the belief there can be a collapse of the initial state to one specific Eigen state. Such questions/observables are given operator representations in quantum modeling, in most of the cases such operators are Hermitian operators/self-adjoint operators (which means that the operator is = the transposed complex conjugate of itself, there are matrix representations of such operators as $n \times n$ square matrices).
7. Non-Boolean logic is thus inherent in the quantum probability modeling, which can also be perceived as the main reason for different results in both these theories (Haven and Khrennikov 2017).

QDT is again based on non-Boolean logic as opposed to CPT (classical probability theory), the basic tenets are as follows;

1. Algebra of events is prescribed by quantum logic
2. Events form an event ring R, possessing two binary operations, addition and conjunction
3. P(A ∪ B) = P(B ∪ A) (Boolean logic)
4. P{A ∪ (B ∪ C)} = P{(A ∪ B) ∪ (A ∪ C)} (associative)
5. A ∪ A = A (idempotency)
6. P(A and B) not = P(B and A) (noncommutativity, incompatible variables)
7. A and (B ∪ C) not = (A and B) ∪ (A and C) (no distributivity)
8. The fact that distributivity is absent in quantum logic was emphasized by Birkhoff and von Neumann. Suppose there are two events B1 and B2 that, when combined, form unity, B1 ∪ B2 = 1. Moreover, B1 and B2 are such that each of them is orthogonal to a nontrivial event A not = 0, hence A ∩ B1 = A ∩ B2 = 0. According to this definition, A ∩ (B1 ∪ B2) = A ∩ 1 = A. But if the property of distributivity was true, then one would get (A ∩ B1) ∪ (A ∩ B2) = 0. This implies that A = 0, which contradicts the assumption that A not = 0.

The crux of the QDT theory is that the system remains in the superposition state (for example, the agents remaining in the superposition of belief states, which can again be described aptly by a density matrix representation, which is one of the most important tools in quantum theory for representing probabilities, pure and mixed states.), till any measurement of the state is done. Once the measurement is done then the standard view is (the Copenhagen view, its so called since the founding members of Quantum Mechanics, well a majority of them adopted such a view of reality in conferences held at the same place.) that the superposition state collapses to a single state which is what the decision maker, for example, realizes in the real world.

Certainly, there is a huge no. of alternative interpretations of QP, which we do not discuss in the current paper. These are often known as the foundation questions in quantum theory (Aerts and Sozzo 2016).[7]

The next step then is to calculate what is the probability that the superposed state collapses into one final state (technically this is often known as to be the wave function collapse or the state vector reduction). In decision theory terms, this might mean what is the probability that the decision maker will update her belief state?

Hence ,as we see that QP theory is a recipe for measuring such probabilities, and also a recipe for updating the agents' belief states. Here, the celebrated rule for measuring such probabilities is the Born's square of the amplitude rule, which can be formulated in different representations, as shown below (one is the standard wave function representation and the other is the so-called trace formulation).

The following subsection lays down the basic formulation of decision-making based on quantum probabilistic framework.

8.1.6 QP (Quantum Probabilistic) Formulation as an Alternative to EUT: Various Paradoxes Resolved

As we have very briefly seen in the above sections, EUT does not describe faithfully the agents' behavior under ambiguity or uncertainty. Let us briefly explore the paradoxes which have arisen in decision-making in ambiguity scenarios, and how QP/QDT have been able to resolve most of the paradoxes. It is this practical application of the QDT which has made it a suitable alternative candidate to understand human decision-making.

[7]There are many approaches to understand the thorny 'measurement' problem in QM, for example: wavefunction collapse view, hidden variables view, many worldview, ontic versus epistemic status of the wave function view, quantum versus classical logic view, etc.

8.1.7 Contextual Probability and Violations of Bell Type Inequalities

One of the signature results of QP measure is the so-called interference terms, which are present in the probability measures. To simplify let us again consider the BPU formula: Here, we see that the denominator has the summation expression, which is also called as the total probability, or the so-called law of total probability, LTP from now onwards. However, if the same measurement of total probability is done using the QP rule/the Born's rule as shown earlier then it can be demonstrated (Khrennikov 2015) that there is a fundamental change in the expression of LTP, and that expression contains some interference or product terms, as shown below:

Khrennikov (2015) has shown in different papers that the interference or the perturbation term is the term which differentiates between quantum and classical probability measure, and such terms are based on the contextual probability concepts. In terms of a physical theory, we can go back to the most celebrated quantum experiment, the so-called, double slit experiment (often quoted by Feynman, there are many references of this, for example in famous Feynman lectures, to the path breaking text by Feynman and Hibbs on Path integral method.) in double slit experiment the probability that one electron/a particle hits the screen behind the two slits at a particular position, is calculated based on the Born's principle. Here again, the LTP in a classical sense fails, since there are additional perturbation terms. Surprisingly these additional interference or perturbation terms appear in human cognition experiments, mainly, while describing human choice under ambiguity or uncertainty (Haven and Khernnikov, 2013).

There have been many interpretations of this experimental result, however from the perspective of the decision theory, one can take the view that the perturbation term is the result of incompatible contexts, for example, three contexts in the experiment, one when the first slit is open, two when the second slit is open, and three when both slits are open, are incompatible with each other. This point is critical since in the case of financial decision-making there are many such circumstances which are incompatible with each other.

Bruza and Busemeyer (2014) were among the first to formalize cognitive modeling based on quantum probabilistic framework, where the main objective is assigning probabilities to events. Space of belief is a finite-dimensional Hilbert space H, which is spanned by an appropriate set of basis vectors. Observables are represented by operators (positive operators/Hermitian operators) which need not commute, [A, B] = AB − BA = 0, where A and B are two linear positive operators. Generally, any initial belief state is represented by density matrix/operator, outer product of ψ with itself $\rho = |\psi\rangle \langle\psi|$, this is a more effective representation since it captures the ensemble of beliefs. Cognitive states can be pure states, or, mixed states. Both types of states can be formalized by density matrices representation. Mixed states: $\rho = \sum w |\psi\rangle \langle\psi|$, which is nothing but a classical ensemble of pure states, with proper weightages, w. Some properties of ρ: $\rho = (\rho^*)T$, for pure states $\rho = \rho\text{^}2$ this property is used to check whether the state is pure or mixed, a mixed

state can be thought as an ensemble of pure states where each pure state is a superposition of basis states, like 0 or 1 bits, $(\psi\rho\psi) > 0$: positivity, Trace $\rho = 1$.

Measuring the probability of choosing one of the given alternatives, is represented by the action of an operator on the initial belief state. While making decision, superposition state collapses to one single state (can be captured by the Eigenvalue equation) Observables in QPT represented by Hermitian operators, which are specifically self-adjoint; A = (A*)^T. E(A) = Tr(A ρ), every time measurement is done one of the Eigenvalues of the A is realized. $A = \sum aP$, which is the spectral decomposition rule: a's are the Eigenvalues and P's are the respective projectors which projects the initial state to the Eigen subspace specifically for measuring the probabilities on which we can use the Trace formulae: Trace formula: p(ai) = Tr(Pi ρ). however, as soon as the measurement is done the state of the decision maker, in this case, updates toρ': Pi ρPi/Tr(Pi ρ), this is the simultaneous updation of the agents' belief state.

8.2 Basic Modeling of Belief States of Agents

However, the scenario can be simplified by writing a pure state $\psi\rangle$, which can be thought of as composed of two basis states, say $0\rangle$, and $1\rangle$, such that **<ψ> = c1* <0>+c2* <1>**

Now such a state is commonly called as a qubit, here 0 and 1 state can be two decision states based on two incompatible criterion, and the presence of such incompatible criteria creates the fundamental uncertainty in the decision-making process/in the mind of the decision maker. Such superposition is unthinkable in classical ensemble representation, where we would like to simply give weightages to each supply selection criterion. However, such an ensemble representation fails to capture the uncertainty in decision-making, as has been argued earlier in the paper.

Then certainly we can use the operator and Trace[8] formulation as discussed above to measure the probabilities that ultimately 0 or 1 will be chosen.

Here choice is based on the action of an operator on $\boldsymbol{\psi}\rangle$, such an operator in case of cognitive modeling is analogous to a question being asked to the decision maker given the specific information context, once the decision maker answers the question the initial state reduces/collapse to either 0 or 1, and simultaneously the belief state updates according to the trace formula.

Again in the context of supplier selection, we can imagine the decision maker being asked questions on which selection criteria to adopt given the information set available. Such decision then (as shown in the earlier sections) collapses the state $\psi\rangle$ into either of the basis states, and also simultaneously updates the belief state of the decision maker, which again can be transformed using the same trace formulation when new information set is available.

[8]Trace simple means summation of the diagonal elements of the matrix in question.

There are at least three advantages of using this formulation, namely, one, capturing the so-called order effect, two, capturing the modified LTP with interference terms, and three explaining non-Bayesian probability updates. The following passages provide such formulations.

Such effects are quite critical in case of a complex decision-making like supplier selection, since, one, there are inbuilt uncertainties, two, there are incompatible contexts like incompatible selection criteria, three, there can be important order effects which implies that probability of choosing one criterion over the other significantly might change due to the sequence of actions performed by the decision maker. Such effects are elaborated below.

1. Order effects
   As mentioned above, to capture the operator acting on the initial belief state of the manager/decision maker we use the most general type of operator, positive linear operators. A positive operator valued measure (POVM) is a family of positive operators {Mj} such that Pm j = 1 $\sum$Mj = I, where I is the unit operator. It is convenient to use the following representation of POVMs:

$$\mathbf{Mj} = \mathbf{V}*_{\mathbf{j}}\mathbf{V}_{\mathbf{j}},$$

   where **Vj: H** $\rightarrow$ **H** are linear operators. A POVM can be considered as a random observable. Take any set of labels α1, …, αm, e.g., for m = 2, α1 = yes, α2 = no. Then, the corresponding observable takes these values (for systems in the state ρ) with the probabilities p(αj) $\equiv$ pρ(αj) = TrρMj.
   We are also interested in the post-measurement states. Let the state ρ was given, a generalized observable was measured and the value αj was obtained. Then, the output state after this measurement has the following form:

$$\boldsymbol{\rho}\mathbf{j} = \mathbf{Vj}\boldsymbol{\rho}\mathbf{V} * \mathbf{j}/(\mathbf{TrVj}\boldsymbol{\rho}\mathbf{V} * \mathbf{j})$$

   Both order effects and interference terms in LTP can be demonstrated using POVM.
   Consider two generalized observables a and b corresponding to POVMs Ma = {V*j Vj} and Mb = {W*j Wj}, where Vj $\equiv$ V(αj) and Wj = W(βj) correspond to the values αj and βj. If there is given the state ρ the probabilities of observations of values αj and βj have the following form:

$$\begin{aligned}\mathbf{pa}(\boldsymbol{\alpha}) &= \mathbf{Tr}\rho\mathbf{Ma}(\boldsymbol{\alpha}) = \mathbf{TrV}(\boldsymbol{\alpha})\boldsymbol{\rho}\mathbf{V} * (\boldsymbol{\alpha}), \mathbf{p}(\boldsymbol{\beta}) = \mathbf{Tr}\rho\mathbf{Mb}(\boldsymbol{\beta}) \\ &= \mathbf{TrW}(\boldsymbol{\beta})\boldsymbol{\rho}\mathbf{W} * (\boldsymbol{\beta}).\end{aligned}$$

   Now, we consider two consecutive measurements: first the a-measurement and then the b-measurement. If in the first measurement the value a = α was obtained, then the initial state ρ was transformed into the state

$$\boldsymbol{\rho a\alpha} = \mathbf{V}(\boldsymbol{\alpha})\boldsymbol{\rho}\mathbf{V} * (\boldsymbol{\alpha})/(\mathbf{Tr}\mathbf{V}(\boldsymbol{\alpha})\boldsymbol{\rho}\mathbf{V} * (\boldsymbol{\alpha}))$$

For the consecutive b-measurement, the probability to obtain the value b = β is given by

$$p(\beta|\alpha) = \mathrm{Tr}\rho a(\alpha)\mathrm{Mb}(\beta) = \mathbf{TrW}(\boldsymbol{\beta})\mathbf{V}(\boldsymbol{\alpha})\rho\mathbf{V} * (\boldsymbol{\alpha})\mathbf{W} * (\boldsymbol{\beta})/(\mathbf{TrV}(\boldsymbol{\alpha})\rho\mathbf{V} * (\boldsymbol{\alpha}))$$

This is the conditional probability to obtain the result b = β under the condition of the result a = α. We set p(α, β) = pa(α)p(β|α).

Now since operators need not commute p(α, β) not = p(β, α)

This formulation is quite important in supply chain context, since there can always be consecutive measurements, for example, choosing first the risk criteria and then choosing which supplier to select, or the other way round.

2. Violation of LTP: We recall that, for two classical random variables a and b which can be represented in the Kolmogorov (1933) measure-theoretic approach, the formula of total probability (FTP) has the form pb(β) = ∑pa(α)p(β|α). Further, we restrict our consideration to the case of dichotomous variables, α = α1, α2 and β = β1, β2.

FTP with the interference term for in general non-pure states given by density operators and generalized quantum observables given by two (dichotomous) PVOMs:

$$\mathbf{pb}(\boldsymbol{\beta}) = \mathbf{pa}(\boldsymbol{\alpha 1})\mathbf{p}(\boldsymbol{\beta}|\boldsymbol{\alpha 1}) + \mathbf{pa}(\boldsymbol{\alpha 2})\mathbf{p}(\boldsymbol{\beta}|\boldsymbol{\alpha 2}) + 2\lambda\sqrt{\{\mathbf{pa}(\boldsymbol{\alpha 1})\mathbf{p}(\boldsymbol{\beta}|\boldsymbol{\alpha 1})\mathbf{pa}(\boldsymbol{\alpha 2})\mathbf{p}(\boldsymbol{\beta}|\boldsymbol{\alpha 2})\}},$$

or by using ordered joint probabilities **pb(β) = p(α1, β) + p(α2, β) + 2λ√p(α1, β)p(α2, β).** Here, the coefficient of interference λ has the following form: **λ = Trρ{W*(β)V*(αi)V(αi)W(β) − V*(αi)W*(β)W(β)V(αi)}/2√pa(α1)p(β|α1) pa(α2)p(β|α2)** Introduce the parameters

$$\begin{aligned}\gamma\alpha\beta &= \mathbf{Tr}\rho\mathbf{W} * (\boldsymbol{\beta})\mathbf{V} * (\boldsymbol{\alpha})\mathbf{V}(\boldsymbol{\alpha})\mathbf{W}(\boldsymbol{\beta})/(\mathbf{Tr}\rho\mathbf{V} * (\boldsymbol{\alpha})\mathbf{W} * (\boldsymbol{\beta})\mathbf{W}(\boldsymbol{\beta})\mathbf{V}(\boldsymbol{\alpha})) \\ &= \mathbf{p}(\boldsymbol{\beta}, \boldsymbol{\alpha})/\mathbf{p}(\boldsymbol{\alpha}, \boldsymbol{\beta})\end{aligned}$$

This parameter is equal to the ratio of the ordered joint probabilities of the same outcome, but in the different order, namely, "b then a" or "a then b". Then,

$$\begin{aligned}\textbf{Interference term } \boldsymbol{\lambda} = 1/2\{&\sqrt{(\mathbf{p}(\boldsymbol{\alpha 1}, \boldsymbol{\beta})/\mathbf{p}(\boldsymbol{\alpha 2}, \boldsymbol{\beta}) * (\gamma\boldsymbol{\alpha 1\beta} \\ &- \mathbf{1}) + \sqrt{(\mathbf{p}(\boldsymbol{\alpha 2}, \boldsymbol{\beta})/\mathbf{p}(\boldsymbol{\alpha 1}, \boldsymbol{\beta}) * (\gamma\boldsymbol{\alpha 2\beta} - \mathbf{1})}\end{aligned}$$

In principle, this coefficient can be larger than one. Hence, it cannot be represented as λ = cos θ for some angle ("phase") θ, cf. However, if POVMs Ma and Mb are, in fact, spectral decompositions of Hermitian operators, then the coefficients of interference are always less than one, i.e., one can find phases θ. The interference term can thus be both trigonometric and hyperbolic, which actually makes human decision-making under uncertainty more complex than

found in the application in quantum physics. There is a very good scope of extending this analysis in understanding deviations of stock or asset prices from fundamental values, for example when there is a constructive interference term we get inflationary pressure on prices and vice versa.

In the investor behaviour context, we can imagine the random variables, a and b (which may or may not be dichotomous) as two separate questions regarding investing in a specific asset, and the above formulation demonstrate that when the order of the questions are reversed, or when such questions are incompatible with each other interesting effects are generated which cannot be captured via the classical probabilistic modeling. Such order effects can be more prevalent during crisis periods with greater ambiguity or uncertainty.[9]

8.2.1 Use of POVM (Positive Operator Value Method) Operators

Use of POVM in supplier selection when there is noise in the ambience: an example

Earlier, we have presented a very brief introduction to the POVM approach which helps in realizing some general results in decision-making. However, more specifically, in a decision-making process like supplier selection, there can be inherent noise. Yearsley (2017) has provided a brief yet comprehensive discussion of various types of noises/errors which may creep into experimental design for decision-making. Here, mainly two types of errors can be present while making decisions on supplier selection, one, when the manager is under time pressure and commits error while final decision, which means though he/she may have a definite belief state the final choice may not reflect the same, and two, there can be too lengthy choice criteria which make the manager to choose wrongly even if the manager has a definite belief state in principle.

The scenario can be well represented by two choice criteria, say A and B, hence some decision makers who have a definite belief state of preferring A over B may still choose B instead of A due to the noise in experimental design. Again to model such a scenario, it is simply not possible to use projection operators, say Pa for collapsing the decision state to A, and Pb for collapsing the decision state to B. Hence, we need some more general positive operator representing the decision-making so that even if the belief state is that A is the right criteria there still will remain some small probability of choosing B.

Technically such operators can be simply positive operators. Say Ea is the operator associated with the belief state that A is the correct decision criterion, then the operation of Ea on $a\rangle$ can be captured as, $\langle A, Ea, A\rangle = 1 - \varepsilon$, and $\langle B, Ea,$

[9]This approach has been developed by Khrennikov in several of his studies, and is known now as the Vaxjo interpretation of QDT.

$B\rangle = \varepsilon$, with $0 < \varepsilon < 1$, or in other words, ε is the error probability in the decision model. A similar representation can be given for state B, again since A and B are orthonormal states, $\langle A, Ea, B\rangle = 0$, etc.

Here, we would like to make another couple of observations which may explain why POVM can be apt for different financial market scenarios. The first such property is that POVM lacks unique realization, which means that the same positive operator (like Ea) can be generated from different sets of underlying measurement operators which are related by Unitary transformations (Yearsley 2017). Such a set up can be quite helpful in describing different belief states which is equivalently described by the same positive operator. It also means that the final belief state after the measurement is different if the underlying measurement operators are unitary transforms of each other, even if the positive operator corresponding to them is the same. This in practice may mean that even if the final choice (say between A or B) is the same under these scenarios, the belief states supporting such final choices are different. We think such a set up actually broadens the decision-making modeling in general more specifically in case of decision making under uncertainty in financial markets (where just to remind ourselves, uncertainty is not equal to a risky situation modelled by probability distributions, but a superposition of different possibilities or beliefs, this is also the fundamental difference between quantum modelling and classical decison theory models.) there can be various interesting features, like order effects, noise in the decision making, conjunction effects etc. which can hardly be captured by traditional modelling.

Second, Yearsley (2017), Busemeyer et al. (2015) among others have also noted that positive operators can be a good choice for describing decisions when the decision responses can outnumber the basis elements of the decision-making space (here the finite dimensional Hilbert space). Which again means that such operators can be apt for describing the so-called unsharp measurements, where even if the orthonormal basis states are A and B, the choice responses can also comprise answers like 'may be'. In such cases, first we construct projector operators and then normalize them to generate positive operators which can help us measure the probabilities of choosing 'maybe' type options.

Third, many times qualitative or mixed studies in financial economics is very frequently done with Likert scale like experimental designs. There is a very good compatibility between POVM operator method and such scales.

8.2.2 Non-Bayesian Updates in Belief States

Basieva et al. (2017) have shown that Bayesian updating may not explain agents decision-making under extreme conditions, like uncertainty. For example, if the initial description of the world states available to the agents does not contain any event due to the seeming implausibility of it, then according to standard Bayesian updating scheme it is simply not possible to have a positive posterior probability about such an event, this is termed as zero prior trap.

However, in the scenario of high uncertainty, for example, stock market crisis, there can always be updating in belief states based on surprises. Such an update can be explained easily with the help of projection postulate if the Hilbert space is large enough. Specifically in case of modelling behaviour under a global crisis, or a wide asset market collapse we need to describe big jumps in belief states of agents from nearly zero priors, yes there are theories based on 'black swan' or fat tail distributions, but here the technique of Non Bayesian or quantum probability updations are more general in nature.

8.3 Use of Creation and Annihilation Operator in the Decision-Making[10]

Of late Khrennikova et al. (2014) have used well known creation–annihilation operator **formalism in** cognitive modeling in the context of political decision-making, and financial decision-making among other contexts. Creation and Annihilation operators are the most fundamental tools in the so called second quantization picture of quantum theory, which is also widely known as the quantum field theory (QFT), such operators are used to create or destroy particles on the initial ground state of the system, which can be a vaccum with no initial particles. These operators are also used in so called modal expansion of the wave operators. Such operator formalism can also be adopted in the current financial market behaviour model, which can be used to model updates of beliefs/updates of asset prices in markets, such formulation will be free of limitations which a typical Bayesian learning model will suffer, like the zero prior update problem, which would help understanding how given the information set the initial basis belief state (say $\mathbf{0}\rangle$) transform into another basis, say, $1\rangle$, or given the information set there is a stability and the basis belief state continues to remain as it is. Again in classical probabilistic formulation, it would be very nontrivial to capture such changes or stabilities. Below is a simple formulation of the same formalism.

Here we use two operators a and a*, the operator a* creates the belief that selection criteria $1\rangle$ should replace the initial $0\rangle$, $a^*0\rangle = 1\rangle$ and the operator a \annihilates" the belief that the $1\rangle$ is the right selection criteria, or, $a^*1\rangle = 0\rangle$ (it can also be interpreted as the operator of creation of the belief that the state 1 would collapse to state 0).

[10]Creation–destruction operators are used widely in quantum field theory, which actually gives the so-called second quantization representation, where the field operators can be viewed as a superposition of creation and destruction operators. Creation operator creates a particle/quanta of a specific momentum from the vacuum state, and the destruction operator destroys a particle of a specific momentum. Use of such operators in case of financial market modeling can be found in Bagarello and Havens (2014).

These operators satisfy canonical anticommutation

Relations: {a, a*} = I; {a, a} = 0; {a*, a*} = 0

where I is the unit operator and {A; B} = AB + BA denotes anti-commutator of two operators A; B: In the basis 0, 1 these operators can be represented by 2×2 matrices:

$$\text{i.e. } a* = \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix} \text{ and } a = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$$

Again if the belief state remains steady, i.e., even after the questions being asked 0 or 1 remains as it is as belief states, then such a scenario can be captured by the product of a and a* operator as a new operator say B acting on the initial basis sates of beliefs:

i.e. B = a*a, s.t $B1\rangle = 1\rangle$, and so on. Actually, B can also be represented as the projection operator, which collapses the initial state into 1 or 0.

8.3.1 Investor Behavior in an Interactive Environment

Here, we extend our model to include two or theoretically n no. of decision makers deciding which criteria should be used to invest in any asset given the information environment. Information environment in quantum modeling (Aerts et al. opc it) can be considered as to be a large bath of news/hard and soft information, which has a huge no, of degree of freedoms as compared to the agents' belief space. We can consider this scenario to be a market for assets, where the belief states of each decision maker are now entangled with the belief states of the other decision makers. Entanglement is certainly one of the most difficult and often misunderstood concepts in the whole of quantum theory. Here, we would like to be cautious about the usage of the term since it is by no means implied that there is a real physical entanglement between, say, brains of the agents. We would rather use this term in a mathematical sense, which means that the entangled state as a whole is a pure state, whereas the subsystems of the whole state are in mixed states, such that the entire market now can be considered in the aggregate as one decision maker.

Here for simplicity, we consider two such decision makers, say Alice and Bob. Now we consider the system of two agents with belief state spaces Ki, i = 1, 2, with bases 0, 1 as earlier. The belief state space of this system is given by the tensor product K = K1 ⊗ K2 and it has the basis $|00 > i$, $|10 > i$, $|01 > i$, $|11 > i$.28 The basis states $|\alpha\beta > i$ are the states of sharp beliefs, e.g., in the state $|00 > i$ both agents believe that the selection criteria 0 (whatever specifically that may mean) should be chosen. The individual ambiguity of the agents is encoded in superpositions of the form as follows. The joint belief state of two agents is given by the factor product:

$$|\psi_{1i} > \otimes |\psi_{2i>} = (c_0|0i + c1|1i) \otimes (k0|0i + k1|1i)$$

The most general belief state of these two agents has the form of superposition: where cij $\in$ C and $|c00|^2 + \cdots + |c11|^2 = 1$ The creation and annihilation operators of agents are lifted to the belief state space K and we denote them by bold symbols, e.g., $a_1 = a_1 \otimes I$. where I is the identity operator in the matrix form. As was pointed out in Khrennikova et al. (2014), these operators satisfy the so-called qubit commutation relations. For the fixed i, such operators satisfy the canonical commutation relations Eq. (14) for the one-dimensional fermionic system, but for different i, j they commute:

$$[ai, a*j] = [ai, aj] = [a*i, a*j] = 0$$

where [A, B] = AB − BA is the usual commutator. Please note these mathematical techniques are used widely in Quantum theory as a whole (including first quantization which is ordinary quantum mechanics, and second quantization which is quantum field theory).

Hence, the operators/lifted operators here would also work in similar ways as the operators a, a* in the earlier case of an individual decision maker, with the added advantage that this time the whole market decision-making states and outcomes (probabilities of choosing one selection criterion as a whole, or the updating of the market belief state as a whole) might be captured.

Hence overall, we attempt to provide a QPT-based supplier selection mechanism which has the following advantages over the standard decision theory approach based on CPT:

1. This new paradigm helps account for the inherent uncertainty in the decision-making via the superposition principle
2. There is an elegant method of measuring probabilities and measuring belief state updates, which are more efficient than Bayesian probability update theory
3. The QPT when applied in the very context can account for some special results unfound in CPT, namely the violation of the well known LTP, and order effects
4. We also show how the belief state of decision makers can be described via usage of operator formalism
5. Such operator formalism can also be extended to a more interactive market scenario, which comprises of theoretically n no of decision makers.

8.4 Further Research in the Similar Direction

There have been a number of alternative quantum or quantum field theoretic formulation of asset markets in recent years (Havens and Bagarello, Youkolov and Sornette, please check ref list below). These studies focus on modeling the interaction between the traders based on the operator formalism in the quantum field theory. For example in the earlier presented two-agent model (Alice and Bob) if we introduce the interaction between the traders and the information environment, or the so-called Bath (which can be considered as the huge bath comprising of many

degrees of freedom, comprised of hard and soft information) then a new model of decision-making can be formulated. In such a case, formulation agents may start with some initial pure states of beliefs, however, when they interact with the information environment such states 'decohere' and converts into mixed states. This thinking is based on the decoherence theory of modern quantum mechanics, but again proper interpretations of parameters are warranted.

Here, we need to formulate the Hamiltonian of the system which is again comprised of different creation and destruction operators with their commutation relationships, then there can be different conserved quantities represented by the so-called number operators (for example, in a restricted model the total no of shares traded in the market can be conserved, however, these shares are just traded or exchanged from one trader to another), and finally we need to solve the time evolution of such operators which would provide us with the time evolution equations for the market as a whole.

There are still many challenges in the road ahead, for example, developing a fruitful model of n interacting agents, where n can be >2 and large. To conclude we should remember that there are numerous interpretation of the famous 'measurement' problem in QM, i.e. there seem to be two inconsistent processes happening, untill we measure the superposed sate of a system evolves according to Shrodinger equation/ the unitary evolution method, but as soon as a measuremnt is performed we get a so called wave function collapse in a random fashion, these two procedures are inconsistent. there are several interpretations (multiverse theory, pilot wave theory, spentanoues collapse of wave function, decohernce theory etc.), however application of quantum theory in decison making at large may still give rise to equally challenging issues, but a new begining also.

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Part V
Globalization and Environmental Degradation

Chapter 9
Green Crimes as a Dark Side of Globalization

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9.1 Introduction

Green crime is an important matter that needs to be overcome and prevented due to its numerous negative influences on the community and the public order. Negative effects caused by crime are actually greater than those which may be seen, because they are of a diffusible nature. These harms start from the material spiritual damages that are directly caused by the crimes, and they extend directly to the victims. Indirectly, victims' close relatives and the entire community also lose. Environmental crimes have also been globalized. Green crime has grown to such an extent that countries that cannot solve them alone.

The aim of this study was to examine green crimes committed during the environmental transformation process as the subject point. Toward this aim, green crimes and related concepts are explained and clarified in this chapter. The globalization of green crimes and problems encountered for solving them are also discussed. We investigated the matter using spatial econometrics. The GeoDa packet program was used to analyze and compare regions of the world (South America, North America, Europe, Asia, the Middle East, and Africa). We evaluated rates of green crime in South America, North America, Europe, Asia, the Middle East, and Africa.

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9.1.1 The Green Crime Concept

Crime and guilt are violations of legal norms. Punishments to be imposed in the event of violations of these norms have been specified through criminal laws. Crimes can be against individuals, entire communities, states, nations, and the international community as a whole. Some theories have approached crime from biological and psychological perspectives (individual focused), while other theorists have attempted to give sociological explanations (with social and environmental factors). Sociological theories have focused on interactions between humans and the environment in the explanation of a crime. Today, during the processes experienced at local and global levels, sociological theories have been used in explaining the features and environments of areas where criminal incidents happen, especially because of social, cultural, and economic reasons (Axworthy and Ross 2006).

Green crime, as a concept, was introduced in the 1990s; with it came a new viewpoint regarding crime. Various concepts are used to explain green crime, which is defined as damage caused to the environment and the neglecting of the environment, without paying attention to the importance of the damage. One of the concepts is *eco-crime*, which was introduced by Walters in 2010. The term encompasses environmental risks, rights, and regulations in relation to the issue (Walters 2010).

The recently developed concept of *conservation criminology* deals with environmental crimes in amore interdisciplinary manner. Conservation criminology examines issues from psychological and sociological standpoints, seeking answers to questions such as how and why environmental laws are made, how and why they are disrupted, and what should be done about them. It also emphasizes the protection of wildlife, endangered species, decision making, policy development, and the application of laws intended to address each item (Lemieux and Clarke 2009; Wellsmith 2010; Gibbs et al. 2010).

Despite the fact that these concepts have also been used, green crime is more comprehensive in that and it includes all of the topics mentioned above. It includes not only the damage caused to the environment but also the negligence involved in not paying necessary importance to such damage (Lynch 1990; Beirne 1995; Halsey and White 1998; South 1998; South et al. 2013). In addition to addressing the fact that environmental damage disrupts and wears away at nature, green crime as a concept also includes reference to the legal process (environmental laws, judicial proceedings, and criminal procedures) as well as environmental regulations enacted to protect special areas and specific types of environments. Finally, green crime addresses the monitoring and controlling of environmentally damaging activities (White 2008, 2009, 2010, 2011).

Environmental crime is a matter that must be overcome and prevented due to its numerous impacts on individuals, communities, and the public order. Because of the spreading effect, its negative impacts are actually worse than what is seen. This is due to the fact that environmental crimes leading directly to tangible and intangible damages. They cause direct harm to victims, with victims' immediate relatives and their community being indirectly harmed as well.

9.1.2 Globalized Green Crimes

The environment is the whole of universal assets. Vegetation, animal communities, inanimate beings, and civilizations created by people throughout history (as well as the products of civilizations) are the common property of all people (Keles and Hamamci 2005). The environment is both the medium and the condition in which a living thing exists. It can be expressed as the air, water, and/or soil that constitute the common living areas of all living things. It is a medium in which living beings maintain their life functions, and the means by which chemical and physical functions among living and nonliving elements remain in balance.

However, due to the fact that environmental assets have been damaged as a result of various kinds of human activities, environmental problems have arisen. The fact that certain plant and animal communities have almost disappeared because the air, water, and soil have lost their viability by way of disruption over time, and that their living environments have changed or have been consumed excessively for the sake of human needs, each indicate a loss of environmental assets.

Environmental problems include all kinds of adverse effects that take place in the environment and can impair the health of the living things, environmental values, and ecological balance. Damage caused by environmental pollution and disruption is of a widespread nature. Considering its long-lasting impacts, it influences not only a single person but everyone, even future generations; it influences not just one nation but all nations; and not just human beings but all organisms and places of ecological equilibrium.

Because modern technology has significantly reduced time and space limitations, damages caused to the environment are increasingly adding up; these negative impacts on the environment and nature have become globalized in nature. The manufacturing industry may have increased productivity, but in so doing the people involved have caused the destruction of forests, the accumulation of waste, and climate change with their own hands.

All of these that threaten the human welfare are what the human beings do with their own hands. Beck (1992) described postmodern society as a global risk society, because we are manufacturing our own issues through increases in productivity and technology (e.g., logging, deforestation, and fly tipping). Each of these causes problems like climate change and global warming due to dangerous greenhouse gases being emitted during industrial activities. Many countries are cooperating with each other in order to solve these and similar problems. This is because even though countries are separated by borders on a map, damages caused to the environment are extending beyond the borders of countries in ways that affect all of us, since we are in the same ecosystem. Through the globalization of industry these problems are now global, not local.

Environmental protection includes the maintenance and conservation of resources which we rapidly lose and cannot replace. İt aims to both prevent an ongoing situation from being altered and to eliminate a harmful situation. For example, acid rain caused by intense industrial activities has caused the lives of

many lakes and forests in Canada and Scandinavia to come to an end. In order to find a solution to widespread atmospheric pollution, more serious measures have been taken with regard to factory chimneys; the *Clean Vehicle Rebate Project* has also been emphasized. Industrialists, by way of equipping factories with smoke filter systems, and automobile manufacturers, by way of equipping vehicles with catalytic mufflers to reduce harmful effects of exhaust gases into the market, have taken common measures.

It has been observed that green crime has emerged in four basic issues. These can be specified as air pollution, deforestation, water pollution, and species declines and animal rights.

9.1.3 Air Pollution

Surveys show that the rate of carbon dioxide in the air is not constant anymore, and that it has steadily increased since the industrial revolution. The main source of this increase is the use of fossil fuels such as coal and oil. Figure 9.1 shows the global increase of carbon dioxide emissions, which creates the greenhouse effect. Accordingly, it is seen that carbon dioxide emissions in the last 50 years have increased more than 3.5 times around the globe.

It is estimated that carbon dioxide emissions in the atmosphere will nearly double over the next 60 years. This corresponds to the 1.5–4.5° rise of the average world temperature. As a result, it is expected that there will be significant climate changes in the world, the most important of which are rising sea levels, melting of the polar glaciers, and flooding in coastal areas.

Air pollution occurs both in the general environment in which living things exist and respire, and in the houses where people meet their heating and cooking needs. Therefore, people and other living things are at risk for exposure to air pollution in

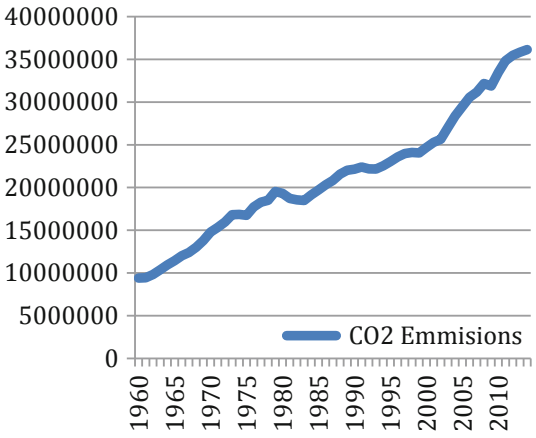

Fig. 9.1 Increase of carbon dioxide emissions in the world

any environment. Air pollution causes acute and chronic respiratory problems in humans, and it influences children and young people in a negative way. Air pollution causes increases in cancer rates, decreases in the production of forests and forest products, and significant damage to the surfaces of historic buildings. Air pollution can be expressed as one of the most important green crimes because of the negative impacts it introduces to human health and natural life (TERI 2015).

According to data published by the World Health Organization (WHO) in 2018, 6.5 million people lost their lives due to reasons originating from household air pollution. This represents 7.7% of all deaths in the world during that time. Household air pollution can lead to acute lower respiratory infections in children under age five, and to ischemic heart disease, stroke, chronic obstructive pulmonary disease (COPD), and lung cancer in adults (WHO 2018). Figure 9.2 shows the rates of diseases caused by household air pollution in different regions of the world since 2012. Paralysis as well as heart and lung diseases have most commonly occurred in the Western Pacific and in Southeast Asia.

On the other hand, air pollution originating from the general environment (ambient air pollution) caused the deaths of 3 million people worldwide in 2012; this represents 5.4% of total deaths. Of those, 25% were due to lung cancer, 8%

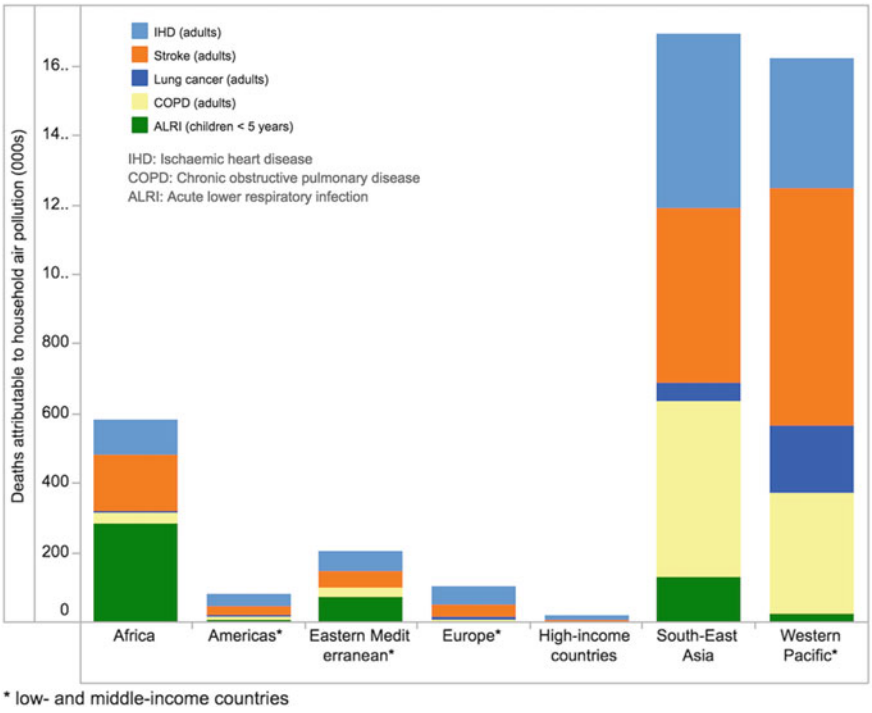

Fig. 9.2 Mortality from household air pollution (000s.). *Source* WHO (2018). Global Health Observatory Data

were due to COPD, about 15% were related to ischemic heart disease and stroke, and about 17% were due to respiratory infections. Although all types of air pollution create health problems in humans, it is worth noting that these problems are mostly seen in countries with low and medium levels of income (WHO 2018).

9.1.4 Deforestation

The destruction and eradication of forests are caused by various activities, such as those which are necessary for meeting the demand for fuel and creating new construction sites in previously forested areas. The destruction of forests is one of the important factors in the emergence of problems such as climate change, prolonged dry seasons, flooding, erosion, and the disappearance of plants and animal species (Baykal and Baykal 2008).

Recent studies have estimated that the global forested area is about 4 billion hectares in 2018; this covers approximately 30% of the total territorial area of the world. However, in the last 30 years, the destruction of forests has continued in many regions, with forest areas decreasing every day. Figure 9.3 shows the global decrease in forest areas from 1990 to 2016. The forest area was 41 million square kilometers at the beginning of the 1990s, but it had dropped to less than 40 million by 2016 (The World Bank 2018).

Important components of the discussion of forest losses are the need for opening up agricultural land and the need for wood. Over the past decade, Brazil and Indonesia have both been trying to move the population surplus of crowded regions to uninhabited tropical forest areas. This has increased the destruction of forests by

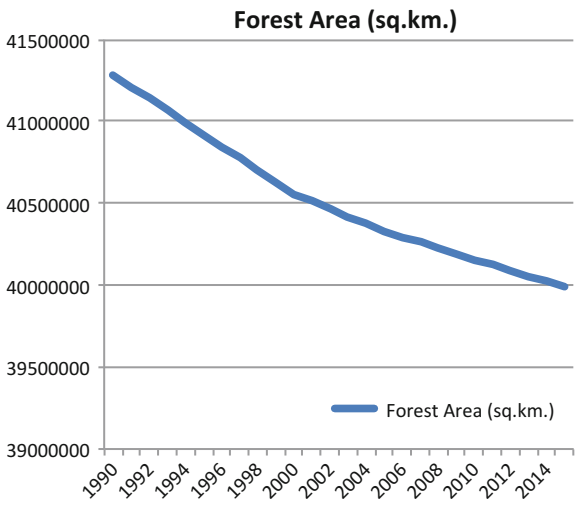

Fig. 9.3 Forest areas (m^2) in the world. *Source* The World Bank (2018)

the opening of wide roads, with settlements in agricultural lands in areas such as the Amazon rainforest.

Pressures have been exerted by rich countries who are in need of raw materials. For example, Japan, whose tree assets are scarce, has been importing a large amount of timber from tropical rainforests (Dudley et al. 2010). Figure 9.4 shows the comparative status of lost and gained forest areas over the last 30 years. The red marked areas indicate the loss of forest areas, and the blue marked areas indicate the gain of forest areas. Deforestation of the tropical areas is of special significance in reviewing these maps.

Forests contain large amounts of carbon deposits. In this respect, deforestation and the deterioration of forests are accepted as the main causes of climate change. According to the predictions of The Intergovernmental Panel on Climate Change (IPCC 2014), deforestation, and deterioration of the natural structures of forests are responsible for the 17% of global carbon emissions; this surpasses the entire transport sector of the world as being the third-largest source of greenhouse gas emissions (Can 2013; The World Bank 2016). This is significant in light of the fact that consequences of natural threats such as extreme rain, hurricanes, earthquakes, and droughts are aggravated by the deterioration of natural ecosystems (due to activities such as deforestation) and the drying of the wetlands (Dudley et al. 2010).

9.1.5 Water Pollution

Water pollution refers to physical, biological, and chemical contamination of water. Numerous conditions may cause water pollution. Factors such as the excessive use of detergents, soaps, aggressive cleaning materials, and burnt oils, as well as uncontrolled waste (such as discharging the oil of vehicles at the same place after changing) constitute the basis of domestic waste and the contamination of water resources. In addition, pollution of the air and soil cause the water to be polluted, indirectly. Water resources are being polluted and destroyed in many parts of the world due to primitive agricultural practices, disorganized settlements, irregular industrialization, and inadequate infrastructure. The various solid and liquid wastes

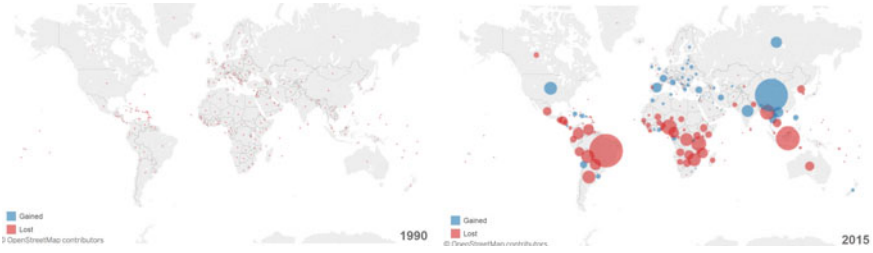

Fig. 9.4 Gained and lost forest areas between 1990 and 2015. *Source* Khokhar and Tabary (2016)

produced by industrial activities adversely affect both surface water and underground water resources in large scale, in terms of quality. Water resources, especially those close to urban settlements, are in constant danger.

In the past century, the world population has tripled, but human water demand has increased sixfold. At the same time, many water basins have deteriorated due to deforestation and other changes leading to various hydrological effects. Climate change, in combination with other pressures, deepens the existing water crisis. It is expected that water quality will be adversely affected by climate change each passing year due to large variabilities in precipitation, increased water tensions (e.g., periodic shortages) in some regions, and deterioration of environmental services (Aertgeerts and Angelakis 2003). Figure 9.5 shows water quality risks for the year 2050, according to a study prepared by UNESCO. It is estimated that in 2050, Europe, Africa, the Middle East, and the Far East will be the regions where water quality is most at risk.

About 10% of the water consumed in the world is used in homes, while 70% is used in agriculture, and 20% is used in industry. The pollution of drinkable water is increasing day by day. This is caused by the mixing of domestic waste, industrial waste, natural waste, and agricultural pollutants which make their way into clean water. The main reason for water pollution is the improper depuration of wastes generated by various industries (such as mining, metallurgy, chemistry, and leather), and their disposal directly into the environment. Therefore, the solution points to careful use of water in the world's industries.

The concentration of industrial activities in urban areas is a threat to the quality of water and access to water resources in those regions (World Water Assessment Program 2018). As shown in Fig. 9.6, no increase in drinkable water has been observed for urban populations throughout the world, over the past 30 years. An increase has been shown for populations in rural areas, however.

The lack of clean water has already had a significant impact on public health. More than 2.2 million deaths, corresponding to 4% of annual deaths, have been

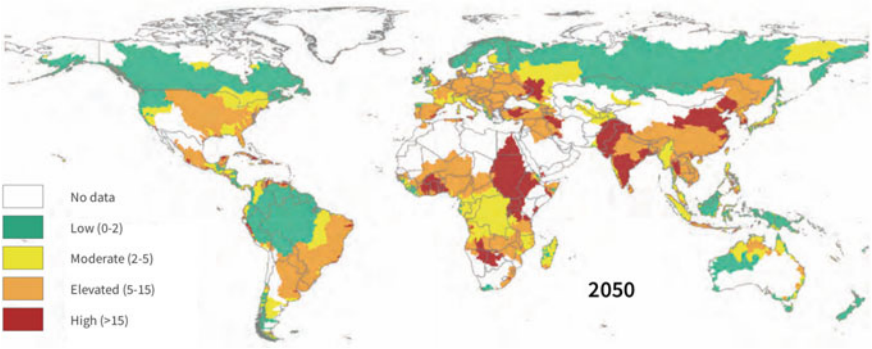

Fig. 9.5 Predicted water quality risks for the year 2050. *Source* World Water Assessment Program (2018)

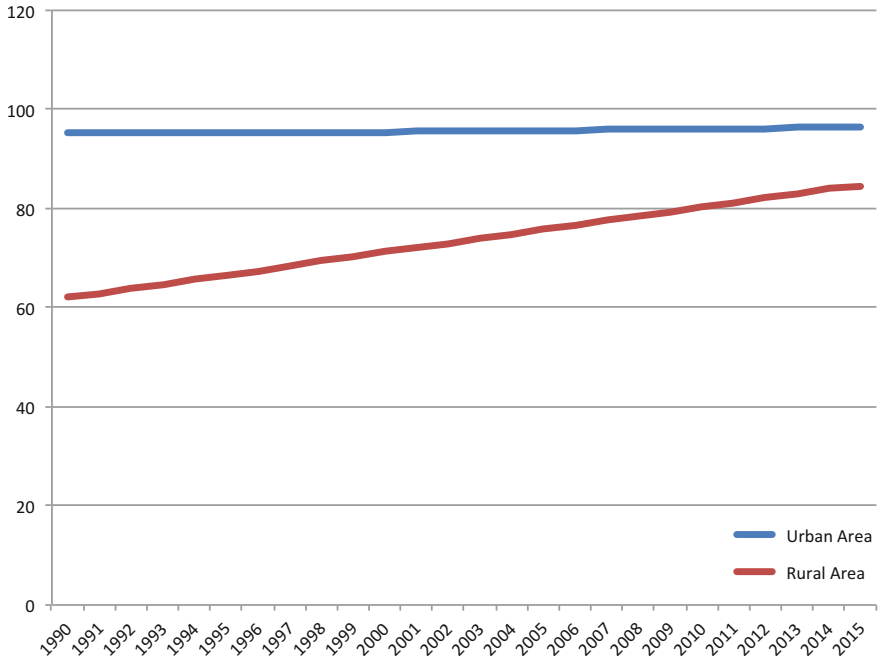

Fig. 9.6 Improved water sources (urban and rural areas). *Source* World Bank Data (2018)

associated with clean water deficiencies and lack of sanitation. It is calculated that city residents in Asia (700 million), Africa (150 million), and Latin America and the Caribbean (120 million) do not have access to sufficient amounts of drinking water. These figures are expected to increase (World Water Assessment Program 2012). Tensions occurring between countries who face the issue of access to water result in political problems from time to time. All of these pressures are expected to increase under the conditions of climate change (Dudley et al. 2010).

9.1.6 Species Declines and Animal Rights

The animal kingdom is an indispensable part of nature. A healthy and balanced environment is only possible when the existence of animals is accepted, and when they are allowed to maintain their lives. It is certain that without animals, the balance of nature will deteriorate. Improving the environment, protecting environmental health, and ensuring an ecological balance all require the protection of animals (Dönmez 2013).

The most important international text on the issue of animal rights is the Universal Declaration of Animal Rights. The Declaration was proclaimed at a

ceremony on October 15, 1978 at the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris. The Universal Declaration of Animal Rights underlines the fact that all living beings have natural rights, and the respect shown for animals by humankind cannot be separated from respect shown by people for others.

In this context, it presents the basic principles regarding animal rights, including the assertions that animals should not be mistreated or treated in a cruel manner; that if it is necessary to kill an animal, it should be executed in a short time, without pain and without causing fear; that each animal that needs the support of a person, is given the proper nutrition and treatment; that experiments performed on animals which cause physical and psychological suffering are in violation of animal rights; that wild animals have the right to live and reproduce freely in their own natural environments; that even a dead animal should be treated with respect; that the unique legal status and rights of animals have to be recognized by law; that the protection and security of animals should be regulated at the level of state organizations; and so on.

However, many human-induced activities lead directly or indirectly to the violation of animal rights; sometimes they even lead to the extinction of an animal species. According to estimations by the International Union for Conservation of Nature (IUCN) and as it seen in Fig. 9.7, 35% of bird species, 52% of amphibians (double life), and 72% of rocky corals remains particularly vulnerable to the effects of climate change. In its fifth Assessment Report, the IPCC confirmed that climate change which occurs as a result of human activities exacerbates current pressures on ecosystems and wildlife, eventually leading to extinction. These situations are made worse by the fact that most endangered species affected by irregular climatic conditions also live in regions that have become more sensitive to environmental impacts due to specifics of various biological factors (e.g., ecological, behavioral, psychological, and genetic characteristics) (World Wildlife Fund [WWF] 2015).

It has been asserted that the extinction of animal species will destroy the ecological balance of the planet. Each animal species has a role in the ecological system. For example, soil microorganisms provide carbon, oxygen, and nitrogen cycling; micro-marine organisms assist with the absorption of carbon dioxide; and insects perform efficient pollen transport (IUCN 2018). Deterioration of the ecological system can lead to the endangerment of animal species, even to the point of their depletion. For example, the most important reason polar bears are threatened with extinction is climate change. The natural lives of polar bears have been affected due to the melting of their life areas, which are made up of sea and ice. The shrinking of the ice cover and the thinning of the remaining ice are also threats. New economic developments such as oil and gas exploration works can disturb polar bears and increase human–animal conflicts.

The African elephant is endangered, largely because of the Asian-originated demand for ivory, which increases illegal hunting. Additionally, infrastructure projects (such as dams, roads, mines, and other industrial facilities) and the loss of farm-based habitats considerably diminish the survival chances of African elephants (WWF 2015). Living in a healthy and balanced environment is an animal

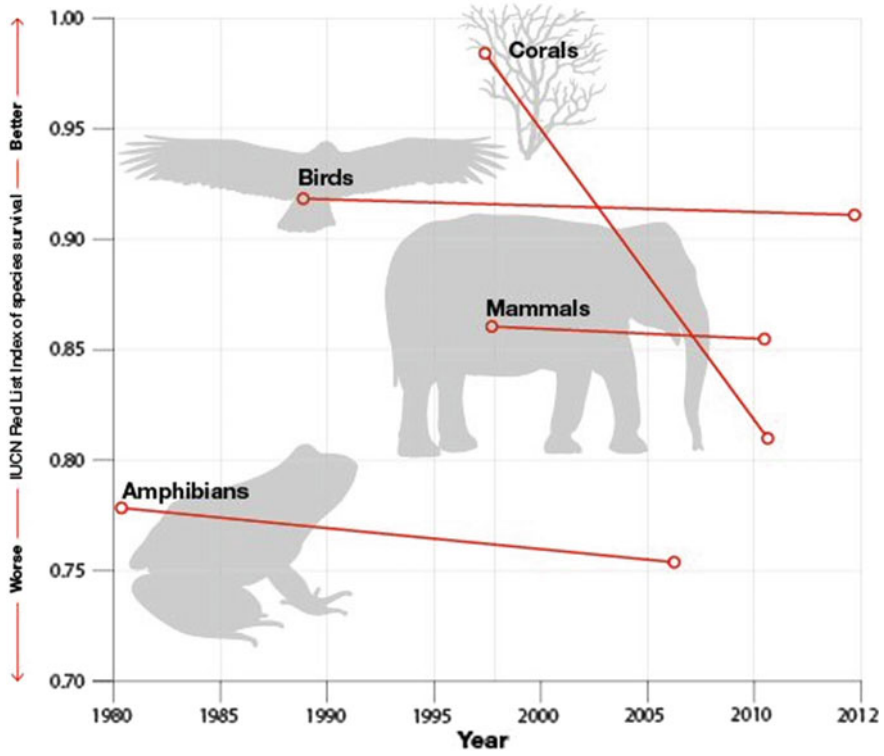

Fig. 9.7 Endangered species. *Source* IUCN Red List of Threatened Species (2018)

right. Living animals are beneficiaries of these rights. Living animals as well as future generations of animals that have not yet been born are the possessors of these rights.

It is a must that the laws qualify these acts as a crime. A crime becomes committed by doing the act prohibited by law; for realization of a crime, a loss must occur. However, environmental crimes are distinguished from crimes in the classical sense due to some of their characteristics. In such crimes, it is difficult to identify the perpetrator and the victim. This is because with environmental crimes, both the environment and society are subjected to damage, as opposed to just individuals. However, many green crimes still do not constitute a crime.

While many are concerned with harm, laws still differ from country to country. Because green crimes are global in nature, efforts must be made to address them. Many green crimes are not illegal, so green criminology is considered transgressive in that it steps beyond traditional criminology and into new issues. White (2008) argues that criminology should be concerned with anything that causes physical harm to the environment and/or human and nonhuman inhabitants, even if no law is broken.

As a result, it is not possible to say whether states actively fulfill their environmental protection missions. Since issues of environmental responsibility are technically complex, government institutions that execute these types of projects must employ personnel with advanced levels of expertise. These institutions should be equipped with authority, and not be affected by potential political pressures. They should be allowed to come legally before a judge in the case of making technical mistakes.

9.2 Methodology

This study was designed to analyze green crimes around the world, using four basic indicators (air pollution, water pollution, deforestation, and species declines and animal rights). We analyzed situations in countries around the world, using data obtained from The World Bank official web site. We used spatial cartogram maps to determine similarities and dissimilarities among countries, in terms of green crimes. GeoDa and the R-INLA package program were used for this purpose. We analyzed cartogram maps using Moran's *I* statistics. We used 2005–2017 yearly data for indicators, and developed an *a priori* hypothesis for each indicator:

Hypothesis 1: Air pollution position is related to green crimes.
Hypothesis 2: Deforestation situation is related to green crimes.
Hypothesis 3: Animal rights situation is related to green crimes.
Hypothesis 4: Water pollution situation is related to green crimes.
We tested these hypotheses and controlled for our expectations, as described below.

9.2.1 Spatial Analysis

Applied work in regional science relies heavily on sample data that are collected, with reference to locations measured as points in space. What distinguishes spatial econometrics from traditional econometrics? Two problems arise when sample data have a locational component: (1) spatial dependence between the observations and (2) spatial heterogeneity in the relationships being modeled.

The field of traditional econometrics has largely ignored these two issues, perhaps because they change the Gauss–Markov assumptions, especially for regression estimation techniques. If there is a spatial dependence between the observations, in terms of Gauss–Markov assumptions, explanatory variables have fixed effect in repeated sampling. So, there must be alternative estimation techniques for this situation. On the other hand, if there is a spatial heterogeneity for variables, Gauss–Markov assumptions are affected from this. The subject of this text is alternative estimation approaches that can be used when dealing with spatial data samples (Le Sage 1999).

9.2.2 LISA Maps

LISA cluster maps, especially show selected regions, using Moran I statistics. Moran I statistics are described with four groups, namely high-high, low-low, high-low, and low-high. (Annoni and Kozovska 2010). In LISA, spatial clusters are highlighted by bright colors. High-high regions are colored red. High-high regions in cartogram maps mean, there is a positive homogeneity for individual and neighboring high values of selected indicator. Low-low regions are colored blue. With these, positive spatial autocorrelations emerge from individual and neighboring low values. LISA satisfies the following requirements:

(a) The LISA for each observation gives an indication of significant spatial homogeneity and similarity of observations and
(b) The sum of LISAs for observations is a global indicator of spatial homogeneity (Anselin 1995).

Spatial autocorrelation is really important, especially for spatial econometrics (Haining 2009). The hierarchical methods of spatial autocorrelation in spatial analysis can be described as: The first one is spatial autocorrelation obtained from the lag function without weight (Chen 2008), and the other is spatial autocorrelation using weight function, not lag operator (Cliff and Ord 1981).

One of the important points of spatial autocorrelation modeling is to estimate and obtain a square spatial weights matrix (Getis 2009). However, the method by which a weight function might be selected objectively is still a pending question awaiting resolution. If we could not choose a suitable weight matrix, spatial results and their effects of spatial analysis will not be statistically significant.

9.2.3 Weight Functions-Spatial Contiguity Matrix

Before constructing a spatial weights matrix, we must make a spatial contiguity matrix by using weight function. For n elements in a geographical system, a spatial contiguity matrix, C, can be expressed in the form:

$$C = \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1n} \\ c_{21} & c_{22} & \cdots & c_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ c_{n1} & c_{n2} & \cdots & c_{nn} \end{bmatrix} \tag{9.1}$$

where c_{ij} is a spatial term used to analyze the situation of similarity of neighborless between region I and j. Obviously, we can write a spatial weight matrix as

$$W = \frac{C}{C_0} = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \ddots & w_{nn} \end{bmatrix} \text{ or} \tag{9.2}$$

$$W* = \frac{nC}{C_0} = n \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \ddots & w_{nn} \end{bmatrix} \tag{9.3}$$

where

$$C_0 = \sum_{i=0}^{n} \sum_{j=0}^{n} c_{ij}, \quad \sum_{i=0}^{n} \sum_{j=0}^{n} w_{ij} = 1 \tag{9.4}$$

W is mathematically can be defined as $W*$. In the literature, $W*$ shows spatial weight matrix.

9.2.4 Weight Functions-Spatial Weight Function

In general, we can see here are two main problem acts: The first problem is, which affects everything through space, the second problem is clustering and isolating. The first problem tends to equality and the second problem can be defined as spatial heterogeneity (El Naschie 2000).

The first problem can be taken into the account for Earth's area and on the other hand, the second problem can be handled in a spatial econometrics and geographical system (Chen 2008). The action at a distance reminds us of Tobler's first law of geography (1970, 2004), while geographical classification needs some force. The relation of the two forces introduces four kinds of spatial subjects: (1) long-distance actions—global correlations, (2) quasi-long-distance correlation actions or quasi-global correlations, (3) short-distance actions or quasi-local correlations, and (4) proximal actions or local correlations.

These types can be handled and analyzed using four different definitions:

(1) Long-distance action or global correlation and inverse power function. The inverse power law reflects the action at a distance in geography, so the global correlation can be reflected with an inverse power function such as

$$c_{ij} = r_{ij}^{-b} \tag{9.5}$$

where b defines the distance friction coefficient (generally, $b = 1$). This function comes from the gravity model estimation (Hagget 1977). Cliff and Ord

(1973, 1981) used this function to obtain significant spatial matrix, which is called in the literature as Cliff-Ord Weight.

(2) Quasi-long-distance correlation action or quasi-global correlation and negative exponential function. The quasi-global correlation can be described as

$$c_{ij} = \exp\left(-\frac{r_{ij}}{\bar{r}}\right) \tag{9.6}$$

r_{ij} refers to the distance between location i and location j, and r, the average distance of all the distances between any two locations.

(3) Short-distance action or quasi-local correlation and semi-step function. This is also called as "*quasi-proximal action*". Defining a *critical distance* r_0, the short-distance action can be described by a function as

$$c_{ij} = \begin{cases} 1, & \text{if } r_{ij} \le r_0 \\ 0, & \text{if } r > \mathrm{r}_0 \end{cases}, \tag{9.7}$$

which gives a binary matrix or 0–1 contiguity matrix.

(4) Proximal action or local correlation and step function. Proximal action is an action of correlation in terms of neighboring. If region i is next to region j, the value of the spatial correlation is 1; otherwise, the value is 0. The local correlation can be described by the step function:

$$c_{ij} = \begin{cases} 1, & \text{if region is on region } j \\ 0, & \text{others} \end{cases} \tag{9.8}$$

This definition is as a result of a 0–1 contiguity matrix.

In order to clarify the criteria for selecting a weight function, we must know the similarities and differences between these weight functions, as demonstrated in Fig. 9.8.

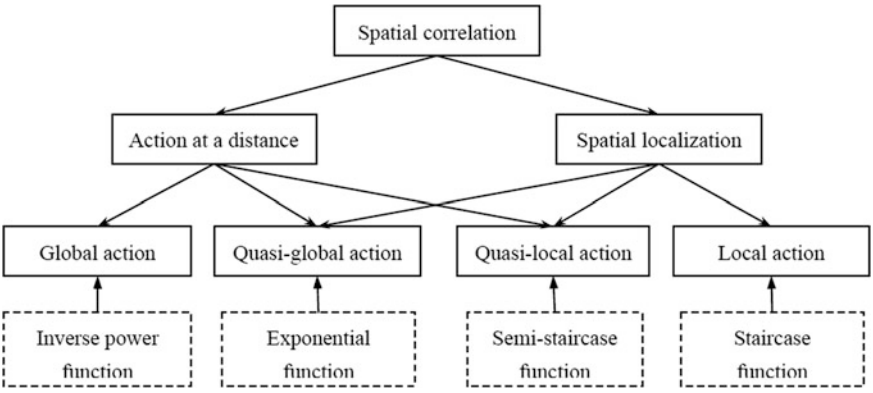

Fig. 9.8 The four types of spatial actions corresponding to four kinds of weight functions

Summarily, to analyze LISA Maps, we have to use a spatial weights matrix. The spatial weights matrix is an important step for estimating a spatial econometric model. Also, this can be said as a spatial equation for observations and variables (Anselin 1988). We must say that some econometricians say, W is accepted to be a theoretical definition of spatial dependence, these same econometricians more often than not use a W which is at best statistically significant. In many studies, W has no obvious relationship in terms of spatial dependence. Thus, models taken into account using these structures are not true. This is not to say that analysts have not alternative techniques for this problem. Some properties have been used to solve this. Some examples can be given as:

(1) Spatially contiguous neighbors;
(2) Inverse distances raised to some power;
(3) Lengths of shared borders divided by the perimeter;
(4) Bandwidth as the *n*th nearest neighbor distance;
(5) Ranked distances;
(6) Constrained weights for an observation equal to some constant;
(7) All centroids within distance *d*; and
(8) *n* nearest neighbors.

9.3 Findings and Discussions

We analyzed four green crime indicators using LISA Maps. LISA Maps can only be handled with a weighted matrix. The weight matrix is in the case of homogeneity/heterogeneity in the data set of the data variable or the indicator and in the economic units. As explained in detail in the previous section, it does not occur with different weights in the literature. In the study, it is mentioned that the surface matrices provided for an indicator are taken.

First, we analyzed air pollution cartogram maps, as shown in Figs. 9.9 and 9.10.

Figures 9.9 and 9.10 show levels of air pollution in the world. Figure 9.9 can be described as the spatial positioning of the countries around the world in terms of air pollution; it is the LISA map for air pollution. The LISA cartogram maps help to determine the homogeneity between the economic units discussed, as previously emphasized. Figure 9.10 gives information on the level of statistical significance of the LISA map (Table 9.1).

For air pollution, two classifications can be analyzed. First are the high-high area, meaning high homogeneity, and high similarity. The countries classified in high-high areas have a high air pollution level. Among these countries, Iran, Iraq, and Saudi Arabia are the same in terms of air pollution (Table 9.2).

Figures 9.11 and 9.12 show the situation of deforestation around the world. Figure 9.11 can be described as the spatial positioning of the countries around the world in terms of deforestation. Figure 9.12 gives information on the level of statistical significance of the LISA map. For deforestation, two classifications can

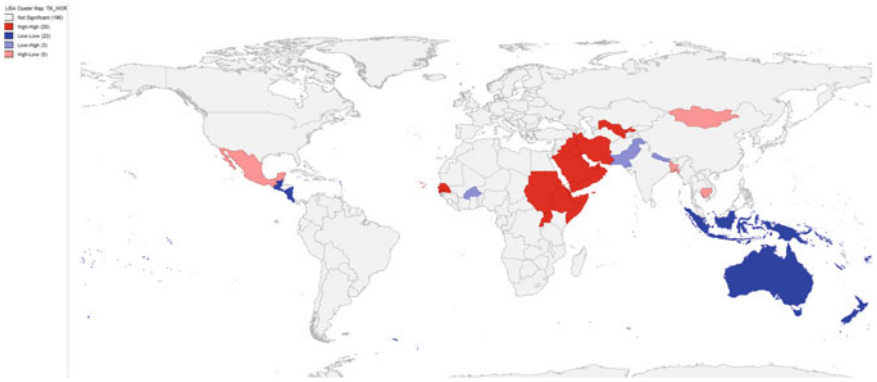

Fig. 9.9 Air pollution LISA map around the world

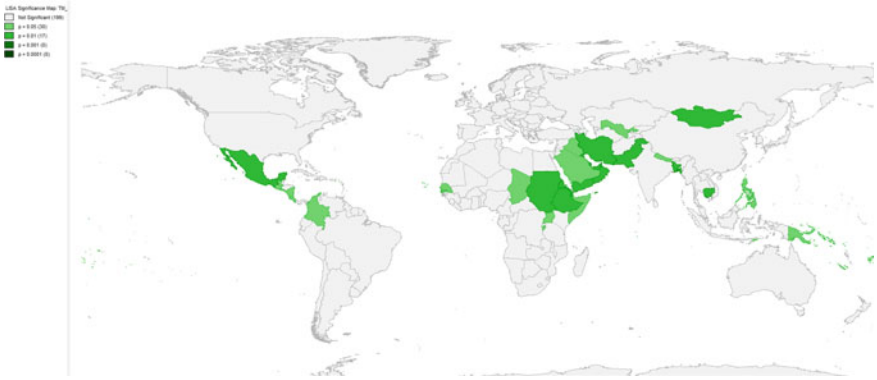

Fig. 9.10 LISA significance map

Table 9.1 Country classification–air pollution

LISA map areas (5% significance level)	Countries
High-high areas (red color)	Uzbekistan, Iran, Iraq, Saudi Arabia, Yemen, Oman, Qatar, Sudan, Uganda, Ethiopia, Kiribati, Somalia, and Senegal
Low-low areas (dark blue color)	Australia and New Zealand

Table 9.2 Country classification–deforestation

LISA map areas (5% significance level)	Countries
High-high areas (red color)	The United States, Canada, Kiribati, Venezuela, Argentina, Chile, China, and Vietnam
Low-high areas (light blue color)	Peru, Norway, Ukraine, Kazakhstan, Papua New Guinea, and the Central African Republic

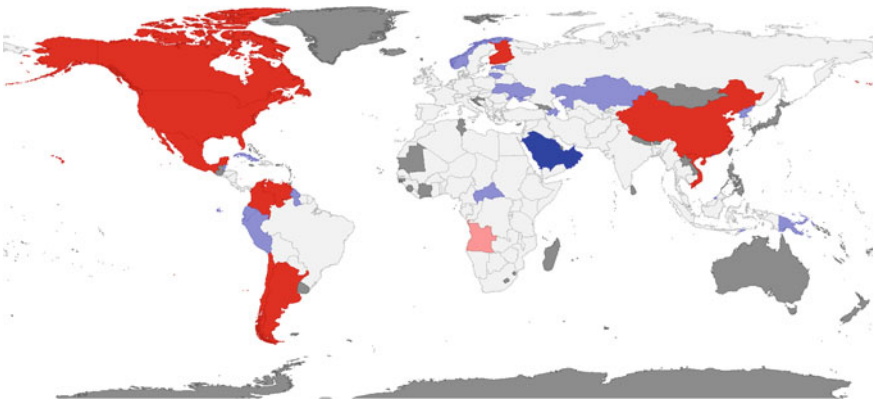

Fig. 9.11 Deforestation LISA map around the world

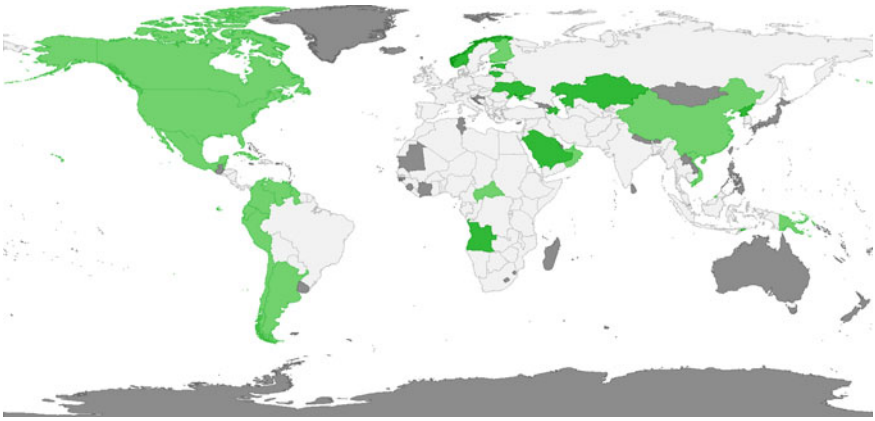

Fig. 9.12 LISA significance map

be analyzed. The first is the high-high area, meaning high homogeneity and high similarity. The countries classified in high-high area have high deforestation levels. Among these countries, the United States and Canada are the same in terms of deforestation (Fig. 9.13; Table 9.3).

Figures 9.14 and 9.15 show the situation of animal rights around the world. Figure 9.14 can be described as the spatial positioning of the countries around the world in terms of animal rights. Figure 9.15 gives information on the level of statistical significance of the LISA map. For animal rights, two classifications can be analyzed. First are the high-high area, meaning high homogeneity, and high similarity. Countries classified in high-high areas have high animal rights levels. Among these countries, Venezuela and Peru are the same in terms of animal rights (Figs. 9.16, 9.17 and 9.18; Table 9.4).

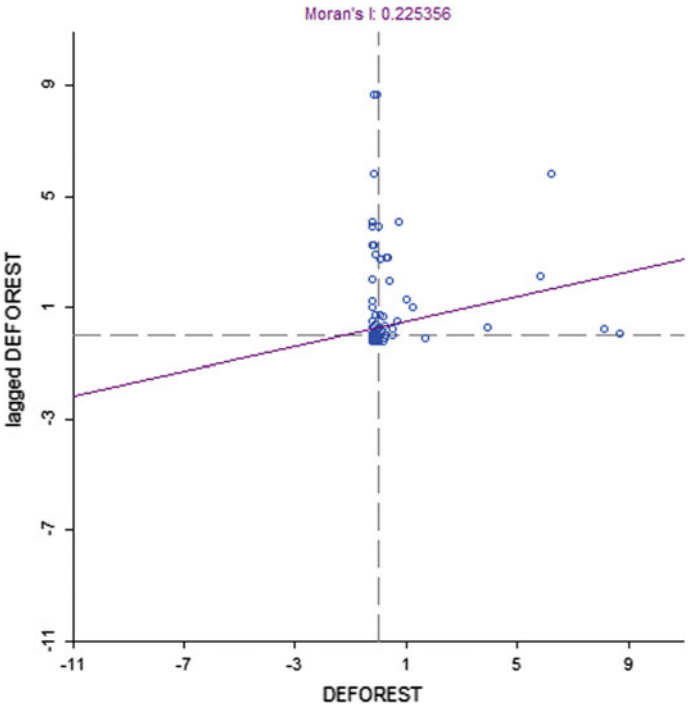

Fig. 9.13 Moran's I graph of deforestation indicator

Table 9.3 Country classification–animal rights

LISA map areas (5% significance level)	Countries
High-high areas (red color)	United States, Kiribati, Venezuela, Peru, Bolivia, Chile, Nigeria, Pakistan, Indonesia, and Papua New Guinea

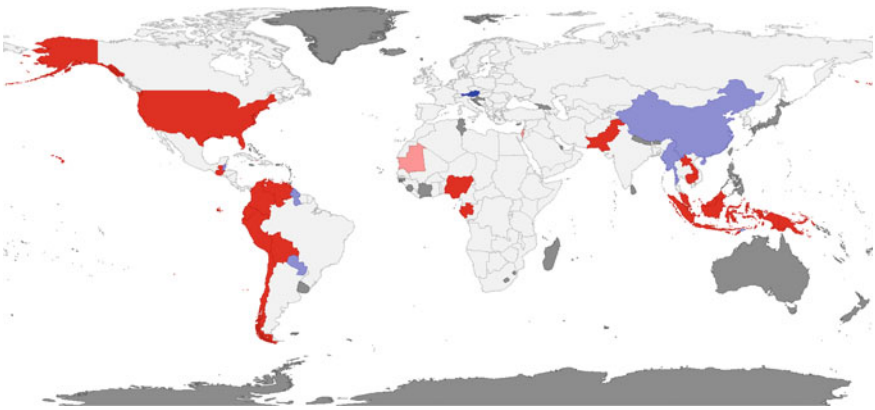

Fig. 9.14 Animal species LISA map around the world

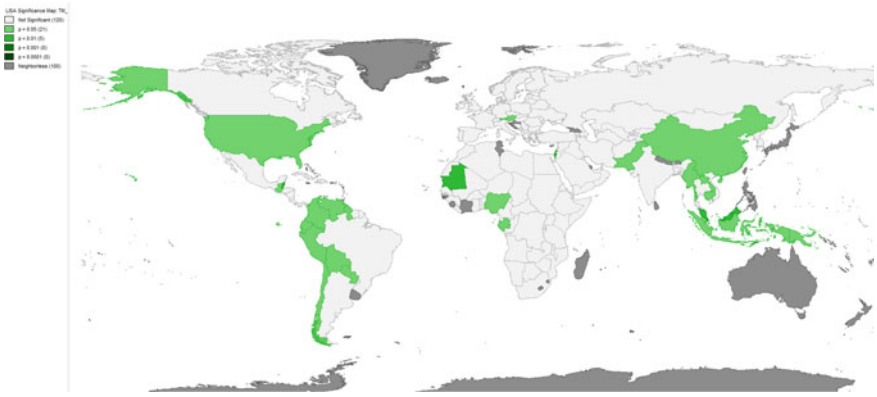

Fig. 9.15 LISA significance map

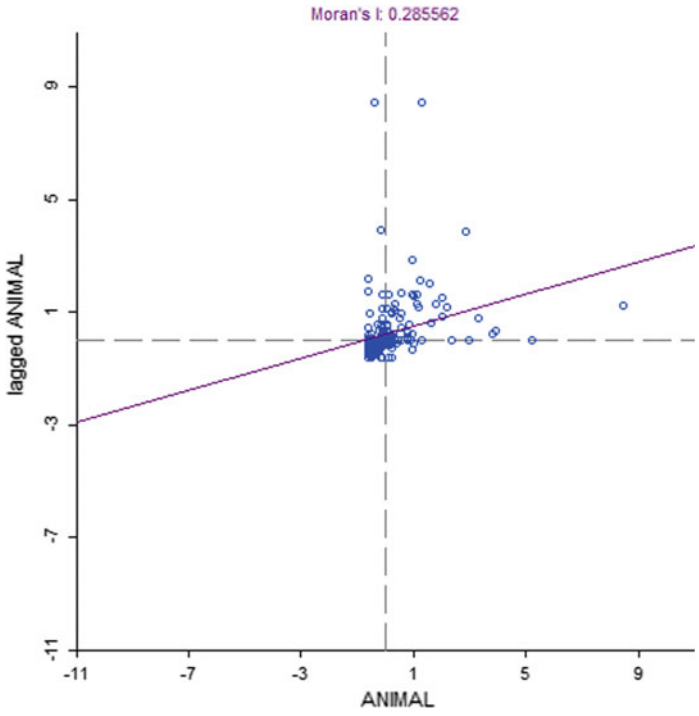

Fig. 9.16 Moran's I graph of animal species indicator

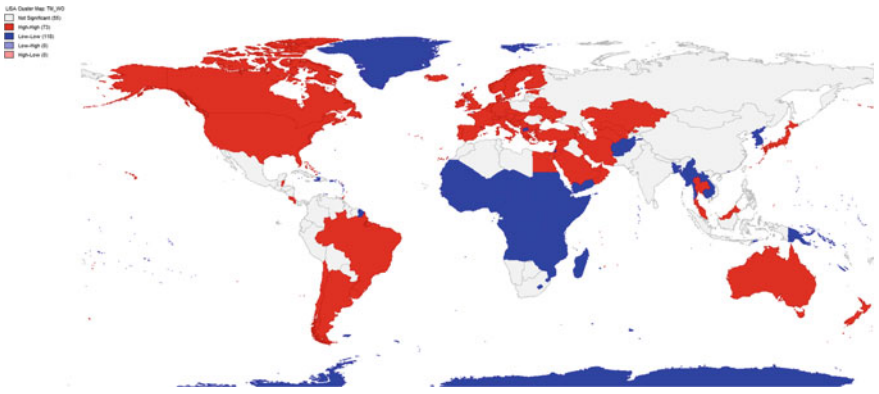

Fig. 9.17 Water pollution LISA map

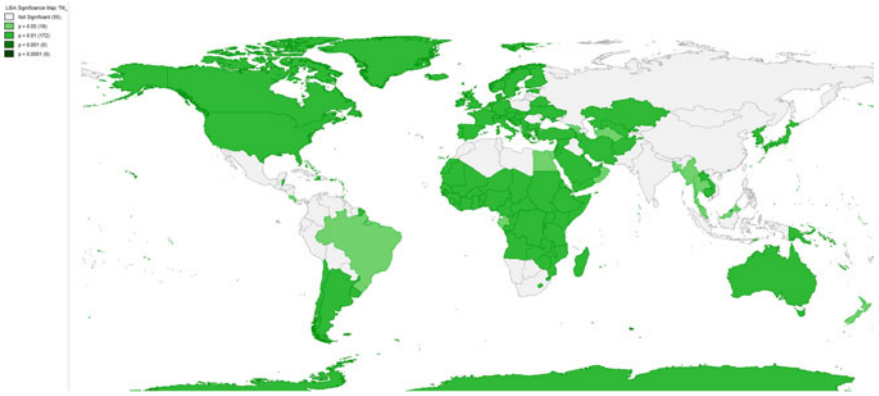

Fig. 9.18 LISA significance map

Table 9.4 Country classification–water pollution

LISA map areas (5% significance level)	Countries
High-high areas (red color)	The United States, Canada, Brazil, New Zealand, Uruguay, Chile, Costa Rica, Fiji, Iceland, Ireland, The United Kingdom, Spain, France, Belgium, Germany, Italy, Austria, Bulgaria, Greece, Croatia, Slovakia, Ukraine, Turkey, Belarus, Norway, Sweden, Estonia, Syria, Jordan, Egypt, Oman, Iran, and Australia
Low-low areas (dark blue color)	Guinea, Niger, the Central African Republic, Ethiopia, Somalia, Zimbabwe, Madagascar, Angola, Yemen, and Afghanistan

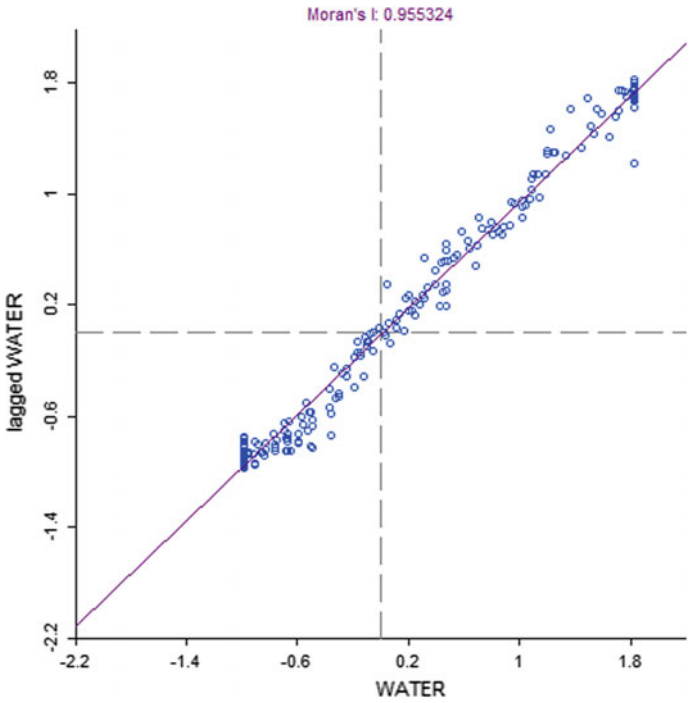

Fig. 9.19 Moran's I graph of water

9.4 Conclusion

The committing of green crimes in the course of environmental transformation is an important matter that needs to be overcome and prevented due to a great number of negative impacts they have on individuals, the community, and public order. This is because negative effects caused by green crime are actually much greater than what is seen. The harms from these crimes lead not only to tangible and intangible damages, but they also cause the victim (directly) and the victims' close relatives and the entire community (indirectly) to lose. For this reason, environmental crimes are considered to have become globalized in nature, and the have grown to the extent that countries cannot solve them alone.

Recent studies have shown that green crimes increased in the 1990s and have appeared in categories of four basic issues. One of them is air pollution. Researches show that the rate of carbon dioxide in the air gradually increases due to the use of fossil fuels, such as coal and oil. Air pollution causes the death of more than 3 million people because of it is linked to diseases and conditions such as lung cancer, COPD, strokes, and respiratory infections.

Deforestation is another type of green crime. The total forest area in the world has been specified as 4 billion hectares. This covers about the 30% of the territorial

area. However, in the last 30 years, the destruction of forests has continued in many regions. Forest areas are decreasing every day. Deforestation aggravates the consequences of natural threats such as extreme rain, hurricanes, earthquakes, and droughts by deteriorating the natural ecosystem.

Water pollution is the third type of green crime. In the past century, the world population has tripled, but human water demand has increased sixfold. At the same time, many water basins have been deteriorated due to deforestation and other changes leading to various hydrological effects. The lack of clean water has a negative impact on public health. The 2.2 million deaths corresponding to 4% of the annual deaths have been associated with clean water deficiencies and lack of sanitation.

The topic of species declines and animal rights, as its own category, is also important to the discussion of green crime. Without animals, it is certain that the balance of nature will be deteriorated. Improving the environment, protecting environmental health, and ensuring an ecological balance also requires the protection of the animals. However, many human-induced activities lead directly or indirectly to the violation of animal rights, even to the extinction of animal species.

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Chapter 10
Globalization and Environmental Degradation in Sub-Saharan Africa

Bertha Z. Osei-Hwedie, Napoleon Kurantin and Kwaku Osei-Hwedie

10.1 Introduction

The chapter discusses the environmental impacts of mining in sub-Saharan Africa (SSA) in the era of globalization with the view of highlighting the benefits and challenges. The environmental degradation has become a topical issue, and conservation tops the agenda worldwide. Therefore, the objectives of the chapter include explaining the role/status of mining in Africa's development; identifying the investors; examination of the socioeconomic, political, and cultural transformations taking place in SSA mining and the environment; the positive and negative environmental impacts; and gauge whether the benefits outweigh the negative environmental impact. The foremost question is: why is mining associated with more negative impacts in Africa, and other developing regions?

Increased globalization has enabled the mining sector in Africa to attract foreign investment from big corporations and individual entrepreneurs. Most foreign investments have been in copper and gold mining, and oil extraction. Similarly, globalization has facilitated the migration of small-scale individual entrepreneurs to the African continent to engage in mining. African governments prioritize and depend on mining in their development strategies, and consequently, encourage foreign

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investment in the mining sector. Whereas foreign investment in African mining is critical to the promotion of socioeconomic development, it equally poses enormous environmental challenges. Therein lies the paradox of mining as a pole of growth and development, culminating in something as into the resource curse and making globalization, in the context of mining, a double-edged sword for the continent.

The chapter is organized into three parts: After the introduction is the literature review that discusses the theoretical perspectives establishing a relationship between globalization, mining development, and environmental impacts; and the situation in Africa. Some illustrations are drawn from countries that have received the bulk of the foreign investments since the twentieth century, and are politically stable, including Ghana, South Africa, and Zambia (Boocock 2002).

The chapter relies on a number of theories to discuss the links between globalization, mining development, and environmental implications. These are neoliberal theory of development, globalization, and political ecology, which, combined, explain the importance of mining and foreign investment, and associated environmental and social impacts. The literature review goes further to understand the nature of Africa's mineral wealth in general, and contribution to growth and development; and the context within which mining takes place.

10.2 Literature Review

This section focuses on theoretical perspectives and analyzes the environmental impacts of mining in SSA. The main theoretical framework is political ecology, which is supplemented and reinforced by theoretical arguments on development and globalization for comprehensive analysis. Political ecology is a contested concept because it has many definitions that include aspects of political economy, formal political institutions, and environmental change. However, there are commonalities among the varied meanings such as explanations of the relationship between nature and society, environmental degradation, local resource conflict, state conservation failures, and environmental narratives (Robbins 2012).

Renowned scholar, Robbins (2004, p. 12), defines political ecology "as an empirical research-based exploration to explain linkages in the condition and change of social/environmental system, with the explicit considerations to relations of power." In this light, political ecology exhibits two associated with environmental change, and alternative ways of doing things and addressing mismanagement and exploitation to ensure sustainability (Robbins 2012). Essentially, therefore, political ecology consists of two interlinked terms, politics and environment/geography that provide the framework for the political and social analysis of the use of natural resources and the environmental impacts in terms of the benefits and problems. Specifically, the framework analyzes the relationship between nature, the state, and society by highlighting the power differentials regarding the use of the environment, associated benefits and problems, and environmental sustainability (Mullenite 2014/15).

By referring to power, political ecology brings in the state which has the authority to determine the use of the environment and distributes the benefits and costs in society (Robbins 2012; Kronenberg 2013). In the African context, costs and benefits are allocated and distributed through patron–client relationship, under both democratic and nondemocratic political systems (van de Walle 2007). Further, political ecology points to the significance of the state, in terms of institutional, policy, and regulatory capacity, regarding the process of development, foreign investment, and environmental issues. It is in this context that Mullenite (2014/2015, p. 54), adopts Ioris' (2014) terminology of the political ecology of the state or environmental statehood that is symbolic of state-fix. State-fix is conceptualized as a complex balance between three types of interests: groups making up the state, society, and the environment which needs to be managed in a way that is acceptable to both groups of the state and society. Therefore, the state, according to Ioris (2014) reviewed by Mullenite (2014/2015, p. 54), "aims to respond to emerging environmental situations that affect society and economy, but only within the limits of the hegemonic political and economic priorities that shape environmental statehood." What is relevant in this respect, is the state's institutional, policy, and regulatory capabilities to delicately respond and balance the needs of special interests, society as a whole, foreign investors and the environment. This is exactly the biggest challenge for the state in SSA.

Bryant and Bailey (1997, pp. 28–29) identify three major and intertwined assumptions of political ecology which are relevant to Africa as a developing world: First, the costs and benefits related to environmental change, generally, are unequally distributed among actors. Second, unequal apportionment of the costs and benefits either deepens or lowers existing socioeconomic inequalities. Thus, in this context, concerns about the environment and development cannot be separated. Third, there is also the assumption that the unequal socioeconomic impact of the changing environment has implications for the power of actors. Therefore, environmental change enriches some actors while impoverishing others.

A fundamental assumption in political ecology is that "politics is inevitably ecological and that ecology is inherently political" (Robbins 2012, p. 3). This understanding of societal and ecological processes as being fundamentally intertwined calls for an integrated analysis of social and material dimensions of environmental change. For that, political ecologists emphasize the value of place-based study and methodological pluralism (Paulson and Gezon 2004). Furthermore, by focusing on how political economy systems and relations shape, and are shaped by, the environment and resources, scholars in political ecology illuminate the importance of multi-scale analysis (Bryant and Bailey 1997; Leach et al. 1999; Robbins 2012). Henceforth, such drivers of environmental problems, for instance land degradation resulting from mining are often observed and identified in the larger political and economic context rather than "blamed on proximate and local forces" (Robbins 2012, p. 13) such as population growth or inappropriate resource management practices. Following this, political ecology offers a rich repertoire of critical investigation and examinations of representations of "nature" and of dominant interpretations of environmental problems, including prevalent responses to

such problems (Escobar 1999; Adger et al. 2001; Paulson and Gezon 2004). Moreover, by focusing on access to, and control over, resources and social relations of production, political ecology illuminates the many and crucial tensions and conflicts in strategic interests, experiences, knowledge, and practices among and between individuals and groups socially differentiated by overlapping relations of power rooted in class, gender, race, and ethnicity (Paulson and Gezon 2004).

It is important to supplement the political ecology approach with the neoliberal theories of development and theories of globalization because of the need to explain development strategy that informs the mining sector and the resultant impact on the environment; and the (global) context within which mining takes place. The three frameworks, combined, provide a comprehensive and multidisciplinary analysis of politics, environment/geography, development, and globalization. Neoliberal paradigm, which emphasizes private sector-driven economic growth, free market with a market-friendly state, international division of labor based on comparative advantage, and liberalization of trade, has guided development, worldwide (Haque 1999). The idea of "trade not aid", popularized by President Bush Junior of the USA and Prime Minister Thatcher of the United Kingdom in the 1980s, made African states to turn to their comparative advantage in raw material production as part of the structural adjustment of their economies. This, in actuality, is the continuation of the inherited policy of dependence on raw materials for spearheading development in the post-structural adjustment era. Reliance on foreign investment underscores the lack of an indigenous private sector and local investors in SSA countries, another inheritance from the colonial era. Unfortunately, neoliberal's emphasis on export-led economic growth, trade liberalization, and foreign investment driven by profit maximization has meant that insufficient attention had been paid to the environment, thereby worsening environmental problems (Haque 1999).

Globalization provides the context within which to discuss political ecology and development. Globalization is a complex and contested concept, with multiple and far-reaching effects and has generated intense multidisciplinary debate (Baylis et al. 2014). There are numerous definitions and conceptual analyses, however, the primary preoccupation is with economic aspects such as privatization, liberalization of trade and finance, and internationalization and integration of production. In short, it is interdependence, interconnectivity, and integration of production and markets (Baylis et al. 2014). It is the highest stage in the development of global capitalism. Thus, globalization may be defined to emphasize three factors: First, the free flow of goods and services facilitated by modern communication and transportation. Second, the shortening of time and space such that occurrences in one part of the world affect other distant parts. Third, it is a historical process outlining transformations in all aspects of life, economic, political, cultural, social, legal, technological, and military.

However, one conceptualizes globalization, it is evident that it has major impacts on the current world economy, especially, in the areas of foreign trade, international investment, and finance while expanding openness and integration in all interactions at the global level (Baylis et al. 2014; Held et al. 1999). Intensification of globalization in the late twentieth century and, most especially, in the twenty-first

century provides an even freer context for the promotion of development in SSA, and increased awareness of environmental damage led to the push for sustainable development. Sustainable development calls for equal consideration of development and environmental issues with the adoption of international agreements, such as the Kyoto and Paris Climate Agreements Economic globalization has perpetuated the international division of labor among states and confined mineral producers to the periphery and margins in the global commodity value chain. This has intensified unequal trade to the detriment of mineral exporters.

10.3 SSA Mining Resources

Undoubtedly, mining has a significant positive impact as the production of raw materials is the cornerstone of the economy of most SSA countries. The production of minerals and oil is very critical in this context, with almost all SSA countries depending on a single commodity as the pole of growth, for export to generate revenue for socioeconomic development. Moreover, the majority of mines in SAA are foreign owned and undertaken by big foreign corporations, with some mining done by small companies or individual entrepreneurs. Small-scale mining may be both official and unofficial (illegal). The illegal mining operations are normally economically marginalized, unregulated, and employ harmful extraction methods to mine mostly diamonds and gold (Edwards et al. 2014).

Africa is estimated to contain 30% of the world's mineral resources, most of which remain unexplored and, currently form the basis for a lot of optimism for a mining boom in the region (Edwards et al. 2014, p. 304). The Mining Indaba held in South Africa in 2018 anticipated a mining boom for SSA producers. Such forecasts are spurred by the increased flow of foreign investment to SSA mining sector which has raised the prospects for improved economic growth and development conducive to poverty alleviation. The huge infrastructural foreign investment that accompanies mining, boosts further the prospects for good economic performance. These include the building of roads and railways from mines to smelters and ports for export to the world market; and hydroelectric dams as sources for electric power supply to the mines (Edwards et al. 2014).

The African mining sector remains attractive to foreign investment for a number of reasons. Neoliberal orientation of privatization, deregulation, and open economies have made African mining attractive to foreign investment. Inflows of foreign investment into Africa from Western countries were first triggered by the policy of privatization, especially, of state-owned enterprise in mining and manufacturing as part of an economic restructuring. However, the upsurge in flows of foreign investment to SSA, as Haque (1999, pp. 204 & 208) argues, is due to "… the availability of their undervalued privatized assets and cheap {labor}, … minimal environmental standards and requirements: it is much easier and cheaper for foreign companies to marginalize pollution and restoration costs in developing countries in the process of producing industrial goods. There is evidence, for example, that the

adoption of neoliberal policies in Ghana, Tanzania, and Zambia has resulted in significant increases in foreign investment in the mining sector (copper, oil, gold), with corresponding increases in environmental degradation." Additionally, the abundance and unexplored mineral resources make the SSA mining sector irresistibly attractive to foreign investment inflows (Edwards et al. 2014).

10.3.1 Mining Industry and Environmental Impacts—Positive and Negatives

Africa is rich in mineral resources. However, it remains (one of) the poorest regions of the world. This is a paradox. To understand its rich and diverse resources, there is a need for the classification of ore mining, as each has a different value and impact on the environment. This includes metals such as copper, gold, silver, iron, bauxite, uranium, nickel and platinum; mineral fuels such as oil, gas, coal, and shale oil; industrial minerals such as phosphate, asbestos, and salt; and construction minerals such as sand, gravel and stones. They also share the same processes of exploration, mining, processing, transportation, and consumption. Some minerals such as diamonds and gold have high economic value. The mining chain creates linkages between the producing and consumption markets, which currently show a high demand for African mining exports, especially, by China.

Both positive and negative impacts accrue from mining operations. The positives are mostly economic as growth poles and promotion of development, employment creation, revenue, and foreign exchange; and physical infrastructure that enhances growth. Unfortunately, although mining development provides the potential for growth in terms of Gross Domestic Product (GDP) and development, the state lacks the institutional capacity, policy and regulatory framework to handle the enormous flows of investment into the mining sector and environmental impacts (Edwards et al. 2014; Haque 1999). Therefore, in spite of the huge revenue earned from mining sectors, states have no or inadequate institutional capacity to formulate and implement or enforce policy and regulations to manage and control the environment within which mining takes place.

State incapacity is made worse by poor governance, the corruption, and politics of patronage which invite social protests, sometimes resulting in the death of mineworkers. The Marikana massacre of 34 striking mineworkers in South Africa was a result of the standoff between striking miners against the South African police, with the police sanctioned to shoot protesting miners to protect mining companies' interests (Edwards et al. 2014; p. 303). Zambian miners have been subjected, occasionally, to shooting by Chinese owners of copper and coal mines on the Copperbelt, Solwezi, and Sinazongwe (Collum Coal Mine). Most significant of these shootings took place in 2010 and 2012 (Sautman and Hairong 2014), and most recently in 2017. The Zambian state has been slow to prosecute offenders. For example, attempted murder charges against Chinese managers of Collum Coal Mine were dropped, and this might have been construed as shielding Chinese

investors. It should be acknowledged, however, that Zambian striking miners killed a Chinese manager at Collum Coal Mine in 2012 (BBC News 2012). Both the South African and Zambian situations reflect the power differentials between foreign mining corporations and hapless miners, and the "state-fix" which tilts to foreign investors at the expense of local mine workers.

10.3.2 Mining and Environmental Degradation

Negative environmental impacts are both direct and indirect. The extent of environmental damage is a manifestation of the degree of state's incapability to manage the environment to ensure sustainable development. Mining has the most direct effect on the environment while indirect effects emanate from infrastructure that accompanies foreign investment in mining, such as roads, railways, ports, and harbors; and mining settlements pose the second biggest threat to land, soils, forests, and water bodies. The direct negative impact of mining on the natural environment occurs in areas where mining operations take place and are done through four major ways.

First, it is through the destruction of the land area. Negative impacts take place at any phase of the mining process (Edwards et al. 2014; Davies 2012; Boocock 2002). Thus, exploration, extracting, ore processing, plant operation, processing of waste, and transporting minerals, all have a serious negative impact on the environment and humans, especially, those residing in the immediate vicinity. For example, dumping of mining waste affects soils, and transporting of ore causes air pollution that affects the health of humans. Mining areas are easily identified by the heaps of waste dumps. Additionally, drinking water was seriously polluted when the Chinese mine owners dumped mining waste into both the Kafue river in 2006. Second, acid mine drainage is a very serious problem in SSA mines. It is the process of managing the outflow of acid water from the mine. It is a major problem at abandoned mines due to sulfide mineralization. When iron sulfide materials are exposed to air and water, they are converted into soluble sulfide acid and to iron compounds, which, in the long run, might become highly toxic to both the environment and humans, especially, since it renders water unfit for use (Davies 2012).

Third, abandoned mines have negative consequences. They contribute to acid mine drainage, surface and groundwater pollution, soil contamination, loss of productive land, siltation, contamination of aquatic sediments and fauna, risks posed by abandoned shafts and pits, and landslides due to the collapse of waste and tailing dumps (Davies 2012; Boocock 2002). There have been incidents of children falling into abandoned mines which they use as playgrounds.

Fourth, is the tendency of downsizing, degazetting, or rezoning a protected area to enable mining to take place. This results in loss of land to mining which is given priority to the detriment of the farming communities, another indication of power dynamics that shape the use of land resources by the state. For example, it is alleged that the government of Botswana moved the Basarwa (the Bushmen) from their game reserve to pave the way for diamond mining.

Fifth, other negative impacts of mining include the building of roads, railways, and ports; settlement for those who have been displaced; construction of townships for mine workers, and rural–urban migration in search of jobs at the mines. The rural–urban migration has led to rapid urbanization in countries like South Africa and Zambia with high-population density in mining cities. Moreover, rural–urban migration has other negative consequences in both urban and rural areas. Mine employment accentuates inequalities between mine and non-mine wage earners, and distorts livelihoods through increased cost of living. Rural areas lose active labor, thus affecting farming (Davies 2012).

Indirect negative impact of mining is mostly manifested through the extracting processes that push existing population into sparsely uninhabited areas, which in turn puts pressure on indigenous land use. Another indirect negative impact is in the form of growth of settlements on the outskirts of mining areas which puts pressure on the environment. Lastly, corruption, plus poor governance, are identified as indirect negative impacts of mining as vast revenues from mining give rise to misuse and inability to respond to the needs of the poor. Poor governance also translates into incapacity by the state to formulate, implement and enforce "mining-development" controls and give foreign investors leeway for unabated exploitation of natural resource with the danger of depletion within a short time period. These, in turn, would give rise to political protests by those who are not benefitting, thereby undermine political stability (Edwards et al. 2014, p. 304).

10.4 Methodology

The chapter adopted the mixed quantitative–qualitative methodology to provide a wholesome understanding of the nature of mining and environmental impacts in SSA. **S**econdary data sources were drawn from studies done with quantitative and qualitative analysis of environmental impacts. Quantitate analysis employs some statistical analysis and qualitative data were generated through content analysis of studies on mining and the environmental impacts. This, essentially, means surveying the various documents.

Quantitative multivariate model of investigation and analysis of natural resources, to a degree, confirm part of the scare resources stance and that of the abundant resource war/conflict school of thought. The chapter employs Cohen's (1960) Kappa statistic or Kappa Coefficient test of reliability in meeting its main objective. This is, how many times a particular secondary source material makes references to the content inherent in these noted variables: (i), Foreign Direct Investment; (ii), Development/al; (iii), Negative (Environmental degradation); (iv), Social aspects (local community welfare); (v), Benefits (physical infrastructure); (vi), Institutional capacity; (vii), Regulations; and (viii), Political ramification (governance) under review. Based on this, "reliability" is calculated utilizing Cohen's (1960) Kappa, which approaches 1 when coded as perfectly reliable and 0

when there is no agreement other than what would be expected by chance (Haney 1977). Cohen (1960) defined and computed the Kappa Coefficient as follows:

$$k = \frac{P_A - P_C}{1 - P_C} \tag{10.1}$$

where:

P_A Proportion of units on which the raters (source of information/data) agree.
P_C The proportion of units for which agreement is expected by chance.

Source: Cohen (1960).

The interpretation of Cohens' (1960) Kappa Coefficient of reliability test is based on Table 10.1.

Lasswell (1949, p. 47) makes clear his position in a choice between handling historical and social problems "with more exact methods" and "with precision" versus the alternative of a purely "qualitative, impressionistic and conjectural" approach. By the time, the author opens his concluding paragraph with the succinct question, "Why, then, be quantitative about communication?" the reader has little doubt about Lasswell's (1949: 52) answer: "Because of the scientific and policy gains that can come of it." The advantage and strength of quantitative measurement and analysis are buttressed by the words of Lord Kelvin: "when you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot—your knowledge is of meager and unsatisfactory kind" (Kelvin 1889, p. 130).

In addition to the quantitative modeling, the method of content analysis applicable to qualitative approach is used in the analysis of the presented datasets. Kondracki and Wellman (2002) espouse that the process of quantification is an attempt not to infer meaning but, rather, to explore usage. Analyzing for the appearance of a particular word, phrase and/or content in the textual material is referred to as manifest content analysis (Potter and Levine-Donnerstein 1999). As such should the analyst stop at this point the analysis would be quantitative and thus, focusing on counting the frequency of specific words or content. Henceforth, in this study, the focus is on discovering the underlying meaning and implications of the words and/or the specific content (Chambliss and Schutt 2010; Babbie 1992; Morse and Field 1996).

Table 10.1 Cohen's Kappa statistic interpretation

Kappa statistic	Strength of agreement
<0.00	Poor
0.00–0.20	Slight
0.21–0.40	Fair
0.41–0.60	Moderate
0.61–0.80	Substantial
0.81–1.00	Almost perfect

Source Landis and Koch (1977)

Table 10.2 Descriptive statistics of variables in sample

Content	World Bank/ IMF	Central intelligence agency	Africa mining report	World gold council report	World conservation congress	Adjusted count
FDI	3	4	10	5	2	24
Development	3	1	8	3	2	17
Social aspect	7	4	9	5	3	29
Benefits	7	4	7	3	4	24
Inst. Capacity	6	6	7	3	2	24
Negatives	8	5	10	4	5	32
Regulations	4	4	8	4	5	25
Governance	7	4	8	3	3	25
Total						200

Source Africa Mining Report (1995–2015a, b); Central Intelligence Agency (1995–2015); International Monetary Fund (1995–2015); World Bank (1995–2015); World Conservation Congress (1995–2015); World Gold Council Report. (1995–2015a, b).
Note (i) Foreign Direct Investment; (ii) Development/al; (iii) Negative (Environmental degradation); (iv) Social aspects (local community welfare); (v) Benefits (physical infrastructure); (vi) Institutional capacity; (vii) Regulations; and (viii) Political ramification (governance) under review

The data-sets for this study are sourced from international organizations' annual report and publications from the time period 1995 to 2015. The sampling frame comprises of both print and electronic media, obtained from the World Bank/ International Monetary Fund (IMF) annual reports; Central Intelligence Agency (CIA) annual World Factbook; Africa annual Mining Reports; World Gold Council Annual Reports; and the International Union for Conservation of Nature (World Conservation Congress—Environment and Society Portal) Annual Reports. According to Miller and Brewer (2003) a sampling frame is defined as the set of source materials from which the sample is selected. Based on the techniques of systematic sampling:

$$r, r+i, r+2i, r+3i \tag{2}$$

R is randomly selected from 1 through i until the frame is exhausted (Scheaffer et al. 2006; Levy and Lemeshow 2008). Therefore, out of 50 electronic and print secondary sources (interval = 10) with 200 entries divided by the noted content variables relative to the main objective of the chapter were selected for investigation and analysis in Table 10.2.

10.5 Findings and Discussions

The presented datasets in Table 10.2 above is guided by the paradigm of political ecology, neoliberalism and the processes of globalization in achieving the objectives of the chapter which include explaining the role of mining in Africa's

development; identifying the investors; examination of the socioeconomic, political, and cultural transformations taking place in SSA mining and the environment; the positive and negative environmental impacts; and gauge whether the benefits outweigh the negative environmental impact.

FDI in the mining sector within SSA has a substantial and almost perfect Kappa Coefficient result of .67. This confirms the huge FDI in the economies particularly, the mining sector. Chinese investment in African mining is said to have "quadrupled from US$25.7 billion in 2000 to US$103.4 billion in 2009" … and "Australia's investment approximated US$45 billion" (Edwards et al. 2014, pp. 302–3. It has been argued and pointed out that "such investment is historically unprecedented in African natural resource development" (Edwards et al. 2014, p. 303). However, it is clear that the Democratic Republic of Congo (DRC), for example, took "market share" from other countries by maintaining more than US$300 million exploration expenditure for three years in a row from 2014 (Woods and Lane 2017).

The mining sector forms the backbone of most SSA economies. For example, three quarters of Zambia's exports are derived from mining, primarily copper, followed by cobalt (Boocock 2002). It contributes substantially to economic growth through exports, generation of revenue, and infrastructure development. Impressive growth rates placed SSA countries among the highest growing economies in the world in the 2000s. These included mineral-producing countries such as Ghana, Tanzania, and Zambia (World Bank 2015).

On the development front, the computation resulted in a moderate Kappa Coefficient of .55. Although there has been substantial investment in the mining sector, this has failed to spur economic growth and development in SSA. The institutionalization of neoliberal policies within the processes of economic globalization led to the opening up of the SSA economies with a focus on the extractive sector—mineral exploitation and development. Increased pace and rate of mineral exploitation by multinational corporations have not helped the host nations in SSA; it has contributed to the stagnation of their development. Not only do multinational corporations exploitation of minerals lead to the development of enclave economies but also, increased profits are repatriated to home countries instead of using it to develop the economies of SSA.

The international edition of the Guardian newspaper in 2017, reported that African economies received US$162 billion mainly in loans, aid, and personal remittance. However, in the same year, US$203 billion was taken back from the continent, either directly through multinational corporations repatriating profits and illegally moving money into tax havens and/or by costs imposed by the rest of the world through climate change adaptation and mitigation. The net result was an annual deficit of US$41.3 from 47 countries where, many and if not most, of their citizens remain trapped in a vicious cycle of poverty. Therefore, contrary to the widely held view that abundant strategic natural resources aid economic processes of growth and development, empirical evidence shows that countries that are solely dependent on the foreign exchange earnings from the export of primary resources such as minerals are at higher risk of political, economic instability, and hence, conflicts (Ross 1999; Collier 2000).

Most of the countries in SSA have relatively weak infrastructure network systems. This chapter computed the result of .54 which conveys a moderate outcome on the variable infrastructure. The proposed infrastructure development is substantial in some cases, including roads, railways, power plants, and ports. The quest for export diversification in the respective economies has encouraged mineral resource exploitation. A growing trend toward companies offering to build the necessary infrastructure, to a degree, has taken the burden off host countries with already limited infrastructure investment to pour much needed funds into development used primarily for mining. Several prominent public–private partnerships or private concession projects related to infrastructure development signal a trend of partial privatization in several host countries within SSA.

Infrastructure development remains one of the biggest threats to protected areas, resulting in the degradation of forests by opening access to otherwise intact and remote areas. Moreover, infrastructure development presents an additional threat to forests and freshwater ecosystems, not only through the permanent loss of wildlife but arguably even more through physical incursion into forests and the disruptions to wildlife habitats. Direct impacts from mining and logging entail deforestation that encompasses the following: the site covered by roads, mines, excavated minerals and earth, equipment, and settlements associated with the mining activities. Indirect impacts from mining or logging can pose a greater threat to habitat degradation (Reed and Miranda 2007, p. 2). Moreover, infrastructure investment comes at a cost. The infrastructure-for-investment arrangement preferred by Chinese investors mortgages Africa's resources on a long-term basis, and raises questions of the fairness of such deals for African economies.

The adverse effect and impact of the paradigm of neoliberalism and globalization are felt and seen by the increasing environmental degradation in SSA countries. A substantial computed Kappa Coefficient score of .66 is recorded on the variable of environmental degradation. Although contributing immensely toward economic growth and public finance, mining has equally led to enormous negative environmental impacts. In a nutshell, this reinforces the notion that mineral endowments do not in the very long run lead to sustainable development that provides equitable distribution. Rather, in most cases, they hinder inclusive development and is thus, responsible for environmental degradation and persistent poverty, sometimes leading to social unrest and conflict. SSA economies have enjoyed huge mining revenues from as far back as the late 1960s; however, its per capita GDP is presently among the lowest in the comity of nations. For instance, Ghana's economy is expanding at a commendable growth rate as a result of increased mining activities. However, according to the World Bank (2007), Ghana's natural resources, upon which so much of the country's economic activity and the population's livelihood depend, are being depleted at an alarming rate.

Negative environmental impacts surmount positive effects of the mining sector. All phases of mining have adverse impacts on the environment because of air pollution, soil contamination and land degradation, water pollution, and pollution in food due to chemicals used in exploration, extracting, and processing. Studies about South African, Ghanaian, Zambian, DRC, and Namibian gold, copper, cobalt, and

uranium mines, respectively, testify harmful effects to the environment and health of mercury and sulfur dioxide (World Bank Group 2015; Cukrowska et al. 2012; Ettler et al. 2012; Nkulu et al (2012); Boocock 2002). Waste from the mines has made the soil unfit for agricultural production, and what is produced as well as fish, the Zambian Copperbelt, for example, unfit for human consumption. In 2011, the Konkola Copper Mines on the Zambian Copperbelt was found guilty of polluting the land, and water in the Kafue and Zambezi Rivers in 2006, which caused severe sickness and deaths of residents (World Bank Group 2015; Foil Vedanta 2016a, b). Ghana is experiencing "severe environmental problems, primarily caused by artisanal mining (Boocock 2002, p. 14; Hilson 2001). Illegal small-scale mining in Ghana, popularly known locally as "galamsey", has caused extensive damage to water and land that the country might face the possibility of importing water in the future. Chinese and local miners are heavily involved in galamsey.

The computed result of Kappa Coefficient of .63 depicts a substantial response on the variable social aspect in the form of local community welfare. The chapter brings to light the importance and concerns of local communities' assumptions about the world and their place in it and the very different positions within the forces of globalization. The chapter suggests that local community members contend with the impact of environmental challenges that they did not authorize and do not benefit from. There is emerging struggles and politics of power over mining in between the state, local community and the multinational corporations within the international political system. An indication and manifestation of the structural element of power and scale as shaped by both structural configuration and power within each sector alongside the agency of all three different actors across multiple scales and/or levels.

Socio-spatial processes change the importance and role of certain geographical scales, reassert the importance of others and, on occasion, create entirely new scales. The continuous reorganization of spatial scales is an integral part of social strategies to combat and defend control over limited resources and/or a struggle for employment (Swyngedouw and Heynen 2003, p. 913). Environmental conflict in recent times has been associated with how struggles over shrinking environmental resources—as a result of overuse, unfair distribution, misuse or degradation—build up the stresses which trigger conflict. According to Homer-Dixon (1996, p. 359), "Scarcities of environmental resources—in particular cropland, fresh water, and forest—are contributing to mass violence in several areas of the world. While these "environmental scarcities" do not cause wars between countries, they do sometimes aggregate stresses within countries, helping stimulate ethnic clashes, urban unrest, and insurgencies." Moreover, multinational entities equally contributed to the emergence of social class structure in their respective host states. Some schools of thought argue that the existence of these oligopolies led to a change in economic base and structure of nations including SSA. The shape, the values, tastes, and attitudes of the average SSA citizen is undermined through aggressive advertising and inside information about the market (Chuwuemeka et al. 2011).

On the dimension and variable of institutional capacity, the computation resulted in a moderate Kappa coefficient of .53. Although, SSA is well endowed with

mineral resources it is challenged by the technical knowledge on how best to integrate it into the broad stream of economic development activities. It has the world's largest mineral reserves of platinum, gold, diamonds, chromite, manganese, and vanadium (Africa Review Report on Mining 2009). However, it has weak political will and capacity to enforce legislative framework pertaining to mining. Indeed, in spite of the fact that SSA countries have environmental laws, such laws and standards are not as stringent as the international ones (Shinn 2015). Thus, Wells (1990) noted that the power of multinational corporations lies in their productive capacity, financial resources, investment, and being transnational economic actors. Eze (2011) also argues that multinational enterprises tend to bring down economies overnight. A few clicks of a computer mouse can devalue a nation's currency very quickly, wasting away the life savings of millions of breadwinners.

The resultant Kappa coefficient of .57 manifests a moderate variable of political ramification (governance) under review. The chapter's findings, collaborate other studies that show that there is a correlation between natural resource endowment and corruption. This may stem from natural resource revenues being easy to control and monopolize by political elites (Boix 2003; Bueno de Mesquita and Smith 2009; Edwards et al. 2014), in turn reducing incentives to provide accountability and transparency. Moreover, such high-rent activities yield available funds for patronage and unofficial transactions. Expectedly, resource-abundant countries engender a political state that is factional or predatory and distorts the economy in the pursuit of rents (Auty 2001, p. 839). It is even worse in resource-dependent economies, where governments have weaker incentives to invest in costly monitoring and control institutions for detecting and punishing corruption. Indeed, leading government actors may themselves benefit from bribes relating to control over resource production and exports (Meredith 2006). Hence, corruption should be positively related to natural resource abundance and, in particular, dependence.

10.6 Conclusion

The chapter has used the theoretical frameworks of political ecology, neoliberalism, and globalization to explain the role of foreign investment and mining in Africa's development. China has emerged as the most significant investor in mining and associated infrastructure development in most SSA countries, followed by other BRIC, and Canada and Australia. It is evident that in spite of the massive flows of foreign investment to natural resource-endowed Africa, which has contributed to growth, development remains elusive with the majority of the population still mired in poverty. The negative impacts of mining on the environment and health have contributed to unsustainable development. Lack of political will, corruption by the elite, weak environmental laws, and regulatory frameworks have compounded the exploitation by multinational corporations and environmental degradation. The capacitation of the state and political reorientation of the political leadership are required for proper management of mining and environment.

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Part VI
Branding, Consumer Culture and Innovation

Chapter 11
The Hegemony of Global Brands: Brands, Globalization, and Local Cultures

Umashankar Venkatesh

11.1 Introduction

Marketers everywhere work toward the objective of identifying gaps in customer needs and wants that they may be able to fill before or better than others, given their resource capabilities and demand potential—both current and future. All this obviously is activated within the broad contours of the mission and vision they may have identified for themselves and their strategic intent.

One of the vehicles to articulate such an aspiration and strategy is to build brands, which have been validated as a very crucial but intangible resource for marketers, that significantly contributes to superior firm performance (Hunt and Morgan, 1995; Capron and Hulland 1999; M'zungu et al. 2010; Jordaan 2014) and is a source of comparative advantage for the firm (Barney 1991). Brands are considered as the "lifeblood" of companies, enabling them to—generate market share, increase customer loyalty, amplify channel power, generate bigger profit margins, and helping to guard against competitive attacks (Steenkamp 2014). To conclude on the strategic relevance of branding to marketers, the authors have gone on to posit that—"perhaps the most distinctive skill of professional marketers is their ability to create, maintain, enhance, and protect brands" (Kotler and Keller 2007: p. 157).

The brand edifice is usually conceived to portray the marketer's commitment in a given context, by embedding them with values that the brand owner believes would appeal to their target customers and align with their ideal/real self and/or private/social self (Belk 1988; Kleine et al. 1993). For instance, marketers have frequently attributed and imbued a brand personality to their brands to stand apart from competing brands successfully (Halliday 1996; Aaker 1997), with brand personality being considered as the central component of brand identity (Aaker 1996).

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Almost every brand created and communicated about by marketers, rests upon rational as well emotional foundations with perceived benefits across both the categories helping build consumer salience and hence franchise. While defining a brand within a consumer-oriented perspective, brands represent the promise of the bundles of attributes that consumers purchase to achieve need fulfillment. The attributes that make up a brand may be real or illusory, rational or emotional, tangible or invisible (Ambler 1992). Additionally, brands are also increasingly needed to reflect a social dimension (Thompson 2012), which again indicates to how "values" embedded in brands are relevant and when aligned with customer aspirations, crucial to defining the brand's salience for the consumer.

The premise of this chapter is to evaluate if global or "foreign" brands have the powers to modify existing values; or are successful in introducing new values hence rituals within the culture of markets they choose to target. The thesis here is to explore if global brands are a more potent force for cultural change in emerging economies as compared to more or fully developed markets.

11.2 Manifestations of Culture

Culture is an envelope which cocoons our very existence and manifests itself in all the artifacts that human beings create and the values, customs, rituals, norms, taboos, beliefs, social behavior, etc., that prevail in the society at a given point in time.

"Culture" is considered to be one of the most complex and confusing terms to define. There are multiple prisms through which the concept of culture has been explored and interpreted. Kroeber and Kluckhohn (1952) collated and categorized the definition of culture in no less than six primary categories as

1. Descriptive definitions of culture which view culture as a system encompassing customs, beliefs, knowledge, laws, and means of expression in a society.
2. Historical definitions of culture which view culture as for how generations progress and continue from one to the next.
3. Normative definitions of culture which try to explain how value systems prevalent in a society gives shape to social and personal behavior.
4. Psychological definitions of culture which explore the role of culture in defining and shaping interpersonal relations.
5. Structural definitions of culture are concerned with explaining the relational aspects of cultural components through abstraction.
6. Socio-genetic definitions of culture, focusing on the genesis and continued existence of a culture.

In his celebrated work Williams (1976) posits that the term "culture" has three divergent and more importantly, competing meanings, i.e,—(i) Culture as a process of individual enrichment—wherein one learns or acquires knowledge and ensuing habits and perspectives that lead to social and/or spiritual uplift; (ii) Culture as a

group's particular way of life—relating to values and norms and how they manifest themselves in routine and rituals of life and living; and (iii) Culture as an activity—pursued by means of reading literature, listening to music, watching movies, visiting museums and monuments, etc.

Culture thus can be seen as the manifestation of the common meanings of symbols and artifacts for individuals in a society; their pattern of practices in different situations; and their commonly held value systems. On the other hand, it can be construed as the complement of activities and objects through which meaning is generated and circulated in a society. To wit, Hofstede (2001: p. 5) concluded culture as being the

> … collective programming of the mind which distinguishes the members of one group or category of people from another.

Whereas, Spencer-Oatey (2008: p. 3) posits culture as the—

> … fuzzy set of basic assumptions and values, orientations to life, beliefs, policies, procedures and behavioral conventions that are shared by a group of people, and that influence (but do not determine) each member's behavior and his/her interpretations of the "meaning" of other people's behavior.

In the context of studying culture and its possible impact on marketing in general and consumption behavior in particular, what is most important is that certain characterizing features of culture make it an attractive construct for marketing practitioners. The more notable ones of these characteristics are that

- Culture is learnt and is subject to change albeit gradually. Hence, the hope for marketers to shape consumption behaviors by appealing to target markets by (say) using or portraying values that may be alien to the target market's culture but is presented to the populace as a more contemporary or ethical or superior set of values than what they may be currently subscribing to.
- Apart from the visible manifestations that a culture represents such as—Literature; Architecture; Food Habits, etc. (Herman and Kempens 1998), there is an invisible dimension of a culture consisting of the predominant and shared values or social norms (Hannerz 1992). Marketing practice more often than not takes cognizance of this, aligning its marketing mix-related decisions to reflect (or in some cases, contradict or question) the prevalent societal values, for instance, for securing marketing communication or targeting outcomes.
- Culture is equally an individual, psychological and social construct and is both psychologically and socially distributed in a group. This has obvious connotations in marketing for instance—in the context of segmenting and targeting specific collectives or groups using distinctive positioning strategies.
- Finally, individuals in a culture are usually members of—or aspire to a membership of—different cultural groups at any given point in time. This further provides marketers with a fertile ground to present new propositions, which promises the target markets a possibility to achieve association and identification with their aspirational groups.

One of the significant features of cultures is how they are drivers as well as representations of social stratification. Traditional societies have been stratified since yore on the bases of the clan; tribe; lineage; slavery (ownership of people); estate system (control of land); and caste. Societies are classified as "closed" or "open" societies on the basis of—whether vertical mobility is possible and allowed in such societies or not. Closed societies, virtually do not allow any opportunity for an individual to move up (or down) the social class ladder whereas open societies may manifest more vertical mobility.

As a case in point, in a society like India, caste has been a predominant basis of stratification, wherein parentage and family of birth determines to which unequal group a person will become a part of, based on their parents' status, and where they would remain for the rest of their lives (Kerbo 2009). However, in his seminal work on religion and society in India, Srinivas (1952) has concluded that—the caste system (among Hindus) as being not really a rigid system wherein the position of each component caste is fixed permanently. He reported that movement has always been possible (though theoretically forbidden), especially in the middle regions of the hierarchy, wherein a low caste is able, in a generation or two, to rise to a higher position in the hierarchy by adopting rituals and pantheon of the higher castes(e.g., behavior and rituals as—vegetarianism and teetotalism). He called this process of upward mobility as—*Sanskritization*.

In a later work comparing this process of *Sanskritization* with Westernization, he interestingly observes a contradiction of modern Hindu social life in India, wherein he had found that while the *Brahmins* (higher caste) were becoming more and more Westernized, the other non-Brahmin castes were becoming more and more *Sanskritized*. In doing this, the lower strata castes were "faking up" customs that the Brahmins were busy discarding. He concluded that as far as these castes were concerned, *Sanskritization* seemed very much to be an essential preliminary to Westernization (Srinivas 1956, 1966).

Overall, therefore it transpires that new or modified behaviors and rituals that are adopted by individuals in a given cultural milieu are aspirational, mostly motivated to transition from one stratum to another—signifying upward social mobility and hence engineering a departure from the existing milieu, defined by distinctions of class, status, gender, age, and occupation.

11.3 Culture and the Consumption Ritual

The discussion above does point to the fact that part of the vertical mobility across social classes in an old and tradition-rich society like India is something that is actioned by—the changing of behaviors and rituals, definition and acquisition of assets, pantheon, etc. This also can safely be deduced, therefore, that consumption (and avoidance as well) of certain goods and services is correlated with this concept of vertical mobility across classes in a given culture. For instance, based upon the meaning and intent of the process of *Sanskritization* postulated by Srinivas (1952),

people in a given class of society may and do try to move up the social class hierarchy in a particular milieu by affecting changes in their behavior in terms of adopting (or discarding)—patterns of behaviors and rituals including consumption of goods and services.

Based upon consumer behavior research, Arnould and Thompson (2005) have conceptualized a term—"consumer culture theory" (CCT), referring to a set of related theoretical perspectives that addresses the dynamic relationships between consumer behavior, the marketplace and cultural meanings. They consequently define consumer culture as

> …a social arrangement in which the relations between lived culture and social resources, and between meaningful ways of life and the symbolic and material resources on which they depend, are mediated through markets." (Arnould and Thompson 2005: p. 869)

The preceding definition of consumer culture clearly indicates the mediating role of markets, and hence brands, in creating and satisfying—different and aspirational meanings of consumption across various categories of products and services.

The purchase and consumption of consumer goods may largely be seen as being driven by their utilitarian and commercial value considerations. However, this consumption is largely governed by its appropriateness within a given cultural context; and the ability of the said goods to carry and communicate cultural meaning (Sahlins 1976; Douglas and Isherwood 1978). Consequently, commenting upon the structure and movement of this cultural meaning of consumer goods, McCracken (1986), posits the cultural meaning of consumer goods as being mobile and he reports this meaning as constantly to be "in transit". He infers that as far as consumption of goods is concerned, the cultural meaning thereof is drawn first from a culturally constituted world and transferred to a consumer good, which then is subsequently passed on from the object to an individual consumer. The following conclusions of his are of great relevance to the theses being developed in this chapter, that—(i) cultural meaning, in the context of consumer goods, resides in three locations, namely—the culturally constituted world; the consumer good per se; and the individual consumer; and (ii) the means through which (cultural) meaning is drawn out of and transferred between these locations, are—the consumer rituals; advertising, and the fashion system.

What therefore can be asserted is that cultural meaning is encapsulated and conveyed by-products/goods (hence brands) to an individual consumer through—appropriate value proposition design; positioning strategy; and marketing communication (or the overall brand building strategy). This transmission of cultural meaning would effectively mean changes in the consumer rituals and fashion system reflecting a reshaping of existing underlying values and norms; or learning of new values not earlier present and/or manifested in existing rituals. A simple example of how a new consumer ritual can be introduced is—the case of how marketers in India have successfully promoted the concept of celebrating a day in

the calendar coined as—Mothers' Day[1]—as a day signifying one's love for her mother. This is a contrivance that was nonexistent earlier in this form in India and has been propagated by brand owners and marketers, who have built a new narrative in a society where an earlier generation common Indian citizenry would have no cognizance of such a day.

Rituals have an important role in consumption occasions and have been traced back to ancient human civilizations as well as being evident in contemporary times (Tannahill 1995). For instance, even in modern India there exists in certain communities—distinct rituals around consumption of food of certain type on certain dates, ranging from—absolute fasting; not eating certain types on certain (auspicious) days or even different times of the day; and then to slaughtering and consuming animals to a deity as a devotional offering.

Rituals have been conceptualized as—expressive and symbolic activities that often include repeated and unusual behaviors occurring in fixed, episodic sequences (Rook 1985; Vohs et al. 2013). In the anthropological context, rituals are supposed to be gateways through which individuals may pass through to assume a different social identity, motivated usually to create a persona that is liberated from past or existing restrictions that once limited their actions. In a marketing context, this transition is facilitated through ritual guides, symbols, and stories, enabling the consumer who is led through this ritual process to make purchases of and claiming "authentic" or rightful ownership over products that might have been seemingly inaccessible to them earlier. Thus, a marketing strategy that understands and integrates rituals and their cultural meanings within its design—induces people to adopt new patterns of purchase and consumption by guiding them through psychological and social transformations which the target segment could not embrace merely by intent and effort.

Vignette:

For instance, in the Indian context across many of its sub-cultures - a young man living with parents even after getting married is perceived natural and is almost a given fact. In such a milieu, values pertaining to independence and privacy are relatively seen as subservient to the norms of duty and responsibility. Enters a Bank in this scenario, with a marketing communication campaign built around a story of how a young couple in such a family situation is forced to behave (abnormally) – almost as brother and sister – and cannot display overt feelings of love while at home and how an easy home-loan facility can remedy this and how this is the new normal. This is to facilitate a social and psychological transformation of inducing independence by inserting and validating a new norm in a given milieu and thus changing consumption behavior.

McCracken (1986) evocatively writes how a ritual is a social action intended to manipulate cultural meaning for purposes of collective and individual communication and categorization. While discussing how cultural meaning is transferred

[1]The origins of Mother's Day date back to ancient Greek society. The ancient Greeks dedicated an annual spring festival to Maternal Goddesses and ancient Romans also celebrated a spring festival called Hilaria, which was for a Mother Goddess called Cybele (Gill 2018).

specifically from "goods to individuals", he classifies rituals across four types, namely—Exchange, Possession, Grooming, and Divestment rituals.

In the exchange ritual, i.e., when one exchanges a product with another, maybe as a gift or in one's normal duty as a provider (say parent to children), often the giver chooses a particular brand/type of product which she considers as incorporating the meaningful properties she wants to be transmitted to the receiver. What is considered in any such event as "appropriate" is largely an outcome of cultural values and norms considered acceptable in that milieu. A contrarian value may similarly be also exhibited by deliberately selecting a product that symbolizes a value opposing a norm—for instance, in the Indian context—gifting a box of chocolates instead of the customary traditional Indian sweets during a festival like *Diwali* (the festival of lights, celebrated by Hindus across India). Another example is the more recent urban sensibility in middle and upper income group India, based on the perception of how relatively unhealthy traditional sweets are and, therefore, how these should be replaced with something healthier, say a box of dry fruits or nuts (Ramkumar 2015).

The possession ritual as far as consumer products are concerned, facilitates the consumers to stand apart or identify with a milieu by discriminating between cultural categories as—class, status, occupation, lifestyle, gender, and age (Douglas and Isherwood 1978; McCracken 1986). The ownership of products per se communicates different cultural meanings. For instance in India, before the 1990s having a terrestrial phone at home was a significant status symbol. Even today, owning a house of one's own is a clear indicator of stability and status, with millennials in India wanting to own a home earlier rather than later in their lives (Jain 2016). This is clearly visible in developing economies like India and China where per capita incomes are rising to fuel aspirational purchases as a symbol on part of the consumers signifying their having gatecrashed into a different (higher) strata. A clear indicator is the growth in luxury and marquee car sales in such societies compared to the developed world. For instance, Jaguar in 2017 saw maximum sales growth coming from China at 32% year-on-year growth followed by 24% in America (Monaghan 2017).

The grooming ritual indicates to the extra care and effort that individuals go through to extract the maximum "value" or advantage out of the goods they buy, such that they portray an image or lifestyle—that is commensurate to how they would like their social selves to be perceived as; or how this act or ritual will help them bridge the gap between their real and ideal selves. For instance, in the case of clothing and accessories or cosmetics, one is usually very careful about what they buy (and how they "wear" them)—and look for something that makes a clear statement about who they think they are. In case of personal cars, apart from which (model of) car per se they buy, people also look for accessories and embellishments (for instance color) that may not really add to the functional qualities of the car but certainly enhances the status quotient of the car. For instance, the West and East both are currently experiencing the comeback of "distressed" jeans or simply ripped jeans, which is again considered as fashionable by the rich and famous as well (Gauba 2017; Rainey 2017). Fashion-conscious Indians have also seemingly

embraced this wholeheartedly whereas torn clothing has conventionally symbolized poverty and nothing else for the Indian society.

Finally, the divestment ritual indicates to the event when goods change hands and the role that predominant values of a society, based on which individuals divest or acquire goods. Douglas (1966) indicated to the possibility of how the meaning of goods can be transferred, confused, obscured or lost when they change hands. For marketers it would be possibly mean how they can profitably embed a specific meaning in a good for a particular customer, enhancing the acceptability of the good by the customer. For instance in India buying a car usually entails getting the car "blessed" by an appropriate deity, immediately after purchase (e.g. in India, within the Hindu communities it is customary for families buying a new car, to drive the car straight from the car dealership to a temple and get it blessed by a priest—who also usually draws certain sacred symbols on the vehicle while performing the ritual). Understanding this, many car dealers include a small deity in the form of a figurine or image, along with the free accessories that they give away to a buyer which they can then display in the car. In a society like India, the car dealership needs to be extra careful in such an offering to identify and respect the faith of the buyer and offer a deity (symbol) that is "appropriate". In the case of purchasing a second-hand good, buyers seemingly "repurpose" the good by—either trying and removing any vestiges of previous ownership; or stamping the manifestations of their individuality on the good. Douglas (1966: p. 2), in concluding how "rituals of purity and impurity creates unity in experience," indicates that performing such rituals is not governed on part of individuals by an anxiety to escape some disease, but is an attempt by them to engineer a positive reordering of their environment making it conform to an idea (reflecting a predominant value of that milieu).

11.4 Socioeconomic Stages and Consumption

Although today the traditional and the modern coexist and a purely traditional or modern society may not really exist, it is relevant to paraphrase the difference between the two. Traditional societies and cultures are characterized by being connected strongly to their past in terms of beliefs, values, and customs. They are marked by comparatively lesser tolerance to diversity; rigid patterns of social inequality; societal roles and statuses mostly ascribed by stratifying factors such as caste; community; race, etc. Research has indicated how the non-utilitarian functions such as status gets manifested as a determinant of product and brand choices made (Douglas and Isherwood 1978). In the context of developing countries, symbolic status enhancement has been identified as one of prime importance in product/brand choice (Ger et al. 1993).

Research summarizes the probable reasons for nonlocal brand preference among consumers in developing countries as

- Lesser affluence generating a sense of inferiority and insecurity resulting in a behavior that tries to overcome this by buying certain brands/products (Batra et al. 2000).
- Greater salience of products as status markers thus being an instrument of climbing up the social ladder (Batra et al. 2000).
- Desire to display competence with respect to alien cultures for being perceived as more "cosmopolitan" within the local milieu (Batra et al. 2000).
- The desire to participate in the global consumer community manifested through their purchase and consumption choices (Batra et al. 2000; Kinra 2006).

Explaining the draw of global brands and why do they attract customers across different types of societies at different stages of economic development, Steenkamp et al. (2003), posit that consumers' tendency to prefer global brands is because of—a perceived higher quality and prestige at one hand and because of the "globalness" of such brands in the context of their reach, availability and desirability.

11.5 Cultural Values and Consumption Patterns

In any given society, cultural values among other things, predicate behavioral norms and sanctions which then get reflected in the broad consumption patterns that define and characterize such social groupings. Norms specify ranges of appropriate behavior whereas sanctions indicate the penalties for violation of these societal norms. The theory also classifies cultural values as— self-oriented; other-oriented and environment-oriented values.

Self-oriented values reflect the objectives and approaches to life that individual members of society find desirable, whereas other-oriented values reflect a society's view of the appropriate relationships between individuals and groups within that society. Finally, environment-oriented values prescribe a society's relationships with its economic, technical, and physical environment.

Although the preceding discussion and vignettes in this chapter do relate to changes in the consumption narrative in a country like India and the cultural underpinnings thereof, let us look at two categories of products wherein global brands have made substantial inroads in the Indian market, in terms of—brand awareness, brand recall and loyalty on one hand and market share and dominance on the other. The categories chosen are—Perfumes and Alcoholic Beverages.

As one of the oldest civilizations of the world, India has had a very rich tradition in the context of the above-listed categories, but today in the organized market at least, these categories are dominated by a multitude of global brands, with local brands either being almost nonexistent or playing second fiddle to the global brands and being relegated to the lowest end of the value chain.

The history of alcoholic beverages production and consumption in India dates back to ancient times and can be divided into four broad historical periods for which written records exist. This begins in the *Vedic* era (ca. 1500–700 BCE); then

from 700 BCE to 1100 CE, is the time of emergence of Buddhism and Jainism in India, This is followed by the period of Islamic influence between 1100 and 1800 CE, including the Mughal era from the 1520s to 1800, and finally the fourth period (1800 to the present) including the deep influence of British colonial rule and the recent half-century of Indian independence, beginning in 1947 (Sharma et al. 2010). But even with such an ancient indigenous tradition, the foreign influence in this category is rampant with about 70% of consumption (Haq 2017) in the category of India Made *Foreign* Liquor or IMFL, which is a clear euphemism for domestically produced brands of "western" liquor products such as—Whisky, Gin, Rum, etc. The local Indian liquor called as "Country Liquor" is considered as absolutely low market, low status, and completely not aspirational, although being substantially the same as IMFL barring the taste, alcohol content and brand name. This is a clear evidence of how marketing communication has resulted in the marginalization of local brands not only in terms of their relevance but also as completely status degrading. Seen through the prism of self-, other- and environment-oriented values, clearly, the impact of global brands and their marketing strategies has been to appeal to the redefinition of the self and environment-oriented values. The transformation has been complete in that the consumption of country liquor is seen as status degrading and is the last resort for average Indians. Thus, the global brands have actually redefined the meaning of the alcoholic beverage as a category per se in the Indian market by changing the values associated with the category thus creating a completely alien consumption narrative.

Similarly, the second category of products selected namely perfumes, also delineates almost an identical historical evolution as the case discussed above. Perfumes and derivative items have found mention in pre-Vedic and Vedic period writings. Articles in this category have been part of the routine life in ancient India and have been used in religious practices and rituals, social customs, and domestic rituals (Prasad et al. 2008), with a diverse and highly evolved knowledge and understanding of its therapeutic and health implications as well as the appropriateness of the various essences according to the season and time of day. However, today in India the average consumer looks up to and buys Western (non-local) perfume brands especially when buying expensive perfumes. The local Indian brands are usually in the cheaper (deodorant) category. A recent Indian perfume brand launched by one of the most globally known Indian business houses has continued to struggle to position its mid-range brand of perfume and has finally recapitulated and is now trying to position it as "a perfume that has been created in France…!"

Lamenting the demise of the rich tradition of Indian perfumes and perfumery, Dalrymple (2017) comments

> It is an art for which India was once envied and famed – but today, the duty-free sections in Indian airports are filled with the same alcohol-based fragrances that are available in any other modern capital around the world. Whatever the brand name, most of these originate in France, and specifically from the four major Parisian perfume houses.

Needless to say, the above example is again a clear redefinition of the self-, other-, and environment-oriented values within the Indian culture. For instance, today one of the big movements in human consumption is to veer back to natural products. Well, the Indian perfume was always natural but somehow that was overpowered by the western brands which created the imagery of being modern and more evolved.

11.6 Conclusion

Human consumption rituals are conclusively determined by the cultural envelope and context. To change such a narrative is not easy and is time taking. To break this edifice down and to redefine the cultural meanings inherent in any consumption ritual, marketers target the fundamental values associated with any kind consumption ritual.

The vignettes discussed in this chapter do indicate how the four consumption rituals, namely the—Exchange, Possession, Grooming, and Divestment rituals have been reshaped by global brands by altering the existing value systems surrounding a particular product category. While doing this global brands are altering the norms and hence the sanctions associated with them in a given cultural milieu. These strategies in many of the instances are more or less akin to changing the essential character of local cultures and that too at times permanently. At its most extreme negative sense, this can be the precursor of social strife as well and may lead to a backlash from local cultures as well as regulators, which may be extremely detrimental to the brand.

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Chapter 12
Managing Brand Image in a Global Context

Kirti Dutta

12.1 Introduction

Successfully launching a brand globally adds to the company's bottom line (Schuiling and Kapferer 2004) and enhances its brand's equity (Dutta 2017). A brand present in a number of country markets is perceived as successful and signals prestige, high quality and social status (Keller 2004) and is therefore preferred over local brands (Benedict et al. 2003). Global presence is relevant for services product as well because studies show that a global brand image helps position quality of intangible services like financial services, banking etc. (Wright 2002). The flip side is that it requires a lot of understanding about the needs, wants, usage patterns, customer response, and preference (Dutta 2017). Organizations use marketing communication to primarily educate customers about the attributes of their brand and develop positive associations so that customers feel that it is the best consumption choice for them given their lifestyle and values (Martinez 2003).

In this ever shrinking, ever evolving, and ever-connected world, managing brand image is a constant challenge. Global boundaries are shrinking and brand's activity and buzz around it in one country impacts customers image of the brand in other countries as well and thus affect the brand equity. This is especially true when a brand faces a challenge in the form of a crisis and 'brand crisis are becoming increasingly prevalent in today's marketplace' (Li and Wei 2016). It has been studied that negative news about a brand impacts the consumer's behavior towards the brand, willingness to purchase and willingness to pay (Sago and Hinnenkamp 2014). It is, therefore, important to explore how brands can strategize through marketing communications to manage their brand crisis. For this first, let us develop some understanding of the brand crisis.

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12.2 Brand Crisis

Crisis situations for brands in the recent past has been increasing (Salvador et al. 2017) due to increased product complexity (Kalaignanam et al. 2013), which has been further enhanced by media coverage (Cleeren et al. 2013). Brand crisis is defined as a sudden and unexpected threat to the organizational goals, which can undermine its reputation, cause financial loss and has the ability to create uncertainty (Coombs 2007a). Brand crisis was conceptualized by Dutta and Pullig (2011) as unexpected events that threaten the perceived ability of a brand to deliver the expected benefits. There are both short-term and long-term negative effects of a brand crisis, which have been proved constantly (Li and Wei 2016) like loss in sales, loss in consumer trust, reduction in effectiveness of marketing instruments (Xie and Peng 2009; Van Heerde et al. 2007; Li and Wei 2016). Brand crisis can also spill over the whole industry and can also destroy the trust customer has in the society (Humphreys and Thompson 2014; Cleeren et al. 2013).

It has been studied that the impact of a crisis varies with the reputation of the company. Crisis in a company with a low corporate reputation is an opportunity for other players in the category but a company with high reputation could enhance the perception of risk across category thereby harming the entire category's image resulting in a threat to competitors as well (Siomkos et al. 2010). On the other hand, there can be a positive effect of the crisis on the corporate image when it is managed effectively as it results in perception of a company that is socially responsible. However, it is important to note that a brand that has suffered a crisis would be highly sensitive to crises situations in the future and negative implications would enhance for future recurrences (Siomkos and Kurzbard 1994). Thus, for organizations importance of communication in managing a crisis cannot be argued. Let us now look at the other important player—the consumer. It is important to understand at this point how a consumer forms the perception of a brand through communication.

12.3 Branding and Marketing Communication

Marketing Communication or Promotion is defined as 'the managerial process of communication and organization has with its target audience to generate attitudinal and behavioural responses and facilitate exchanges for mutual benefit' (Jauhari and Dutta 2017). Thus, consumers develop, reinforce, or modify their attitude towards a brand as per the exposure to the brand (Dutta 2017) and has brand building implications (Jones 1999). Communications includes both the aspects—controlled (advertising, personal selling, direct marketing, sales promotion, and public relations) and uncontrolled (word of mouth, publicity) by the organization. Research shows that word of mouth is a factor that customers rely on before a purchase decision is made as they rely on other consumer's consumption experiences for brands and its products and/or services (Hawkins et al. 2004).

Organizations, through their marketing communication, educate consumers about their brand attributes and develop positive associations (Martinez 2003). Consumers, on the other hand, use informational cues and develop their beliefs about brands and the ultimate choice for purchase may be directly influenced by these beliefs (Olson 1978). Consumers can develop, reinforce, or modify brand attitudes depending on their exposure to various brand cues and over a period of time the overall perception leads to the building of a brand image in their minds (Dutta 2017). Organizations can communicate through advertising, sales promotion, personal selling, direct marketing and public relations and publicity, and word of mouth. However, since the focus is on global brand image management, the focus of discussion will be on above the line strategies that use mass media to reach out to the target audience, viz., advertising and public relations and publicity.

Mass media helps disseminate information to a larger audience and is the leading source of information related to information about brands crisis (Shestakov 2012). Marketing communication can use mass media for advertising and public relations and publicity. As far as consumer's credibility related to both forms of communication is concerned, advertisement is perceived to be less credible than publicity. Here, it is important to note that media usually is found to report bad news and therefore there is enhanced possibility of negative information being broadcasted. On their part, consumers are found to put more energy and greater importance to processing adverse information and so negative information becomes more suggestive compared to positive information (Shestakov 2012). The seriousness of the issue is reiterated by the fact that an important factor that affects consumer's buying behavior is negative publicity (Stewart 2003). Negative publicity damages the brand's reputation; influences consumer's negatively and creates unfavorable associations (Dahlén and Lange 2006). This shifts the focus on how important it is for organizations to take control of crisis in their own hands rather than being mute spectators.

12.4 Communication and Crisis

Communication during crisis management can be divided into three stages—communication prior to, during and post crisis (Coombs 2007b) and the latter two are the focus areas of the study. The speed with which companies respond is important as consumers are curious and news media will talk even if the company does not. Negative views that are presented by media can make the crisis appear big or small as they can have different affects (Stewart 2003) and thus a company's response helps them present their side of the story. Companies that respond quickly in a crisis are perceived to be in control (Carney and Jorden 1993) and helps generate more credibility than companies that are slow to respond. Companies that release crisis information before news media or others could (termed as stealing thunder) were perceived to be more credible than companies which allowed media or other parties to report the information first (Arpan and Rosko-Ewoldsen 2005).

Consumer's response to a crisis can vary according to the attention they pay, expectations, and prior knowledge they have related to the brand, the way the information was received (Brathen 1999), consequences of the crisis and their values. Thus, a person who is directly affected by a crisis would be emotionally involved and consequence of the crisis would be more compared to a person who is just an observer (Weiner 1985; Brathen 1999). The current study looks at the communication a brand in crisis does with both participants and observers.

Studies show that during a crisis when consumers receive conflicting (both positive and negative) information then consumers, who are highly committed toward the brand select the positive information with a slight change in brand attitude and consumers who are low on brand commitment select the negative information and their attitude toward the brand declines (He 2016). This highlights the need to build high brand commitment in consumers. Also, consumers respond differently to the different types of crisis (Xie and Peng 2009) so let us understand some of the types of crisis a brand can face.

12.5 Types of Brand Crisis

Brand crisis can be conceptualized into two different types as per the theoretical perspectives as follows 'attribution theory perspective and brand equity theory perspective' (Li and Wei 2016) (see in Fig. 12.1).

Attribution theory (Weiner 1980, 1985, 1986, 2000) suggests that when individuals experience a product failure, they try to understand the cause and their reaction is largely based on how they interpret the result and who/what they attribute the failure to? This is done by analyzing three causal dimensions that are locus (source of failure), stability (whether failure was temporary or permanent, i.e., efforts were made or not to resolve the failure), and control (whether manageable or unmanageable).

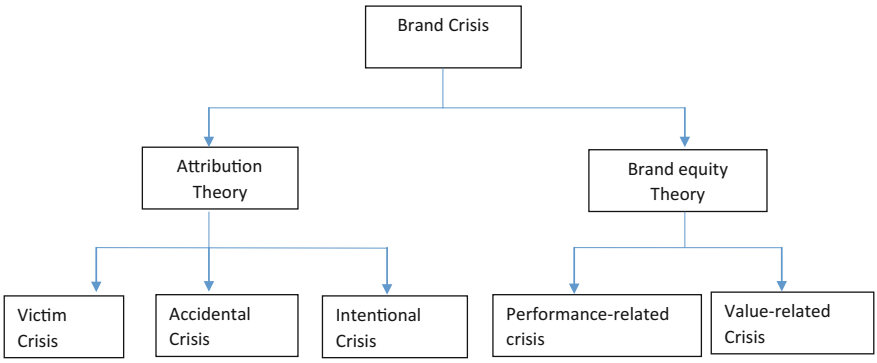

Fig. 12.1 Types of brand crisis. *Source* Weiner (1985), Coombs (2007a), Keller (1993), Dutta and Pullig (2011), Dawar and Pillutla (2000) and Li and Wei (2016)

Coombs (2007a) further identified three types of crisis on the basis of responsibility allocated to the brand for the crisis and it increases from left to right in the figure (for attribution theory). In Victim crisis—brand is seen as a victim of the event. In Accidental crisis—the crisis is considered as uncontrollable or unintentional by the brand and so there is minimal attribution. In intentional crisis, the event is considered purposely done and there is strong attribution for the brand. The brand equity theory takes Keller's (1993) theory of brand equity being functional as well as symbolic and so the crisis can be Performance related or value related (Dutta and Pullig 2011; Dawar and Pillutla 2000). Performance-related crisis is when there is a problem related to the product and the product can be defective or dangerous making the consumers perceive brand's reduced ability to deliver on the functional aspect. In the Value-related crisis, rather than the product, it is the ethical or social issues around the values of the brand that are questioned.

12.6 Brand Crisis and Various Strategies for Marketing Communication

Let us now take a look at some of the various brand crisis situations in the last year and how they were handled. Pepsi's Kendall Jenner ad was one which drew attention as one of the biggest crisis for the year (Torossian 2017). Kendall Jenner joining a protest and offering Pepsi drew a lot of flak and in the week from March 30 to April 5, 2017, Pepsi's social mentions increased day on day. In percentage terms, the increase from April 4–5 was over 193% and from April 3–5 was 21,675% and as per Brandwatch Report average 56.4% sentiments were negative (Joyce 2017). Another study using analytics tool—Emotics showed that 'when compared to mentions from August 2016, the levels of joy and trust decreased by 41 and 28%, respectively, while levels of rage and disgust increasing by 42 and 83%, respectively (Harris 2017a).

Pepsi did respond by pulling the ad and issuing an apology "Pepsi was trying to project a global a message of unity, peace and understanding. Clearly, we missed the mark, and we apologize. We did not intend to make light of any serious issue. We are pulling the content and halting any further rollout. We also apologize for putting Kendall Jenner in this position" (Victor 2017). Here, it is important to note that the response by organizations post crisis is instrumental in deciding the extent to which the brand can be saved (Li and Wei 2016).

One of the most commonly observed response is apology and Pepsi did just that. However, their 'public apology to Kendall Jenner for her role in the soda giant's ill fated commercial triggered even more backlash" (Paquette 2017). Twitter was alive with comments from noted activists that Pepsi needs to apologize to protesters and not Kendall. It was observed that Kendall had consented willingly for the ad and got paid for it and the real apology should have been toward the movement and the protesters which were trivialized in the ad (Paquette 2017). Thus, Pepsi's lack of

understanding in the first place got the ad to the screen. This should not be underestimated as "millions of dollars were pumped into the Pepsi ad campaign after months of brainstorming by copywriters and creative brains" (Nair 2017). Ultimately, the ad was canned and their lack of understanding while apologizing got them to stay in their soup longer.

The year 2017 saw United Airlines facing a disaster in the form of viral video of a passenger being dragged violently off an overbooked plane at Chicago's O'Hare International Airport. CEO of the airlines parent company, Oscar Munoz, in a communication the next day (Monday) stood by the employees and defended them and the blame of the incident was put on the passenger (Associated Press 2017). In a public statement he called it an 'upsetting event and apologized to the other passengers' (McCann 2017). The video was circulated on news websites, TV, Facebook, Twitter (more than 170,000 times), YouTube, etc. (Maheshwari 2017). The intense backlash and boycott resulted in United moving from taking full responsibility for the incident (Tuesday) and apologizing for the incident. However, by the time they did this, it was too late and the public was not appeased leading to drop in customer perception 'to a ten year low' (Torossian 2017). Munoz appeared in 'ABC's "Good Morning, America," and said he felt "shame" when he saw the video of Dr. Dao being dragged from the flight (McCann 2017). United ultimately offered a 'refund to every passenger on the flight' (Stack 2017).A month later, a study by analytics tool—Emotics for the social media mentions (on a scale of minus 100 to positive 100 and a high score reflects a positive content) ranked United fourth with score of 16 'with high levels of distrust'(compared to rank 1 of Virgin Atlantic with a score of 43) (Harris 2017b).

A study by Benoit (1997) summarizes five broad strategies that can be followed for image repair post crisis. These are 'deny, evasion of responsibility, reducing offensiveness of event, corrective action, mortification'. United followed most of these strategies in the span of few days post the crisis. However, Internet and social media have impacted the spread and speed of information multifold. 'People can destroy brand trust at the speed of light, with consequences that are far-reaching' (Winston 2017) so denying and evading responsibility of the crisis is not a good strategy. People can now destroy brand trust at the speed of light, with consequences that are far-reaching. Taking corrective action, which United ultimately promised, would be relevant for recovering the situation in the first go.

Samsung faced a loss of $3 Billion when it recalled its Galaxy Note 7 mobile phones (Gershgorn 2017) as they were catching fire (since September, 2016)—not once but twice as the replacement Note 7s also burnt up. It all started in September 2016 when Samsung recalled 2.5 million devices due to overheating issues and 2 weeks later, US Consumer Product Safety Commission issued nationwide recall due to report of 100 dangerous battery incidents in the US. However, the replaced phones also started catching fire. Post the recall, Samsung concentrated on ensuring that consumers were not using Note 7, pushed updates to all relevant users to 'brick' the device and 'very few additional details were released' (Moynihan 2017). As per a report in the Wall Street Journal, Samsung misdiagnosed the problem,

there were issues in batteries supplied by both the suppliers (Cheng and McKinnon 2016), first time the reason was design failure, and the second time happened due to manufacturing defect.

In January, 2017 Samsung's Mobile Chief, D.J Koh speaking in an interview ahead of a press conference described it as a 'painful crisis' during his 33 years. The aim was to build the company's credibility ahead of the Galaxy S8 launch. Koh was joined by three independent testing firms (Exponent, UL, and TUV Rheinland) in backing the findings "that it was the battery and not the phone's design or Samsung's manufacturing process, that caused the Note 7 battery issue. 'The electronics [designed by Samsung] did not contribute to the failure of either manufacturer's [battery] cells,' Kevin White, principal scientist for Exponent, said during the press conference" (Tibken and Cheng 2017).

Studies on consumer behavior show that if a company is found responsible for any product failure it is bound to generate negative consequences (Folkes 1984). So in case of a Victim crisis—companies can use deny strategies, in case of accidental crisis—companies can use diminish strategies and in intentional crisis—rebuild strategies can be utilized for overcoming the crisis (Coombs 2007a). Samsung used the diminish strategies and rebuild strategies for launching S8. Also, as per the attribution theory (discussed in section Types of Brand crisis), the strategy adopted by Samsung was that the locus or source of failure was external (suppliers of batteries). Stability was temporary (as Samsung announced withdrawal of the product) and control was not there as external parties supplied batteries. However, Samsung further informed that it was working on putting eight battery checks in place and also constituted a new battery advisory board (Tibken 2017). The blame was, therefore, attributed to the external sources and the negative impact on brand Samsung was reduced. This can be corroborated by the fact that when Samsung Galaxy Note 8 received massive success and even while Apple launched iPhone 8 and 8 Plus models it received preorders for 650,000 units which was 2.5 times the Note 7 (Spence 2017).

12.7 Conclusion

Brands are facing crises and they need to respond quickly in the ever-connected world. Sentiments on social media are important as emotionally charged messages garner more response and are shared more often compared to neutral messages (Stieglitz and Dang-Xuan 2013). So, it is not a matter of choice for companies to respond to the sentiments of consumers. One of the key takeaway is that brands need to own up their mistakes and apologize immediately. Not acknowledging the mistakes leads to amplification of the issue and draws further negative attention. It is better to apologize immediately, sincerely while keeping it devoid of any jargon (Winston 2017). Customers are closely watching how companies operate and the actions they take especially when things are not going as planned. Companies, therefore, need to have an action plan ready when a crises occurs and once the crisis

is over they need to educate customers about the steps taken so that the crisis does not arise in the future. Studies show that control of the crisis will decide whether consumers sympathize toward the brand or harbor feelings of anger. Companies that manage the media to inform the masses about the facts related to locus, stability and control can save the brand from negative impact of the crises (Shestakov 2012). Crises management is the norm of the day and not responding to the crises will not blow it away but turn it into a raging inferno.

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Chapter 13
Innovations in the Era of Globalization: Challenges for Indian Economy

Hanna Olasiuk

13.1 Introduction

Strong innovation activity is an indicator of favorable business environment and itself a determinant of economic development. Especially now when the world is getting flatter and markets operate under unified rules, government, and firms have a challenging task to create and support a system for efficient innovation and creativity outcomes. Thus, the main objective of this paper is to give a comprehensive overview of threats and challenges for the national systems of innovation in India. The findings of this study suggest that globalization has changed competitive forces on the world market, making product and quality demand more homogenous. However, innovative activity varies across countries due to differences in culture, the level of education and access to it, government's expenditures for R and D and overall investment activity and foreign trade.

13.2 Literature Review

13.2.1 Globalization and Innovation Process

Globalization has become a subject of multiple discussions and fierce argumentation among scholars, business people, and policymakers for decades. The concept first appeared in lexicon of OECD representatives in the mid-80th of the twentieth century. Majority of international organizations considered new phenomenon as

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increased and unrestricted movement of goods, services, and factors of production across countries. Globalization through market openness and liberalization might undermine national economy if latter is unprepared to changes. Nowadays it has become a fact that globalization has been constantly creating multiple challenges and benefits for all participants of international economic relations over the past decades (Singh 2017).

A range of firm-based theories of international trade link innovation with product features, form strategy, competition, and market conditions. According to Raymond Vernon theory, country-innovator becomes exporter of new products at the early stages of product life cycle, but it loses gradually its export potential over time as product gets more mature on the market (Vernon 1979). Michael Porter's theory argued that competitiveness of nation depends on the capacity of its industries to innovate and upgrade. Sophisticated market conditions urge firms to invent new products and ways of doing business (Porter 2011). In particular, more knowledgeable and demanding customers expect to receive better products and consumer experience comparing to the customers without any expectations about quality or service level. Consequently, major part of innovative products and processes touch upon marketing activity as important business function, that links innovations with market demand.

Globalization became possible through the willingness of major actors on a global political arena regarding integration, coordination and opening up their markets toward more dynamic international exchange. Particularly, transnational corporations (TNCs) are active participants and beneficiaries in globalization process. They have shifted a major part of manufacturing, R and D and other non-core business activities outside home countries to developing ones to reach cost-cutting and market access targets (Prasada 1997).

India perceived the idea of globalization since 1991 and witnessed it in 1995 by obtaining a membership in the WTO. Due to a number of previously implemented reforms, country has managed to engage in foreign R and D activities in product development for regional markets and generic technologies conducted by TNCs (Singh 2017; Prasada 1997).

13.2.2 National Innovation System

According to the scientific reflections of Stiglitz J. and Dasgupta P., competition is an inherent feature of the capitalistic economic system. Three-dimensional features of competition are reflected in the price and non-price forms, but the most important is a competition of inventions and innovations (Dasgupta 1980). Globalization has weakened producers' pricing power, decreased product life-cycle, minimized first-mover advantage, thus product innovations nowadays are of extreme importance for survival and business success (Agarwal and Thiel 2012). The twentieth century was a starting point of active spillover and dissemination of innovations across counties through their national innovation systems. The existing variety of

national systems of innovation (NSI) aimed at reaping its best from international economic order, regulation, and mechanisms of distribution of innovations.

The first known definition of NSI underlines institution nature of NSIs interpreting it as "set of institutions in the public and private sectors whose activities and interactions initiate, import and diffuse new technologies" (Freeman 1995). Functional analysis brings the meaning of NSIs from narrow, where "R&D institutions—firms, industrial research institutes, research universities and state government laboratories–create and disseminate innovations" (Nelson 1993) to broader one—adding to above mention definition the range of political, socioeconomic, cultural factors and institutions that affect innovation process (Lundvall 1992).

There has been a lot of debate whether trade liberalization and increased competition boosts innovations. Typically, protectionism leads to market monopolization and reduces incentives to innovate, though, larger market share generates more sales that might be spent for R and D (Acharyya 1995). Later research, however, stipulate the opposite: free trade based on comparative advantages reduces the costs of innovation through technology acquisition, decreases opportunity costs and accelerates country's innovation catch-up (Altenburg 2008).

13.3 Methodology

This is an exploratory study with a focus on factors, elements, and trends in the national innovation system. Employed methods include a set of recognized and adopted by international organizations qualitative research tools to describe innovation pace, limitations and future prospects to growth (Shwab 2017). The research is backed up by a solid corpus of theoretical developments in the area of NIS, foreign direct investments, global value chains, foreign trade, clusters, globalization, and economic growth (Jurowetzki et al. 2018). The paper tries to highlight main directions, opportunities, and effect for the Indian economy in the twenty-first century.

Following up Global Innovation Index methodology, innovation index comprises an arithmetic mean of output–input sub-indexes. The ratio of output to input represents the innovation efficiency indicator (Cornell University, INSEAD, and WIPO 2017).

GII methodology employs five input and two output pillars with equal weightage of each parameter in the final assessment (Fig. 13.1). The dataset includes 81 indicators drawn from various international organizations like World Bank, IMF, UNESCO, WIPO and private institutions such as Thomson Reuters, Eurostat, COMTRADE database, etc. (Cornell University, INSEAD, and WIPO 2017).

13.4 Findings and Discussions

India concerned about its innovation pace in the early 90s of the twentieth century. Essential improvements in the education system and telecommunication sector have led to a burst in the IT industry competitiveness. Encouraged by the success,

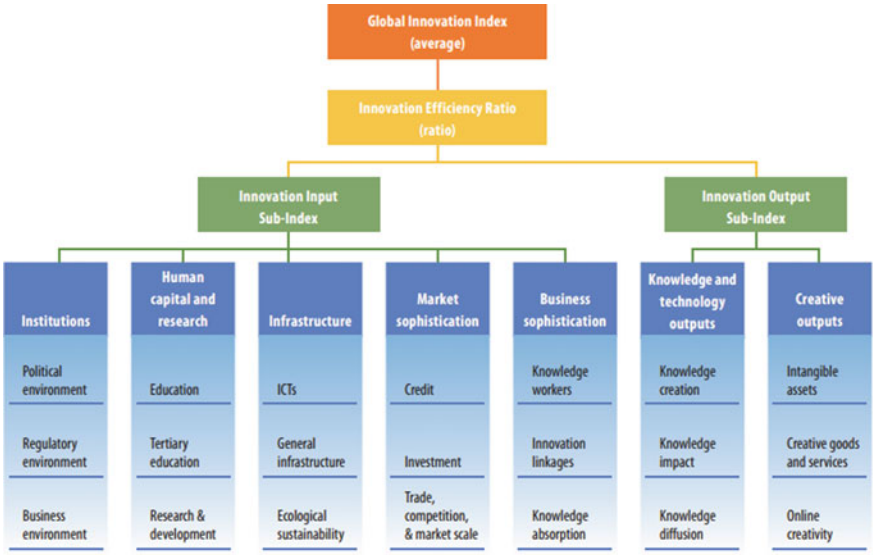

Fig. 13.1 Composition of GII. *Source* Shwab (2017) Retrieved 3/2018

policymakers have designed institutional and financial framework to declare innovations as country's priority (Casanova et al. 2018).[1] On the other hand, stakeholders and policymakers are willing to ensure that all innovations are in total cohesion with sustainable development goals, so that rapid economic growth would not harm the environmental ecosystem. In such a way, business and government try to implement a number of sustainable initiatives, encourage green investment projects, and support social awareness in sustainability issues (Heyden 2014).

Over the past 30 years, both country-wise and world landscape of innovation exports has changed dramatically. Global hi-tech exports reached its peak in 2000 with 24.4% following few consecutive deteriorations. The United States took up leadership in 1999 with 34.3%, however, China in 5 years caught up and even outmatched the US showing 30.4% in 2005. India's innovation exports ratio increased 1.75 times or to 7.13% during 1988–2016 demonstrating consecutive ups and downs (Fig. 13.2).

Yet, there is a lot to be done with innovations in India. According to the latest Global Innovation Index (GII) report, India has taken up 60th rank among 127 economies falling behind BRICS counties like China, Russia as well as Eurasian middle-income countries Bulgaria, Malaysia, Romania, Turkey, Viet Nam, Montenegro, Ukraine, Thailand, Mongolia, and Armenia. However, India is ahead of average lower and middle-income countries. Experts acknowledge rapid

[1]They established a Ministry for Skill Development and Entrepreneurship, created financial schemes for SMEs and incubation programs for startups, announced increased expenditures on infrastructure.

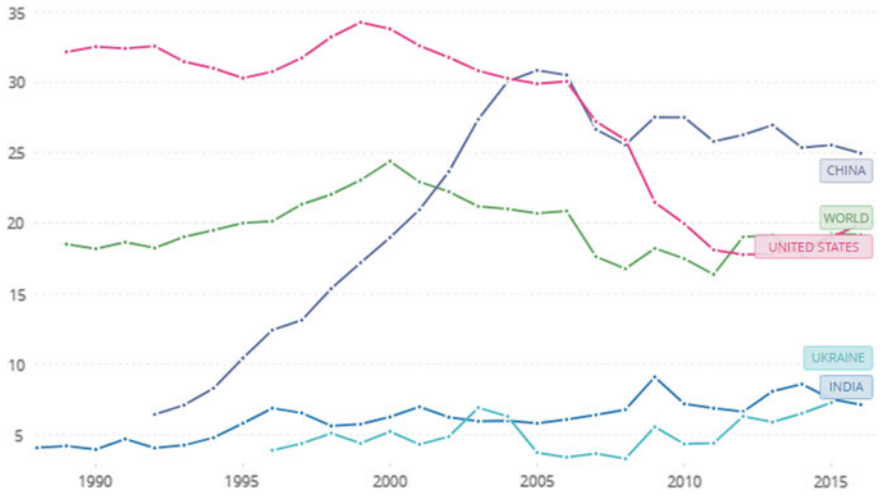

Fig. 13.2 Share of innovation exports to GDP during 1988–2016 (%). *Source* World Bank Open Data Retrieved 4/2018. https://data.worldbank.org/country

innovation pace of Indian economy as an outcome of human capital, infrastructure, and market advancements (Cornell University, INSEAD, and WIPO 2017).

Another metrics of global competitiveness acknowledges India to become a new center of innovation. Innovation catch up would be possible when business and households are ready to incorporate new technologies into their lifestyle and business processes. Thus, country's technological readiness is almost on the bottom of the Global Competitiveness Index 2017–2018 with 107 rank out of 137 (Shwab 2017).

Competitiveness and innovations are tightly interrelated and primarily originate from creativity. Global Creativity Index has estimated strong relationship (0.78) between economic competitiveness and creativity. Correlation of competitiveness, technology, and talent had been estimated at 0.76 and 0.73, respectively, whereas tolerance represented the mediocre effect on competitiveness (Florida 2015). India was ranked 99th in the list of 139 countries by the level of creativity. Interestingly, that technology sub-index as a measurement of R&D expenditures and number of patents per capita is much better (52nd place) than talent and tolerance indicators (92 and 108, respectively). Countries with a lower ranking in technology but with better talent numbers were estimated as more creative in general (Florida 2015).

Also, NIS might be viewed as a standalone trigger of a nation's economic growth (Sesay 2018). Such parameters of NIS like the strength of intellectual property rights (Gould and Gruben 1996), highly technological imports, TRIPS agreement (Ginarte and Park 1997), R and D expenditures are recognized to have a high impact on GDP growth (Falvey 2006).

India becomes a member of WIPO in 1975. In an attempt to protect its intellectual property over the past 20 years India has filed more than 460 complaints and

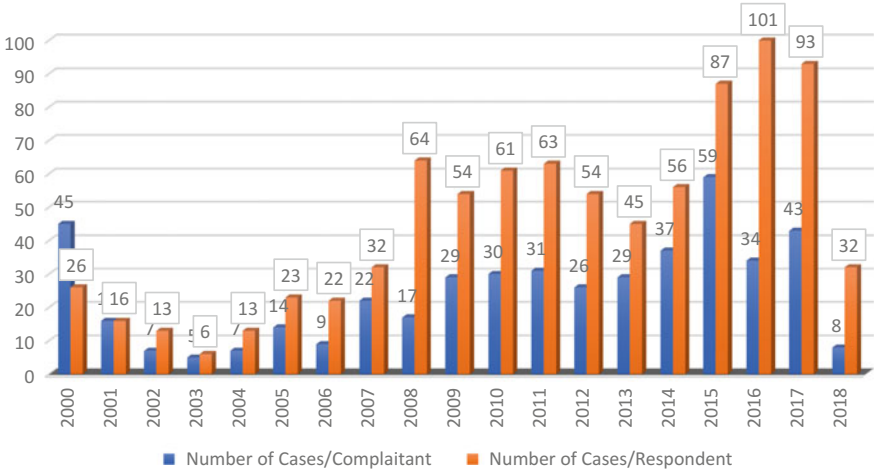

Fig. 13.3 Dynamics in India's IP compliant-respondent cases. *Source* WIPO statistics database. Retrieved 3/2018. http://www.wipo.int/amc/en/domains/statistics/countries_yr.jsp?country_code=IN&party=R

become respondent in 860 cases. Increasing number of complaints demonstrates poor IP protection and the fallacy of inventions (Fig. 13.3).

An empirical study of BRICS national innovation systems has revealed the significant statistical impact of high-tech exports, government expenditures on R and D, patent number, the quantity of scientific personnel, student enrolment in science and engineering. Estimation proofs that increase in these NIS components by 10% induce economic growth from 0.15% up to 0.02% (Sesay 2018).

To take NIS through the prism of capabilities, three dimensions is applicable: innovation, production, and social capabilities. Measure suggested for innovation capabilities are the following: (1) scientific and engineering articles (per capita); (2) USPTO patent applications (per capita); (3) R and D expenditures (% of GDP); (4) Trademark applications (per capita). Production capabilities include ISO 9001 certification (per capita) and Internet users (per capita). Lastly, social capabilities incur years of schooling, adult literacy (% of adults), and index of bureaucracy quality (Fagerberg et al. 2017). All of them are aimed at revealing critical knowledge-based inputs for GDP growth. Strengthening NIS, technology transfer, and knowledge sharing.

During 1996–2015, the USA has maintained its leadership in R and D expenditures with 30.5% share. In contrast, China had an even worse situation with R and D financing than India in 1996, but already in 2 years, it caught up. Existing India's share remains on the level of 1996 and comprises 0.63%, whereas Chinese expenses for science have increased 3.67 times—from 0.563 to 2.033% (Fig. 13.4).

Another comparative study of innovation capabilities and NIS improvement of China and India emphasizes the importance of economic reforms, technology policies, and the emergence of innovative cities in innovation development (Fan 2018).

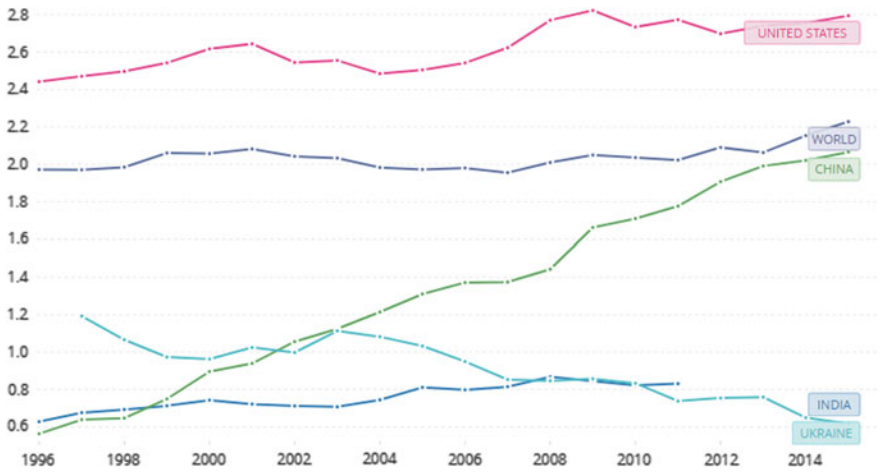

Fig. 13.4 R and D expenditures as a share of GDP during 1996–2015. *Source* World Bank Open Data Retrieved 4/2018. https://data.worldbank.org/country

Nowadays, there are three innovation hubs in India—cities which are recognized to be innovative centers of innovations, among them Bengaluru, Pune, and Mumbai, which are famous for IT and chemical industry developments (Shwab 2017).

Sluggish growth of governmental expenditures has demonstrated the inability of institutions to manage and intervene innovation process mainly due to some structural patterns. Around 55% of all R and D funds was made by the government for military and fuel supply purposes. Namely, India is proud of its weapon, nuclear, and space deployments. Such products as missiles, rocket systems, night-vision devices, reactors, satellite, and launch vehicles were recognized to be competitive by many customers inside and abroad (Mashelkar 2007). India enjoys one of the largest space budgets among G20 countries allocating more than $1 billion. The country benefits heavily from exporting the majority of space technology products. Moreover, economic growth is associated with the contribution of this industry in output (OECD 2011). Other sources of financing refer to higher educational establishments—about 4%, and private business—38% driven by pharmaceutical and automobile industries. Despite this, India demonstrates growing scientific output in terms of SCOPUS publications and growing patent filing activity (Padmanabhan 2018).

13.4.1 Organizational Behavior Toward Innovations

According to early study, innovations in India are predominantly minor, i.e., cost-reducing in nature contrary to major or quality-increasing innovations (Acharyya 1995). A distinctive feature of India and other developing markets lies in the area of "reverse innovations". They are aimed at serving and satisfying need of

a low-income population at the bottom of the pyramid markets. Big business and multinational corporations are enabled to offer low-cost products by introducing innovations into product design, distribution channels, and commercial models (Wolf 2011; Agarwal and Thiel 2012). Even IT-sector with its highly technological developments does not produce radical innovations, and most of the employees are engaged in IT services rather than R and D developments (Taganas and Kaul 2006).

Another research of Bangalore auto SMEs studied out the effects of innovations on employment and labor productivity. Incremental nature of innovations caused employment growth but not productivity. Obviously, that employees do not work effectively as they do not obtain benefits from sales of innovative products. Furthermore, capital to labor ratio growth is twice lower than labor productivity growth, thought the relationship between these variables is enough strong. Neither of the auto-component producers have obtained any national or international patent, which gives little room for sustainability (Subrahmanya 2010).

Clusters as a form of innovations are under-evaluated in terms of innovation development. Among 350 SME-based clusters and 2000 artisan-located ones, around 119 have strong export potential. Reasons for low competitiveness are productivity, technology, and infrastructure issues faced by companies. Indian clusters can benefit from technology and know-how transfer. There are suggestions to set up Special Service Centers (SSC) to incorporate best practices in a product upgrade, process innovations, staff development, and foster innovation-support policies. Organization background for SSC comprises a pool of firms, their associations, governmental institutions interested in tackling industry issues and challenges. Successful cooperation of Indian and Italian clusters in agri-food and leather industries point out the way toward business growth and technological improvement through technology acquisition on a partner basis being a part of the international cluster (Gomes 2001).

According to some research, India is classified as a ‘dynamic adopter’ of technologies through its leg behind from UK in both incremental and radical innovations. Main reasons are the poor technical background of entrepreneurs, low R and D intensity, and slow innovation dissemination (Subrahmanya 2005). Though presently India’s innovation policy lacks mechanisms to facilitate firm networking and capacities to absorb innovations as well as ways of technological modernization in non-high-tech industries (Kaul 2002, 2006). India also needs to work on innovation image to combat the established perception of a country-imitator, unite knowledge base, and cultural values to achieve innovation synergy (Mashelkar 2007).

13.4.2 Indian Culture: Hindrance to Innovations or Key to Success

Culture it is a social phenomenon that makes the world versatile and let the idea of multidomestic view on markets to strive. India is well known for its cultural

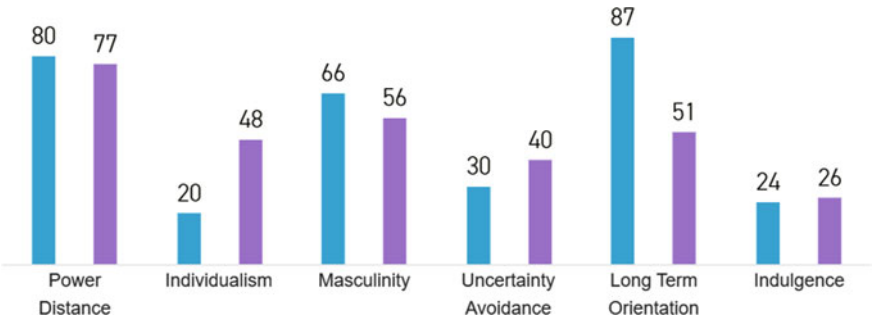

Fig. 13.5 China and India through the prism of cultural dimensions by G. Hofstede. *Source* Hofstede Insights Retrieved 5/2018. https://www.hofstede-insights.com/country-comparison/india/

diversity and relative inviolability of social norms, traditions, and institutions over centuries. Using Geert's Hofstede country comparison toolkit let us compare cultural dimensions of India and China and try to conclude if the differences in culture might affect innovations.

Two countries look similar in terms of high power distance, masculinity, and low indulgence, however, China has more collectivistic aspirations in its cultural genome, low tolerance to risk, and greater tendency to long-term orientation (Fig. 13.5).

13.4.3 Policies to Boost Breakthrough Innovations

OECD report acknowledges growing number of innovation policies implemented by India over the past decade (OECD 2007). In the attempt to tackle innovation challenges of the twenty-first century National Innovation Council and India Inclusive Innovation Fund were set up. The Council designed a 10 years strategic roadmap for innovations with a due date in 2020. Main provisions of a new Science, Technology and Innovation Policy stipulate: (1) priority of certain industries like IT and telecommunication, drug development, agriculture, energy, water, and environmental management; (2) mechanisms for supporting innovation incubators[2]; (3) support of innovation entrepreneurship and inclusive development; (4) emphasize on international R and D cooperation and partnership (Technology 2013). The focal point of this strategy was represented in three domain areas: technologies to satisfy human needs, to create more excellence in business and entrepreneurship and develop knowledge-based industries (Mashelkar 2007).

[2]Small idea—small money initiative, Risky Idea Fund.

By now among large impediments to innovation breakthrough remain low efficacy of government support programs and rigidity of its R and D system, lack of foreign R&D investments, poor quality of tertiary education, deficiency of hi-tech industries. Nonetheless, strengthen the patent law, engagement of scientists in legislation-forming processes, increased governmental awareness regarding innovation, and vast manufacturing capacities have preconditioned technological progress and continue to generate new avenues to rise and operation of NIS under global rivalry (Agarwal and Thiel 2012).

13.4.4 Creativity, Innovation, and Education

Creativity is a personality characteristic, at the same time innovations, are more inherent to groups of people, firms, and nations. It is known that children are more creative than adults but over time there is a tendency to substitute creative abilities with the rational mindset and practical reasoning. Creative capabilities inherently join up with the process of problem identification and problem-solving. Prerequisites to successful innovations are defined as follows: (Datt and Chunawala 2016).

- motivate schoolchildren and undergraduates to identify and solve problems individually appealing to mental and moral obligation to contribute to the society development;
- practice more divergent thinking tests and activities as a way of generating nontrivial business ideas and technological solutions;
- improve teaching mastership and expertise in various areas to be able to expose to greater pool of knowledge and generate knowledge-based problems and innovative solutions.

13.4.5 Conclusions

So far, India has improved its competitive positions by making substantial progress in market regulations, infrastructure development, education, and institutional framework of innovation activity. However, society in India continues to suffer from high level of discrimination and hostility, the majority of the population have no access to high-quality education, areas of technological progress are defined by government R and D priorities and possibilities to export.

Firms in India introduce cost-cutting/incremental innovations which target low-income segments of the market. Still, there is a huge potential for growth considering country's economic growth and increases local demand. All innovation-boosting institutions and policies are in force, although more financial

resources from business, human capital investments, networking, and international cooperation in R and D and technology transfer are required.

To speak figuratively, all these changes are similar to crutches that support movement function of a human body, although they are not able to grant free activity. Movement here means innovation progress, human body its firms that conduct R and D. Proven innovation progress is driven by business initiative, stakeholders' confidence, and market demand. Consequently, all businesspeople and entrepreneurs should focus on creative skills and competencies development, nurturing of innovative mindset at a workplace, organizational design elaboration, proper motivation, innovation network integration, and expansion for the sake of further commercialization.

It is required that higher institutions of educations must elaborate on a new curriculum for innovation-seeking businessmen. Innovation-oriented postgraduate training and MBA programs in business higher education would be able to fill in the knowledge gap.

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Part VII
Globalization and Cyber-bullying

Chapter 14
Trolling: Dark Sides of Globalization

Paroma Sen

14.1 Introduction

Philosophers, since the time of Socrates, were engaged in a search for a good and happy life. Human beings continue this task of finding the best way to lead a life. The search continues to this day because the real form of life is yet to be realized. The real form of life is like the cave theory of Plato, where the images within the cave were not the real description of the reality but only images of the reality. The virtual world which creates an image of a good and happy life in the minds of the people has become an essential part of our lives but in reality, the virtual world does not exist. While we live with the images of the reality, it is our bounded rationality that forces us to consider the image to be the real world as presented to us. This construction of the image is not the interpretation of the world (we live in) but is also an interpretation of our perception of the self. This construction of the self is an outcome of our opinion, perception and statement in the context. Words and expressions are used to define the human being occupying the backdrop; the expressions which are mere images take on the stature of a human being itself. The use of words—product of someone's labour—becomes the steering force in one's construction of the self in the virtual world. At times, this overpowering images also reinstate the social construction in a domain which is somewhere between the private and the public spheres of human life. This chapter focuses on the theoretical narratives across disciplines to understand the dark ages of globalization in the context of trolling. Trolling is a commonly used word referred to the harassment caused to one in any social networking site. It has, however, become a commonly used term for the views/opinion expressed by the intolerant and aggrieved users not in agreement with a particular view/opinion or a video/audio shared by an user in

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Twitter. Usually, the intolerance is over a person's comment on any issue which might have sarcastic overtones, political satire or simply showing off the activities on a certain day. This chapter is divided into four parts—we focus on trolling history, creation of a nation, construction of gender and finally focus on ethics of using this technology. Since the book focuses on the dark sides of globalization, the aim of this chapter is the dark sides of globalization which restrict us and challenge our interactions in the modern era. Through our critical analysis of this phase, we would also interrogate the ways of finding a solution.

14.1.1 Trolling 'HISTORY'

History has come to be created through trolling. Twitter needs no national boundaries, political institutions, jurisdictional spaces. It is a space where all the narratives based on different contexts collapse and give rise to an overlapped space. Social networking in this collapsed space leads to a situation, which controls time and space. The focus here is on the issue of history as a narrative which is not just created by the historians but by the users using the Twitter. There is no methodology followed to understand the past but it is created just on the spur of the moment. In this discussion, the recent issue that arises is the debate that had taken India by a storm over the release of a film named Padmavat (name changed from Padmavati).

The controversy arose after the Rajput community—roots mainly in the state of Rajasthan in Northern India—alleged that some of the scenes in the movie disrespect the honour of the community through the portrayal of Queen Padmini—considered to be a symbolic epitome of Rajput honour and dignity—in the film. Trollers are quick to judge and take on the space in creating an imposed narrative. Social network resists dialogue between people and is often taken over by the attack in most cases by the bystanders. Globalization has helped in creating this equality of occupying a space, where distinctions are getting blurred. Everybody becomes the author and the narrative is lost in subjective perceptions. However, this multiple authorship without (restraint/constraint) takes away the spirit of deliberation, negotiation, debate and discussion. Situating trolling in narrating a past has often led to the use of language not as a means of communication but for unleashing violence. Arguments are overtaken by emotions of anger and hatred thereby; initiating a process of othering. The reality is distorted where the search for the truth is overtaken by the aggregation and the muscle power is shown through the attack. Are these attacks creating the narrative similar to Benedict Anderson's 'Imagined Communities'? Or is it just a product of a globalized world where homogeneity and standardization have overtaken imagination. Before globalization, the spaces were created by print capitalism, literacy, opportunities. Spaces were defined by contexts such as class, communities; it was also defined by accessibility. Post-modern scholars might justify the claim of the presence of multiple actors and denounce

structures that confine individuals. Twitter or for that matter any social networking sites might allow individuals to be free from any structural constraints. Spaces were attached to the certain structural limitation which in the course of time has been overtaken by the absence of any such restraint within the social networking sites. Opening up of the boundaries have not changed the restrictions or limitations of communities restricted in the consciousness. The individual continues to react out of the societal beliefs embedded in his psyche.

Currently, the reactions by the Rajput community have taken the form of trolling in the real world, where communication processes have been overtaken by normalizing the local interactions. Padmavati incident became a subject of trolling in the midst of the crisis within the Rajput community. The character of Queen Padmavati remained mired in two opposing viewpoints, according to some records she was the queen of Chittorgarh in Rajasthan and performed jauher to protect her honour from the invader Allauddin Khilji, whereas another source states that she was a character in a poem called Padmavat. Despite the resurfacing of contradictions over Padmavati, the honour of the community tied to the depiction of Queen Padmavati became a starting point of an attack in spaces outside Twitter. Threats of attacking the lead pair were open in Twitter based on ill-informed perceptions and misrepresentation of the Rajput past. History is being rewritten not by the historian but by the layman, who is aghast at the idea of any confrontation between a Hindu Rajput queen and a Muslim invader. This layman, in the name of protecting the honour of a queen, is up in arms and is rekindling the past perception, as well as, changing the course of history in this new space. Reality is recreated through the use of language. Structures are created in the form of use of the expression of language. Ironically, protecting the societal honour is not done in the space within homes or created outside the homes. Community's honour is symbolic in nature. Language has taken the form of symbols used by individuals to protect their honour at the cost of hurting others. Authorship of writing the past has moved from a methodological activity to reconstructing one based on biases and myths. History is inherited from the predecessors, as a result, there is a lack of combination of a subjective as well as an objective element to it. Twitter by allowing its users a new kind of narrative provides a scope for combining both subjective and objective approach towards history making. History has been converted into experience through the virtual space, where experience is a result of communication. Mead points out that, communication provides a kind of behaviour where individual would become an object to himself, communication would use significant symbols directed not only to others as well as individual himself. (Mead 1934, 139). Since individual becomes an object to oneself there is the creation of a self-consciousness not limited to the perception of the others. Self-consciousness is both a subjective construct as one is within a society and also an objective construct as one perceives oneself outside the self. This construction of the self is also smoothly being co-opted into regimes that the self itself is opposing. The objective acknowledgement of the self in the other is also the process of constructing the world without the oppressors. In the process of getting co-opted in the narrative of the oppressor is a process of constructing the world without oppressor but it is also a process of

silencing the nonself (Radhakrishnan 2007). Getting co-opted in the narrative of the oppressor leads to the creation of the objective identity which allows continuity between two opposing constructions. Social media somehow allow the inherent binaries within human beings to be removed. This allows the emergence of the non-authoritarian attitude to reality and knowledge, but a forceful cooptation which allows the beginning of a peridural control and domination. Cooptation creates a new form of alienation unless it can be proved that there would be suppression of certain kinds of experiences to elevate others. Spaces created by Twitter in the age of capitalistic development supports heteronormativity through the process of cooptation. However, cooptation is not a cooperation or coexistence amongst different experiences but fitting one's personal experience in the acceptable patterned framework provided by Twitter. It is often observed that normativity continues to shape the rules of interaction over mere sharing of experiences. The search of the self in the action of the other led to Twitter giving rise to new tools of domination in this post-political, post-social space, which is still stuck with the historical identification of acceptable pasts. Processing of acceptability is similar to post-colonial chapters of history where the method of writing history was based on 'mnemonic innocence' as pointed by Gayatri Spivak, whereby, certain chapters of history were forgotten to reinforce certain other acceptable ones. In contemporary times, historical subjectivity is not a slave to social situations but conditionalities reined through technology.

14.1.2 Trolling Political and Creating 'NATION'

Trolling has become a political issue as well. There are battles not just fought on the battlefield but in the space created by Twitter. An imagined community of people is created and new boundaries set by the Twitterati. Globalization has created a standardization of a new kind. There could be a formation of the nation not through a plebiscite or referendum but through the process of trolling. These days' votes do not create nation but it is created through social networking sites. It is created through perceptions of supporters, by the political leaders, and media persons. Through wars between ideologies in Twitter, the idea of a nation is developed. Sometimes, ugly battles in the virtual space become more divisive in nature. The recent juvenile exchange of rhetoric between the President of America and the President of North Korea as to who possesses the bigger nuclear button is a typical example of how a war is being fought in the Twitter space.

But Twitter has also ensured democratic participation, transcending caste, class, and gender divisions. However, the responses in the form of trolls were less of deliberation and more of display of might. Generating standardized time zones could not blur the historical time zones. It is not possible to impose linearity, how the political participation or forming of association. Space of Twitter simultaneously creates communist, dictatorial, and capitalist nations. Not distinguished by boundaries these ideas are shaped by leaders, citizens, and non-state actors. While

participation in the city required the first step of qualifying as a citizen for making laws and also governed by it, in a post-globalized world with Twitter identities as qualifying markers the citizenship is not required. Nationalism is not a mode of reclaiming one's land from the colonized rule rather a form of creating the notions of us and them on Twitter. Land as a physical space has been overtaken by social media which is reinforcing its 'unique fellowship' within Twitter users. However, if one goes through the work of scholars from—(Ernest 1981) to (Brubaker 2004) and (Yael 1991)—the theoretical bases of construction of nation might not be too different from the world of Twitter. If language creates standards, symbols, structures and also enables participation there could be a situation whereby one would feel strongly connected to fellow Twitter users than with their neighbours or fellow citizens. Becoming a part of a state is a process guided by norms, controlled by the state and given a framework by rule of law. In this formation or the growth of the state, there was an overarching control over the imagination of the nation. Processing the idea of the nation could happen through cultural homogenization or through acceptance of heterogeneity among cultures and yet their simultaneous coexistence. Twitter might allow the presence of heterogeneous ideas in a domain that is not confined to borders. Ironically, the users of this structure enter this domain not free of their contextual biases. As a result of this central presence of bias, there is adherence to homogenizing ideas. Any countering of ideas might lead to a situation of spilling over of the societal bias in this domain. Ideas are information, as well as, reproduction of bias.

With personalization of this space, the integrity attached to a depersonalized space becomes obsolete. We are the creator of our own loneliness. The digital world is helping us to disassociate from the real world and is creating an illusion of connectivity. This illusion of connectivity is removing the people to people contact within a country. Loneliness within a nation is protected through the creation of fellow feeling beyond borders. The question remains as to why does one want to become a loner. Chinese author Cixin Liu explained loneliness to be a tendency to hide from others and not to let the other person know that one exists. According to Cixin Liu, there is a risk of attack, infection, and annihilation in connecting in the real world. Annihilation with the real world also provides solace in case of complete disassociation with the external and immediate world. Nations are not just formed here but democracy also becomes deontological. Democracy as a way of life is substituted by the loneliness of individuals coming together to address their issues on Twitter. It is also a moment without institutions, reasonability, and debate. Ironically, democracy does not require any substantial shift in human behaviour. Individuals do not focus on participation but only on simulation. This simulation of the reality through the use of language does not make much difference. Individuals maintain their status within a society and do not engage in guided discussions but standardizing their personal behaviours. In his article 'Our lonely connected times' Nishant Shah opined that the author might have put forward the proposition on 'loneliness' in his science fiction with regard to terrestrial interaction in some distant future but it holds true in today's world as well when people are building hostile and dark societies in order to disconnect. This building of illusionary world

perhaps is in response to the increasingly difficult universe that we live in Shah (2018).

While they disconnect in the real or temporal world there is a rise of reinforced connectivity through the establishment of one's position in the space of Twitter. When the project is the creation of a nation, it cannot be either rational or isolated but an emotional act. Since it is an emotional act the force of nationalism remains strong. Nationalism as created by Twitter has the space of creating nation where it does not exist. Nationalism is that state of mind which finds a preference in a situation of disgust with the present world. In such a situation, the solution lies in taking refuge in the past or dreaming of constructing a better unforeseen future. Ernest Renanonce said that all nation-states were built on a grief. It is the grief which is based on not being part of the larger whole. It was claimed that the emergence of capitalism would remove the identities based on sect, caste and estate and feudal loyalties. It is interesting to note that capitalism reinvented such identities. Capitalism could not remove these identities because it led to a situation where a few got the power to dominate many. However, in a globalized world, the grief of a capitalist reality producing loneliness is compensated through addressing of pain in the world of Twitter.

Since we are focusing on the role of Twitter, it is important to emphasize that unlike the nationalism of the past, the contemporary nationalism of the virtual world is a post-modern phenomenon. Despite the changes in this post-modern world, the question remains whether the division of the mind still persists or not. This psychological division still exists through the categorization of strangers in terms of 'more' or 'less' categories. Oommen, for instance argues that there exists at least four different categories of others—first equal other who is different but not subservient to the self, the second category consists of the internal other and refers to the marginalized groups in society such as women or certain established immigrants while the third group contains unacceptable societal group such as homosexuals such as a particular religious group, the deviant other and the fourth one as non-equal outsiders (Kinnvall 2006). Othering has gone to that length whereby the other has been perceived as being dirty. The process of turning the stranger into an enemy is an attempt to securitize subjectivity in times of uncertainty. This securitizing subjectivity becomes possible by mythologizing the chosen trauma and chosen glory. The chosen trauma is used to interpret new traumas. Stuart Hall (Athique 2013) opined that identity is always an open, complex and unfinished game always under construction. Since identity is always under construction those created through Twitter would continue the process of construction of individuals not through the presence of ideas of citizenship, boundaries, and institutions but irrespective of it. Undefined description of the identity of the individual that is ever changing individuals gain the liberty to redefine self-hood based on a self-maximization aspect to oneself. Ironically, the self-maximizing individual when dissatisfied with the surrounding finds a solution in the virtual world. However, the unified space created through Twitter is not similar to market unification. The control of time and space of a post-globalized world mostly refers to a common market structure. Over, here the self-maximization tendencies within

Twitter could also fall back on primordial and other suspecting aspects. Resurfacing of such primordial control could also be a result of subjective insecurities. Globalization has created that kind of a uniformity without a sustained security that the state provides, individuals have found expression as users and not as citizens. The user in the process of becoming an author of his own destiny and life unknown of his social, cultural and institutional position blurs the private and public differences.

However, in such a situation an individual is driven by the passion of controlling and uncontrolling histories. According to the sociologist, Jean Baudrillard, the Kuwait war in the early 1990s, was a virtual event more than an event taking place in reality. This was emphasized further by focusing on the fact that there was a 'disconnect between the electronic media and the depiction of reality, a tearing apart that was as much psychological and philosophical as it was technical in nature' (Athique 2013).

In this post-globalized world, there is the rise of conceptually deficient, legally ineffective and institutionally redundant space. Fusion of all forms of ideas in this space do not make differences invisible but rather gives shape to the deviation of a certain kind. Deviation promotes identities based on culture rather than that of principles. Nation-state functions not on ideas but it also allows protection of individual rights. Rights are not simply provision of spaces but securing of equality between individuals. Despite the failure of the states in many aspects, the focus has been on the building of institutions, especially in case of building of a democratic state. One has to point out the differences in engaging with Twitter. The influence and impact of Twitter upon different individual lives have not been similar. Individuals in autocratic regimes have found an alternative space for their subordinated voice and existence. In such a context, the building of a nation is more a normative function than a contextual one. This normative action of the user is not a regulation over actions but a reinforcing of a distant dream in a virtual world. It is more of a creation of a community of empathy and the support extended can diminish distances between nations. Empathy in this context is a combination of ideas. But information in the phase of informationalization, combines multiple relevant information through hypertext. This form of information sharing makes cultural dimensions of society an important aspect of the network society. There is also a subtle subjective shift from 'paternalistic and institutionalized worldwide' to a pervasive grassroots populism (Athique 2013). However, it is still debatable whether populism is truly finding its space in the network society of Twitter or is it giving scope to a new form of patriarchal control.

Globalization makes it an ideological issue transformed and discussed often showing anger and a sense of resentment against the state within which an individual is surviving. Reflection of anger and reflection of conflict remains a positive aspect of globalization where boundaries do not confine or restrict individual sentiments rather provides a space for addressing it. On the contrary, there could be a situation where individuals could also find this virtual and a hypothetical space a real one. The crisis in such cases is not the interaction rather a crisis in absence of rule of law, principles of the legality of a state. Societies and individuals start

functioning without institutions. Unlike market interactions where the driving force is a rational choice over emotions, in case of a virtual world, there is a lack of institutional control or rules over human interactions. As a result, it is a state of war without war being fought through the use of language. Communication through the use of language and gestures overtakes human interactions of any kind. Individuals in this new setup could be free of institutional limitations but are confronted unending strings of confrontation. Politics do not emerge in this a space of communication, which provides a space individual participation with the aim to fulfill one's civil capacities. Technological innovation could not change the social structures, rather the society found a new scope of expression.

14.1.3 Trolling 'GENDER'

Trolling is a form of online gendered form of violence and abuse. This trolling has become a dark side of globalization with the rise of online bullying, revenge, stalking and sexting. Lumsden and Morgan point out that this form of online abuse on Twitter, Instagram, and Facebook is a kind of 'symbolic violence', which is targeted mainly at women and minorities. While it is a violence using symbols, it might create a public opinion in favour of a certain section and at the same time might as well push out a large section out of the space of public opinion formation. Intimidation is not in the form of silencing through words but through open threats of deaths, rape and body shaming. Using such a virtual space in the form of normalization of violence has led to 'heteronormative masculinization of virtual space' (Lumsden and Morgan 2017). This control of the space for the creation of a heteronormativity is done also through the use of obnoxious and abhorrent words demeaning the identity of a person. The threats spill overtaking the actual place of an individual's life. There has also been the use of malicious techniques such as denial-of-service (DoS) attacks on victim's websites. Feminist bloggers have faced violence by trollers through sharing of personal details like address and phone numbers. In 2007, Melissa McEwan of Shakesville (http://www.shakesville.com/) was a victim of DoS attack (Athique 2013). Gender trolling individualizes women in a space that should have been gender neutral. Are technologies independent of experiences or contexts? Technologies are believed to be independent of the social influence. Space of technology is controlled by its author or the user. One who is using it plays multiple roles whereby, the user is the controller and not controlled. In such a situation, the user could behave like a God and master simultaneously. Both the causes and its consequences are created by the user or the author. In such a situation, the changes in the virtual space could be managed by the person using it, unlike the changes that influence the ontological world. Philosophers like Hobbes (Oakeshott 2011) however, were fearful of allowing people to have complete control over themselves. In absence of the control of the central absolute authority, individuals were to proceed towards leading a brutish and selfish life finally leading to a situation of war of one against the other. The only way to protect the

individuals from any kind of interference was through the process of allowing individuals to give up complete authority to rule over the self to an artificial contract. This contract was to be entered between citizens rather than with the state. But an absolutist control remained a central theme of Hobbesian argument to protect the security of citizens. Before discussing gendered technology, it becomes crucial to ponder over the need to have a leviathan like an arrangement to regulate the behaviour of users. The use of technology was made imperative in the globalized world. Technology is a product of historical change like the introduction of Internet. However, this change remained at the margins of social change thereby, misogynistic behaviour was used to simulate the real-life practices in some cases. The images shown to us is not a 'representation' but a 'remediation' of the reality. Such a change is taking place through photo-realism. Photo-realism provides a lot of scope for changing the colours, making corrections of the pictures, removing visual blemishes, alteration of shadows, etc., by doing this a hyper-reality is created. Hyper-real construct is a symbolic exaggeration whereby there is more than something attached to the meaning of the depicted object. 'This hyper-reality is deeply embedded in the process of communication. In this 'social constructivist' view, the process of mediation involves the production of a symbolic account of the world, as opposed to containing objective 'truthful' representations of anything in that world.' This hyper-realism survives along with 'simulacrum' (meaning of an artificial reality) as they are in 'pictures of things not things themselves' (Athique 2013) Reality is constructed based on symbols, signifiers and indicators.

Interestingly, while the historical contexts change the misogynistic behaviours remain constant and unchanging. Uniformity is then, not caused by globalization but standardization of misogynistic behaviour. Standardization is the connecting factor between technology and society. While society remains or adjusts itself with chaos, it aspires to create standards through norms and customs. In case of technology it is the scope of participation that normalizes differences and, in turn, creates standards. Society normalizes through differences and technology through participation. A code in a society embraces only a homogenous group within it, whereas technology accepts heterogeneity but it is participation itself that creates standardization. Despite the differences in the structures—virtual and social—the commonality is created by the proclivities of human nature. Human beings have been at the centre of discussion for different political philosophers, who focused on proclivities such as ego, fear, insecurity on the one hand, and morals, love, kindness on the other. Interestingly, the approach changes in human beings from being insecure to willingly cooperate with others. Human liberties and freedom of speech with the minimalist role of any regulatory authority change the terrain of human interaction. Gender trolling in Twitter is then not just the expression of power or domination but also freedom of the user to articulate some of the innate feelings.

Globalization reverses the rise of nation-state and thereby allows the process of returning to a Hobbesian state of nature where individual in the process of protecting their individual liberties also end up living a solitary, poor, nasty, brutish and short life (Roberts and Sutch 2004). In such a state when liberties are protected through the expression of opinion without any kind of reasonable restrictions, there

is the scope of abuse within virtual spaces. Due to this, instead of becoming a rationalized space for debate, discussion and argumentation regulated not by rules of reason, the space becomes an extension of the private, personalized domain of human beings. Extension of personal space could be a positive outcome only if the space questions the pettiness of the private through the removal of private trivialities instead of reinforcing it. This extension of the personal in this context is not similar to the feminist call which emphasized that the personal space is also a political one. It is rather the space where the intervention of the state is not seeking the political control is not required as long as the regulation is driven by the rationality of human beings.

14.1.4 Ethics of Using Technology

Ethics provide a framework for the conduct of human behaviour through maintenance of certain rules. Rules in ethics are not similar to laws. Although both law and ethics guide human behaviour yet not following the former only would lead to legal penalties. Modern institutions of the state are based on dichotomies of various kinds especially the distinctions between the private and public spaces. However, these distinctions have been overtaken by the blurring of distinctions in the post-modern world. Especially, with the invasion of technological innovation in the form of Twitter, there is a rise of public within a private. With the presence of the very public within private also could mean the existence of the private within public. Thus, there is not just the collapsing of the spaces but rise of intersections. The rise of this intersection of the space also leads to a situation where the identity is not existential but is an outcome of choice. Whether this choice based identity formations of the post-modern world diminishes the identity-based distinctions and power struggle still remains questionable. If identity is choice based then one can become women, men, animal, robot, etc., similar to Sartre's views. According to Sartre, there is no human nature for him, this is so because there is no God, this is also because of the fact that 'there is no human being, an animal, a criminal, a homosexual, an European or a coward. At each stage, everyone is free to choose to become something other than what he or she has been' (Cooper and Fosl 2010).

Sartre's identity could then become Haraway's Cyborg. Haraway could combine this postmodernist technological turn that affects our lives at present. In 1984, she creates a cybernetic organism known as Cyborg. By focusing on the changes of the modern times, she writes how we all are in a mythic time 'we all are chimeras, theorized and fabricated hybrids of machine and organism'. Image or an identity is opposed to the Goffman phase of struggle between 'I' and 'Me' but rather a creation of a condensed image. This condensed image is a combination of imagination and material reality (Donna Haraway 2016). Before the advent of Cyborg, there was a distinction between a 'self-designed and an externally designed world' (Haraway). Now, the blurring of the distinction is also becoming possible because of globalization. The dark side of globalization gives rise to the moment when the self is

trying to design itself to fit into the externally designed world. Universal unity of the material world is made possible through globalization, and this unity becomes dark when the difference is fused in the garb of unification. Unification or fusion also led to a rise of public space within the private domain, which rather would give rise to the Cyborg citizenship whereby as Haraway points out that capitalist patriarchy would also give rise to informatics of domination.

As long as these changes in the contemporary world allow intersectionality, the deficiencies of globalization could be overcome. On the contrary, the internet age led to the entering of the public in the domestic spaces, not through the intervention of any external forces but through acceptance of it. Modernity brings with it distinctions of spaces to protect individual identity, provide a space where an individual can be given a space free of arbitrary powers that interfere with an individual's thoughts and decisions. While postmodernity questions arbitrary control and disciplining of any kind; it is debatable whether it is able to protect individual rights and their privacy. Twitter becoming a new normal in our lives, one doubts to what extent are individuals able to protect themselves. It is in this context that we realize the need to emphasize the role of ethics in technology. However, the challenge remains that of making sense of a 'post-positivist' changes and allowing some universal ethical understanding to make an acceptable rule to be followed. Somewhere, it is not just the state mandated laws or rules but communicative and discursive practices that have come to define the role of the human beings using Twitter. Since social identities have become stronger the universal meaning attached to ethics is lost in the power relations 'defined by how the users understand certain problem in certain ways, and pose questions accordingly' (Held and McGrew 2007). In this phase of globalization, while the economic connectivity is acceptable and continues to be defined by the scarcity of the market, it is the social agency of a human being that gets challenged in the absence of a tenable rule or ethics.

14.2 Conclusion

Globalization opened the inner corridors of our existence, it enhanced the participation of individuals transcending borders. Spatial othering has been overcome by accepting the existence of the others in a common space. The virtual world has allowed different discourses to prevail that is not restricted to any particular class. Agency does not need the institutional support of any kind. With the rise of a fluid and ever-changing identity spaces are believed to be free of hierarchy. Interconnectivity and communication may have given powers to many moving beyond the core and periphery distinctions, however, the dark sides of the narrative show that human beings are continued to be defined by the perceptions of their consciousness. Human actions are articulated not through explicit demonstration of power but through the disciplining technique of language. Trolling in the modern times have come to display this use of power. Somehow, in the absence of any form of deliberations, trolling as a medium has been successful in writing history,

making nation, socializing gender. Legal intervention remains confined to approving terms of use provided at the beginning of joining these sites, rescuing individuals from a sense of fear, which gets embedded in their minds become difficult to erase. Since human nature is driven by both fear and glory, it remains subject to the action of the self or the influence of the other. In this process, despite its claim to create a space of universal claim of breaking down the historical differences and control, it is the failure of the process of globalization itself that reinforces new kinds of fear and domination through trolling.

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Part VIII
Globalization and Cultural Imperialism

Chapter 15
Impact of Globalization on Education in India: Towards Global Standards or Cultural Imperialism?

Anshu Sharma and Ankur Joshi

15.1 Introduction

Globalization for a country is an aim towards integrating their country's economy with the world economy beyond its geographical boundaries (Beck 2018). In the business context, it is the process of operating at international level and expanding operations across countries. However, during this process; one exposes not only its country's economy, but also its society and culture to external influence (Hong and Cheon 2017). In his seminal work, Hofstede (1980) defined culture as 'collective programming of the mind which distinguishes the members of one human group from another'. According to Berry's acculturation model (Berry 1995, 1997, 2003), there are different ways in which countries respond to this cultural exposure: 'assimilation, integration, separation and marginalization'; depending upon their trade-off between maintaining their own cultural heritage and adopting the external cultures. The way a society responds to this external influence largely depends on various social and psychological factors (Schumann 1986). Amongst these factors, one of the most important factors is the social status of the influencer and the influence. This social status can be understood in terms of the social dominance of the country (Fischer et al. 2012). Countries with high social dominance tend to influence the culture and societies of countries with low social dominance (Coleman 2010). This phenomenon is termed as 'cultural imperialism', which refers to the 'exercise of domination in cultural relationships in which the values, practices, and meanings of a powerful foreign culture are imposed upon one or more

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native cultures' (Tomlinson 1991). The phenomenon of cultural imperialism is not new but with rising globalization in today's time it becomes more and more relevant when we talk of 'global citizenship' (Lewin 2010) and hence becomes a matter of great concern for countries as to where to a draw a line between 'cultural integration' and 'cultural imperialism'. Although there are many shades of this dichotomy, this paper particularly highlights the role of globalization, the subsequent pressure for a globalized education and impact on the national identity (Pike 2000) and indigenous wisdom (Thaman 2003). This paper critically analyses the effects of globalization on the education systems of countries, especially in the Indian context, as a means of cultural imperialism and stripping away of its rich indigenous culture. This includes dramatic changes in the medium of instruction, curriculum, pedagogical changes, and the subsequent impact on learning outcomes and social dynamics in particular. The current paper, however, does not underestimate the positive side of the globalization; it just argues that a balanced approach is essential to reap the true benefits of globalization keeping the local cultures intact. Since culture and education are closely linked, and therefore, it is imperative to maintain a balance between global and local wisdom for holistic development. The authors acknowledge the importance of awareness and learning from other cultures, but it should not be at cost of the dilution of the native culture and erosion of the collective wisdom of the nation. Thus, the chapter concludes by suggesting that the merit of globalization with respect to education gets underscored if the local/indigenous cultures get diluted by the other culture.

15.2 Culture and Education

Education is a means of disseminating knowledge and traditional ways of knowledge transfer were more sustainable as they had knowledge about flora and fauna of their own context (Joshi et al. 2014). Bekerman and Kopelowitz (2008) studied the relationship between education and culture and they concluded that education is incomplete without cultural roots being intact. The ecosystem is a delicate and complex relationship between human beings and land. If this relationship is disturbed, it can have unpredictable effects.

'If you wanted to change a culture in a single generation, how would you do it? You would change the way it educates its children', explained Carol Black, who directed the documentary Schooling the World: The White Man's Last Burden, wherein she questioned whether Western education was another form of colonialism. This paper critically analyses the effects of globalization on the education systems of countries, especially in the Indian context, as a means of cultural imperialism and stripping away of its rich indigenous culture. This includes the medium of instruction, curriculum, pedagogical changes, and learning outcomes in particular. Many scholars in the past have expressed a concern of how education can be used as one means to socially dominate countries (Carnoy 1974; Bowman 1976; Coolahan 2001; Kindler and George 2000). However, few others have

critiqued this view by saying that colonial education was also a means of enlightened paternalism (Whitehead 1995). Yet others have built theoretical models to understand the development of comparative education in western and third world countries (Yang and Gou 2010).

15.3 Globalization and Education

The race towards modernizing education to make it at par with global standards have made dramatic changes in the way education is delivered such as the medium of instruction, curriculum, pedagogical changes and also, to a large extent changed the connotations of what is the meaning of quality education, subsequently impacting student learning outcomes and social dynamics in particular. The following is the critical analyses of few prominent changes:

15.3.1 Medium of Instruction

The medium of instruction in schools in India is predominantly English while the emphasis on learning through mother tongue is drastically decreasing (Meganathan 2015). Even NCERT acknowledges the importance of 'home language' in its National Curriculum Framework (NCERT 2005), but ground realities are far different. It is also observed that some of the schools have strict regulations on speaking in English such as penalizing students with fine if found speaking in a language other than English. In an attempt to adhere to global standards, we should not undermine the importance of the mother tongue, rather we should take pride in making our students multilingual. Many contextual meanings and knowledge are lost when we change the medium of communication. We need to remember that in cultural terms 'medium is the message' (McLuhan 1994).

15.3.2 Curriculum and Pedagogy

The school curriculums are centrally controlled and are largely standardized, more or less the same throughout the country and to a large extent does not take into account contextual differences, sociocultural backgrounds of the students and/or demands of the land (Edward 2013). There is a need to design school curriculums in a way they are more inclusive of the contextual diversity to make it more meaningful (Dogra 2016). The curriculum needs to be largely interdisciplinary in nature so that students' who have to face the world, approach the life in a holistic manner (Joshi and Gupta 2017). As a large part of India is rural there is an increasing need to add agriculture in school curriculum without which knowledge

dissemination would have very less value as it keeps students away from the real-life education (Yadav and Ali 2016). Even the current pedagogy is limited to the classroom, confined to the school boundary, is rigid and discipline oriented. It does not appreciate the different ways of learning (Vaish 2010). The student assessments are also standardized, with very less space for individuality and largely foster competition rather than cooperation (Black 2016)—making education a rat race for marks and grades.

15.3.3 Learning Outcomes

Modern education is preparing children, in the name of success, for a materialistic world defined by jobs in multinational corporations (MNCs)—only to serve needs of the giant corporations, taking them away from their local economy, preparing them for the global economy, driving them towards consumerism. Everyone wants to work for an MNC and takes pride in being a corporate employee, pushing them to be 'job seekers' and not 'job creators'. This has impacted the local economy and small-scale jobs. In this rat race for jobs and the so-called career success, children have started losing their childhood, imagination and creativity; Children have started losing the value of simplicity, compassion and love for nature. They are not prepared to survive in their own environment—losing skills of agriculture, conservation of forest, wildlife, etc., hence the current education system needs to be more focused on sustainable development and cooperative learning (Agashe 2004). There is a pressing need to inculcate a value-based education system (Bhatia and Dash 2011) instead of a career-focussed/job-seeker education system, which is only aimed at preparing students for jobs in the corporate world (Pilz 2016).

15.4 Dark Shades of a Modern 'Global Standards' Education

15.4.1 Loss of Creativity and Imagination

The formal education system as developed years ago can be seen synonymous to a 'factory' (Mitra 2017) with a standardized product (uniformed students) being assessed on standardized benchmarks, learning environment are concrete jail-like rooms, with no interaction with nature. Learning in the fear of failure and greed of corporate jobs. Learning is no more a joy for them. Branding few children as poor, dumb and failures. Disturbing their lives and mental states. Remember different ways of learning create different human beings. Highlighting the importance of different ways of learning Mitra et al. (2016) discussed the self-organizing systems of education in India.

15.4.2 Mass Dislocation

Modern education is forcing people to a large extent, especially young people to leave their native villages to look for jobs in cities and town where they can send their kids to the so-called 'good' schools (Chandrasekhar and Sharma 2014; Smith and Gergan 2015). It is not only putting a pressure on city resources, but also abandoning most of the villages (where livestock, farming) are left to the old population. Xing (2014) also discussed a similar problem in China due to the de-contextualized modernization of education.

15.4.3 Illusion of Success and Poverty Reduction

Education was propagated as a tool for poverty reduction in the developing countries, however, that is not truly the case (see work of Jeffrey 2008). Although the literacy rates and per capita income has gone up but the quality of life has certainly gone down, unemployment issues especially educated unemployment rates are alarming (Patel and Bulsari 2015). Subsequently, there is a rise in the difference between rich and poor, rise in the number of slum dwellers, crime rates and psychological and health problems.

15.4.4 Loss of Self-sustained Living

Education, particularly focused towards creating job seekers has created greater dependence on corporates, both for employment and increased consumption levels. As a result, education has started losing the importance of self-sufficiency, which is also a pressing cause for increasing consumerism. The traditional Gurukuls in India had a very crucial component—swavalamban (self-reliance) in a way that students from day one were expected to perform their activities on their own. This mechanism also ensured that life skills and survival skills get imparted to the child early in his/her life (Joshi and Gupta 2017).

15.4.5 Changes in the Meaning and Dignity of Work

Education is projected in conflict with traditional culture. In the name of secular education, the children are losing their identity and at an extreme level become ashamed of 'who they are'. The local language, food, way of life is tagged as backward and primitive. Work and success are measured and respected by the amount of money earned and status of an individual in society. Work is seen as a means to 'make money' or 'earn a living' and not a means to joy or sustainable living.

15.4.6 Issues Related to Social Justice

Modern education has created another form of social inequality by labelling people educated versus uneducated. It has also spread a wrong belief that uneducated people do not know anything and their work has low value. A huge impact of this is seen in elderly people and particularly women, who have stopped taking pride in the kind of work they used to do——cooking, weaving, household tasks, cattle grazing, farming, childbearing, and so on. This has not only created a sense of shame among them, but has also led to role ambiguity, role stress and changes in family structure.

15.4.7 Cultural Myopia

Modern education is creating a cultural myopia (Mahbubani 2010).—destroying the unique diversity of cultures and individuals. From spiritual teachings of values such as humility, compassion; the modern education is preparing students for jobs in the urban materialistic world—making a consumerist world. It is pushing children into a world of dependence. In a study on Ladakhi students in the Himalayan region of India (Ozer et al. 2017) found that due to impact of globalized education, these students find themselves in a dichotomy between their traditional way of living and the pressure to join the mainstream, which creates an ambiguous self-identity.

15.5 Possible Solutions

The problems are grave and deeply rooted, thus one-shot solutions seem difficult. But, continuous efforts toward creating better education that is based on extensive research has the potential to yield results. Many experiments like Rudolph Steiner School, Evergreen State College, Ekal Vidyalaya, Banasthali Vidyapith, etc., have been trying to create positive impact. Table 15.1 presents a brief overview of initiatives by such institutions:

For India, insights can be drawn from traditional Gurukul education system which addresses many of issues like customization (through strong Guru–Shishya relationship which makes every child special), discipline and cultural understanding (emphasis on indigenous culture), integrated approach to learning (curriculum designed in a manner that integrates various disciplines together), multiple modes of learning (various scriptures that capture similar ideas in multiple forms like stories, ideas, metaphors, analogies) through its unique educational ideology and approach (Joshi and Gupta 2017). Throughout the world, indigenous cultures have flourished that were suitable to the needs of the people in that region and even educational experts have emphasized the need for an education paradigm shift

Table 15.1 Overview of initiatives for education reforms

Institution	Initiative/unique approach	Rationale
Rudolph Steiner School	Basic traditional learning by keeping students immune from digital intoxication	In these times digital addiction has reached to height that digital detoxification camps are needed
Evergreen state college	Interdisciplinary practical learning	Need to blur the hyper-specialization syndrome
Ekal Vidyalaya	Single teacher	Addressing the educational needs of poor
Banasthali Vidyapith	Fivefold education	Holistic development through education

(Robinson 2010), one such initiative is the rise of creative schools which is transforming education at the grassroots level (see work of Robinson and Aronica 2016) and attempts to closely integrate education and culture for ethnic minorities in Netherlands (see Tolsma et al. 2012). So, the probable solution to problems can come from searching the roots again, while adopting contemporary best practices.

15.6 Conclusion

Based on the critical analysis of the modern global education system, our paper found that there is a far-reaching impact of such globalized education on both individual and social dimensions such as loss of creativity and imagination, mass dislocation, illusion of success and poverty reduction, loss of self-sustaining living, changes in the meaning and dignity of work, issues related to social justice, cultural myopia. Education should be a means to improve lives within the same social fabric and that too in a sustainable way preserving the local flora and fauna and respecting the native traditions. Any education that, in the name of modern global standards, destroys heritage has no value. Narratives of success versus failure, wealth versus poverty, knowledge versus ignorance needs to change. The biggest challenges that confront us are to reinforce the value of the ancient wisdom, while meeting the contemporary demands. The paper suggested a few of the ideas based on their study, which might be able to address some problems. Further researches on this theme will bring newer insights to bring quality improvement in the education.

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Part IX
Globalization and Agriculture

Chapter 16
Is There Any Decline in Growth of Rice Production in Indian Agriculture in Post-liberalization Era: Evidence from Multiple Structural Breaks Analysis

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16.1 Introduction

Agriculture as the backbone of Indian Economy involves 65% of Indian population and it contributes for around 22% of GDP. The Indian agriculture has made great achievements over the years. The food grains production has increased more than fourfold—from 51 million tonnes in 1950–51 to 212 million tonnes during 2003–04 and 257 million tons during 2012–13 growing at an annual average rate of more than 2.4% per annum. However, the recent trends in the performance of Indian agriculture are not satisfactory. During the 1990s, there has been a deceleration in the production as well as the growth rate of all the principal crops. The food grains production has increased at an average rate of 2% from 1991–92 to 2000–01 and experience a negative growth rate around −0.8% during 2001–02 to 2011–12. In the case of rice, the overall growth of rice for the period 1970–71 to 2012–13 is 3.14%. The rate of growth of rice production is the highest for PU (7.38%) and lowest in case of OR (0.56%). One notable feature of the growth analysis is that in 90s decade, the growth rate of rice production has fallen compared to 80s decade in case of six states among the ten states having a stationary trend. The rate of growth of rice production further decreased in the case of seven

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states for the period 2000–01 to 2012–13. The overall growth rate of rice production has decreased from 80s to 90s and 90s to last decade (see Table 16.3).

The measurement of growth of agriculture production involves a number of issues like the choice of period, the selection of cut-off points for different sub-periods, estimation of growth parameters and proper interpretation of results. These points have been taken up in a number of studies made earlier (Sen 1967; Narain 1977; Rudra 1982; Reddy 1978; Das 1978; Srinivasan 1979; Vidyyanathan 1980; Dandekar 1980; Ray 1983; Sawant 1983; Dev 1987; Boyce 1987; Saha and Swaminathan 1994; Sawant and Achuthan 1995; Bhalla and Singh 1997, etc.). The earlier studies on the growth of agricultural output—expect one or two—are based on the traditional time series analysis, i.e. to find a trend equation and then compare the trend between two periods. However, the literature on the modern econometric time series analysis suggests that the growth process must be determined by the statistical properties of the series, and the break point of the series must be endogenously determined. Mukhopadhyay and Sarkar(2001) used the structural break of modern time series specification technique to test for acceleration in food grains production in West Bengal. They also found that the underlying series is a Different Stationary (DS) series with drift implying that one cannot claim for the existence of a deterministic trend in the level of food grains production. However, their analysis is based on the overall West Bengal economy. But West Bengal's agricultural production shows a great variability due to variability in land capacity, climate, fertilizer uses, irrigated area, etc., from district to district. As a result, one may not get a uniform growth rate for all the districts. Ghose and Pal (2007) measured inter-district disparity in the growth of foodgrains production in West Bengal by applying both the exogenous and endogenous structural break analysis to test for acceleration in food grains production. Sengupta et al. (2009) considered the interstate variation of food grains, non-food grains and total agricultural production by considering exogenous structural break due to Perron and endogenous structural break due to Zivot and Andrews. Pal and Ghose (2012) made crop-wise analysis taking into account all India data for the crops like **Food Crops**: Rice, Wheat, Maize (Corn), Jowar(Sorghum), Gram, Bajra(Pearl Millets); **Cash Crops**: Cotton, Groundnuts, Jute, Rapeseed/Mustard Oil, Sugarcane, Tobacco.

The limitation of the above studies is that all have employed the method of detecting one-time structural break. But in reality, there may be more than one break in the series. So it is better to use a method which can identify multiple structural breaks rather than considering one structural break. The analysis of growth by using multiple structural breaks in case of the Indian agricultural sector is still lacking.

In the year 1990, the country was facing a fiscal deficit where expenditure exceeds the revenue and in the year 1991, the central government introduced some Structural Adjustment Programme which is also known as the New Economic Policy (NEP). To cope up with the sudden boom and change in the economy, state governments provided an opportunity for the private sector to develop and reduce its investment especially in infrastructure and agriculture. The policies were taken so that the new reform can make the country economic crisis free and to accelerate the economic growth via industrial development. The NEP emphasized mainly on

the industry, tax reforms, foreign trade and investment, banking capital and markets. It also brought the free flow of technology, labour, capital, trade relations with different countries across the globe thus reducing the international trade barriers. This policy resulted in increased GDP (Gross Domestic Product) growth rate, foreign direct investment and foreign exchange in the Indian economy. But NEP emphasizing on industrial growth and expansion of the service sector particularly in the urban centres has increased the urban–rural disparities.

Thus, **the first objective of this study is to check for the presence of multiple suitable breaks in the growth path of rice production of major rice-producing states in Indian Agriculture during the period 1970–71 to 2013–14 for finding out the effect of liberalization policies on rice production in Indian agricultural sector. That is, if liberalization policies have any effect on the growth of rice production for different major states of India then there should exist a structural break after 1991 as the growth rate may be affected by the liberalization policies. Second, after checking the presence of multiple structural breaks, this study also tries to find out the rate of growth of rice production of major rice producing states for different regimes as suggested by the observed break points by applying least square estimation with breaks** (Bai and Perron 2003a)**. Particularly to check whether the growth of rice production has increased or decreased after the liberalization policies taken by the Government of India in 1991**. In this study, 11 major rice producing states namely Andhra Pradesh(AP), Assam(AS), Bihar(BI), Haryana(HA), Karnataka(KA), Madhya Pradesh(MP), Orissa(OR), Punjab(PU), Tamil Nadu(TN), Uttar Pradesh (UP) and West Bengal(WB) have been taken into account. The reason behind the consideration of these 11 states is that the share of these states in All India Rice production is greater than or equals to 3%.

The structure of the present paper is as follows: Sect. 16.2 presents the methodology of testing multiple structural breaks by using Bai and Perron (1998, 2003a) approach. Section 16.3 discusses the results of estimation. Some concluding remarks are made in Sect. 16.4.

16.2 Methodology and Data Sources

Methodology:

16.2.1 Methodology for Testing the Presence of Multiple Structural Break

The method of finding out multiple structural breaks due to Bai-Perron consists of three steps. In the **first step,** one has to check whether the underlying process is

stationary or not. After checking the stationarity properties of the series, in the **second step,** one has to test whether the deterministic trend process is statistically significant or not. After finding out the significant deterministic trend in **third step,** one can apply multiple structural breaks analysis suggested by Bai and Perron (1998, 2003a).

Step-I: To find out the stationary property of the series, unit root is applied. The present paper uses three alternative tests (a) Augmented Dickey–Fuller (ADF) Test, (b) Phillips and Perron (PP) Test and (c) Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test available in the literature.

A major debate concerning the nature of macroeconomic data has been going on until Nelson and Plosser (1982) published their seminal work. They found that series is Difference Stationary (hereafter, DSP) rather than Trend Stationary (hereafter, TSP). A TSP process indicates a temporary random shock around its trend whereas the DSP process indicates a permanent random shock around its trend. Also, for DSP process, the variance or the higher order moments of the variable is not constant. It is dependent on time. After their work, a large number of studies also suggested that the DSP process is the most appropriate one.

a. **Augmented Dickey–Fuller (ADF) Test**

The test for detecting whether a series is DSP or TSP is called the unit root test, as introduced by Dickey and Fuller (1979, 1981). To understand these processes, consider the following regression equation:

$$\Delta y_t = \delta_0 + \delta_1 t + \gamma y_{t-1} + u_t \quad \text{where } u_t = \alpha u_{t-1} + \varepsilon_t$$

A test of null hypothesis $H_0 : \gamma = 1$ is required against the alternative hypothesis $H_1 : \gamma < 1$.

Now, if one fails to reject the null hypothesis then the underlying process is DSP. On the other hand, if one rejects the null hypothesis then it implies that the underlying process is TSP. Now standard t distribution is not applicable to check the significance of the coefficient of y_{t-1}. Fuller solved this problem and he found a limiting distribution of this coefficient. Again, Dickey (1976), MacKinnon (1990) approximated these distributions empirically and they have derived the critical values from a bigger set of replications. The existence of a trend in the series implies that the underlying process is TS and the coefficient of time is statistically significant. The existence of drift in the model indicates that the constant term is statistically significant. Now, if Δy_t depends on Δy_{t-j} (where j = 1, 2, K, $K < T$) then the above test procedure is called as Augmented Dickey–Fuller test. The ADF test is based on estimating the test regression, which is as follows:

$$y_t = B' D_t + \gamma y_{t-1} + \sum_{j=1}^{p} \delta_i \Delta y_{t-j} + \varepsilon_t$$

where D_t represents a vector of deterministic terms (constant, trend, etc.). The ARMA structure of the errors are included in the model by incorporating the p lagged difference terms, Δy_{t-j}, and the value of p is determined so that the error ε_t is serially uncorrelated. The assumption of homoskedasticity is applicable to the error term. Under the null hypothesis, y_t is I(1) which implies that $\gamma = 1$.

An alternative formulation of the ADF test regression is

$$\Delta y_t = B'D_t + \pi y_{t-1} + \sum_{j=1}^{p} \delta_i \Delta y_{t-j} + \varepsilon_t$$

The ADF unit root test tests the null hypothesis $H_0 : \pi = 0$ against the alternative hypothesis $H_1 : \pi < 0$; it is based on the t-statistic of the coefficient π from OLS estimation of the above equation. The ADF test statistic does not follow an asymptotic standard normal distribution under H_0, but it has a non-standard limiting distribution. Further, this non standard limiting distribution under the unit root null hypothesis is the same as the Dickey–Fuller distribution. So, the same critical values corresponding to the Dickey–Fuller test are applicable for the ADF test as well.

b. **Phillips and Perron (PP) Test**

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. This test is a modification of the original Dickey–Fuller test statistic using nonparametric approach. This test which should ideally be called a semi-parametric test, since it considers the usual parametric regression but treats serial correlations of the error term in nonparametric way. The test regression for the PP tests is

$$\Delta y_t = B'D_t + \pi y_{t-1} + u_t$$

where u_t is I(0) and may be heteroskedastic. The PP tests are correct for any serial correlation and heteroskedasticity in the errors u_t of the test regression by directly modifying the test statistics $t_{\pi=0}$ and $T\hat{\pi}$. These modified statistics, denoted Z_t and Z_π, are given by

$$Z_t = \left(\frac{\hat{\sigma}^2}{\hat{\lambda}^2}\right)^{\frac{1}{2}} . t_{\pi=0} - \frac{1}{2}\left(\frac{\hat{\lambda}^2 - \hat{\sigma}^2}{\hat{\lambda}^2}\right) . \left(\frac{T.SE(\hat{\pi})}{\hat{\sigma}^2}\right)$$

$$Z_\pi = T\hat{\pi} - \frac{1}{2}\frac{T^2.SE(\hat{\pi})}{\hat{\sigma}^2}\left(\hat{\lambda}^2 - \hat{\sigma}^2\right)$$

The terms $\hat{\lambda}^2$ and $\hat{\sigma}^2$ are consistent estimates of the variance parameters

$$\sigma^2 = \lim_{T\to\infty} T^{-1} \sum_{t=1}^{T} E\left[u_t^2\right]$$

$$\lambda^2 = \lim_{T\to\infty} \sum_{t=1}^{T} E\left[T^{-1} S_T^2\right]$$

where $S_T = \sum_{t=1}^{T} u_t$.

The sample variance of the least squares residual $\hat{u}_t$ is a consistent estimate of σ^2, and the Newey–West long-run variance estimate of u_t(using $\hat{u}_t$ is a consistent estimate of λ^2). Under the null hypothesis that $\pi = 0$, the PP Z_t and Z_π statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistics. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term u_t. Another advantage is that the user does not have to specify a lag length for the test regression.

c. Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test

In case of both ADF and PP tests, the null hypothesis is taken to be a unit root and the alternative hypothesis is stationary. The test proposed by Kwiatkowski et al. (1992), takes a different view of the unit root testing problem by taking stationary as the null against an alternative of a unit root, i.e., $H_0 : y_t \sim I(0)$ against $H_1 : y_t \sim I(1)$. They derive their test by starting with the model

$$y_t = B' D_t + \mu_t + u_t$$

$u_t = \mu_{t-1} + \varepsilon_t$, where $\varepsilon_t \sim WN(0, \sigma_\varepsilon^2)$

where D_t is the deterministic components (constant or constant plus time trend) and u_t is stationary and may be heteroskedastic. Notice that u_t is a pure random walk with innovation variance σ_ε^2. The null hypothesis that $y_t \sim I(0)$ is formulated as $H_0 : \sigma_\varepsilon^2 = 0$, which implies that u_t is a constant. The KPSS test statistic is the Lagrange multiplier (LM) or score statistic for testing $\sigma_\varepsilon^2 = 0$ against the alternative that $\sigma_\varepsilon^2 > 0$ and is given by

$$\text{KPSS} = \frac{\left(\frac{1}{T^2}\sum_{t=1}^{T} \widehat{S_t^2}\right)}{\hat{2}}$$

where $\widehat{S_t^2} = \sum_{j=1}^{t} \hat{u}_j, \hat{u}_j$ is the residual of a regression of y_t on D_t and $\widehat{\lambda^2}$ is a consistent estimate of the long-run variance of u_t using $\hat{u}_t$. Under the null that y_t is I (0), Kwiatkowski, Phillips, Schmidt and Shin show that KPSS statistic converges to a function of standard Brownian motion that depends on the form of the deterministic terms D_t but not their coefficient values β. The critical values of the KPSS test statistic can be found in Kwiatkowski et al. (1992).

Step-II: In Step–1 it has to be checked whether there exists any deterministic trend in the series or not. For this purpose, one has to consider whether the coefficient of time arising in the above three tests is significantly different from zero or not. If the coefficient of time significantly differs from zero then one can conclude that there exists a deterministic trend in the series.

Step-III: After finding out the deterministic trend in the series, one can now apply Bai–Perron Methodology for finding out the multiple structural breaks. Most of the studies related to structural change have considered the presence of one-time structural break only (Perron 1989; Zivot and Andrews 1992 etc.). But the macroeconomic time series may contain more than one structural break. Thus, it is better to consider more than one structural break for analysis. In their path-breaking work, Bai and Perron (1998) provided a comprehensive analysis of several issues in the context of multiple structural change models and develop some tests that allow inference to be made about the presence of structural change and the number of breaks. This test is helpful in the changes present and also it endogenously determines the points of break with no prior knowledge.

Now, there are two parts in the Bai–Perron methodology. In the **first part,** we have to identify whether there exists at all any break in the series or not. Bai–Perron mentioned this test as Structural Stability versus an Unknown Number of Breaks. In the **second part**, if at least there exists any break then we have to test the presence of multiple structural breaks in the series. Bai–Perron called this test as Sequential Test.

To carry out the first part of this step-III, Bai–Perron (1998) consider the following linear regression with m breaks ($m + 1$ regimes):

$$y_t = x_t'\beta + z_t'\delta_j + \mu t, t = Tj - 1, \ldots T$$

($j = 1,\ldots,m + 1$, $T_0 = 0$ and $T_{m+1} = T$)

Where y_t is the observed dependent variable, $x_t \in \Re^p$ and $z_t \in \Re^q$ are vectors of covariates, β and δ_j are the corresponding vectors of coefficients with $\delta_i \neq \delta_{i+1}$ $(1 \leq i \leq m)$ and μ_t is the error term at time t. The break dates $(T_1,\ldots,T_m)$ are explicitly regarded as unknown. It may be noted that this is a partial structural change model insofar as β does not shift and is effectively estimated over the entire sample. Then, the purpose is to estimate the unknown regression coefficients and the break dates, that is to say $(\beta, \delta_1,\ldots \delta_{m+1}, T_1,\ldots,T_m)$, when T observations on (y_t, x_t, z_t) are available.

Bai and Perron (1998) built a method of estimation based on the least square principle. For an m-partition $(T_1,\ldots,T_m)$, denoted by $\{T_j\}$, the associated least square estimator of δ_i is obtained by minimizing the sum of squared residuals $\sum_{i=1}^{m+1} \sum_{t=Ti-1}^{T_i} [y_t - x_t'\beta + z_t'\delta_j]^2$ under the constraint $\delta_i \neq \delta_{i+1}$ $(1 \leq i \leq m)$. Let $\hat{\delta}(\{T_j\})$ being the resulting estimate. Substituting it in the objective function and denoting the resulting sum of squared residuals as $S_T(T_1,\ldots,T_m)$, the estimated break dates $(\hat{T}_1, \ldots \hat{T}_m)$ are such that

$$(\hat{T}_1, \ldots \hat{T}_m) = \arg \min_{T_1, \ldots T_m} ST(T_1, \ldots T_m)$$

where the minimization is taken over all partitions (T_1,…,T_m) such as $T_i - T_{i-1} \geq [\varepsilon T]$. The term $[\varepsilon T]$ is interpreted as the minimal number of observations in each segment. Thus, the breakpoint estimators are global estimators and are global minimizers of the objective function. Finally, the regression parameter estimates are obtained using the associated least-squares estimates at the estimated m-partition, $\{\hat{T}_j\} i, e. \hat{\delta} = \hat{\delta}(\{T_j\})$

A Test of Structural Stability versus an Unknown Number of Breaks

Bai and Perron (1998) considered tests of no structural change against an unknown number of breaks given some upper bound M for m. The following new class of tests is called double maximum tests and is defined for some fixed weights $\{a_1 \ldots a_m\}$ as

$$D\max FT(M, q, a_1, \ldots a_M) = \max a_m \mathrm{SupFT}(\lambda_1, \ldots \lambda_{n:q})$$
$$= \max a_m \mathrm{FT}(\lambda_1, \ldots \lambda_{n:q})$$

The weights $\{a_1 \ldots a_m\}$ reflect the imposition of some priors on the likelihood of various numbers of structural breaks. First, they set all weights equal to unity, i.e., $a_m = 1$ and label this version of the test as UD max$F_T(M,q)$. Then, they consider a set of weights that the marginal p-values are equal across values of m. The weights are then defined as $a_1 = 1$ and $a_m = c(q, \alpha, 1)/c(q, \alpha, m)$ for $m > 1$, where α is the significance level of the test and $c(q, \alpha, m)$ is the asymptotic critical value of the test $\sup F_T(\lambda_1, \ldots \lambda_{n:q}) \in \Lambda_e F_T(\lambda_1, \ldots \lambda_{n:q})$. This version of the test is denoted as *WD* max $F_T(M, q)$.

The second part of Step-III is basically on the sequential test.

A Sequential Test

The last test developed by Bai and Perron (1998) is a sequential test of l versus $l + 1$ structural changes, which is as follows:

$$\sup F_T(l+1/l) = \{S_{\widehat{T}}(\widehat{T}_1, \ldots, \widehat{T}_l) - \min \inf S_{\widehat{T}}(\widehat{T}_1, \ldots, \tau, \widehat{T}_{i-1}, \ldots, \widehat{T}_l)$$

where

$$\Lambda_{i,n} = \{\tau; \widehat{T}_{l-1} + (\widehat{T}_l - \widehat{T}_{l-1})\eta \leq \tau \leq \widehat{T}_l + (\widehat{T}_l - \widehat{T}_{l-1})\eta\},$$

$S_T(\widehat{T}_1, \ldots, \widehat{T}_{i-1}, \tau, \widehat{T}_i \ldots \widehat{T}_l)$ is the sum of squared residuals resulting from the least squares estimation from each m-partition (T_1,…T_m) and $\widehat{\sigma}^2$ is a consistent estimator of σ^2 under the null hypothesis.

The asymptotic distributions of these tests are derived in Bai and Perron (1998) and the asymptotic critical values are tabulated in Bai and Perron (1998, 2003b) for $\varepsilon = 0.05$ ($M = 9$), 0.10 ($M = 8$), 0.15($M = 5$), 0.20($M = 3$), and 0.25 ($M = 2$).

After performing the first and second part of Step-III, the crucial decision is the selection of major break points.

The Selection Procedure

For determining the number of breaks in the underlying series first one has to look at the *UD* max$F_T(M,q)$ and *WD* max$F_T(M, q)$ statistics to check whether there exists at least one structural break or not. Then, decide the number of breaks based upon an examination of the sup $F_T(l + 1/l)$ statistics constructed using the break date estimates obtained from a global minimization of the sum of squared residuals (i.e. one can select m breaks such that the tests sup F_T $(l + 1/l)$ are non significant for any $l > m$). Bai and Perron (2003a) conclude that this method leads to the best results and is recommended for empirical applications.

After the break points, it is essential to find out the whether growth rate changes from regime to regime or not. The next section describes the method of finding out such changes in the growth rates.

16.2.2 Least Square Regression with Break Points

For estimating an equation using break point least squares, it is important to point out that the resulting estimated equation is simply a linear regression model in which some of the variables are interacted with regime dummy variables, as in Equation

$$y_t = X_t'\beta + \overline{Z_t'}\bar{\delta}_j + \epsilon_t$$

Thus, most of the discussion related to the linear regression model in "Basic Regression Analysis".

16.2.3 Data Sources

The period of analysis is 1970–71 to 2013–14 for 11 major rice-producing states as stated above. All the data has been collected from the different issues of the Statistical abstract, Agriculture at a Glance, Agriculture in Brief, Handbook of Statistics of Indian Economics, www.indianstat.com (an online commercial data service), Cost of Cultivation data published by the Government of India.

16.3 Results of Analysis

16.3.1 Results of Unit Root Test

The results of ADF, PP and KPSS test statistics and their trend for checking unit root and trend are presented in Tables 16.1 and 16.2.

From the results of Table 16.1, one can conclude that among all the 11 major rice-producing states the underlying process is Difference Stationary (DS) in case of Madhya Pradesh only. So, one can not apply the multiple structural break analysis in case of Madhya Pradesh.

Now among the ten states following Trend Stationary (TS) process (i.e. Andhra Pradesh(AP), Assam(AS), Bihar(BI), Haryana(HA), Karnataka(KA), Orissa(OR), Punjab(PU), Tamil Nadu(TN), Uttar Pradesh(UP) and West Bengal(WB)), the ADF test statistic is statistically significant at 1% level in case of 6 states like AP, AS, BI, KA, OR and TN, and at 5% level in case of HA, PU and UP. In case of WB, this is significant at 10% level.

After checking whether the process is DSP or TSP type using unit root test, one has to consider whether the trend coefficient in case of TSP (i.e. deterministic trend of the series) is significant or not. Note that if the series is of DSP type, the Bai–Perron methodology cannot be applied. These results are presented in Table 16.2.

Now from the results of Table 16.2, one can conclude that among the ten states following TS process, the coefficient of deterministic trend is positive and statistically significant at 1% level in case of AP, AS, HA, KA, OR and WB, and at 5% level in case of BI, PU, TN and UP (Table 16.3).

Table 16.1 Results of unit root tests

	ADF		PP test		KPSS test
	ADF statistics	Probability*	Adj. *t*-statistics	Probability*	*LM*-statistics**
AP	−4.821122	0.0019	−4.818263*	0.0019	0.119908
AS	−5.076953	0.0009	−5.194991*	0.0007	0.126434
BI	−4.251416	0.0087	−4.212531*	0.0096	0.114477
HA	−3.529362	0.0311	−3.529362*	0.0311	0.167646
KA	−5.23572	0.0006	−5.131973*	0.0008	0.080187
MP	−1.659645	0.7505	−1.659645	0.7505	0.260619
OR	−7.395679	0	−7.315292*	0	0.070619
PU	−3.482476	0.0461	−4.363135*	0.0065	0.117414
TN	−3.940243	0.019	−3.94785*	0.0187	0.099881
UP	−3.476933	0.0436	−4.390721*	0.0061	0.011871
WB	−3.379388	0.0682	−3.497172*	0.053	0.093768

*MacKinnon (1996) one-sided *p*-values
**Kwiatkowski et al. (1992, Table 1)
*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.2 Results of trend analysis

		ADF			PP test			KPSS test		
	Variable	Coefficient	*t*-statistic	Probability	Coefficient	*t*-statistic	Probability	Coefficient	*t*-statistic	Probability
AP	C	6.4853*	4.8448	0.0000	6.4853*	4.8448	0.0000	8.5673*	193.9821	0.0000
	TREND	0.0171*	4.1478	0.0002	0.0171*	4.1478	0.0002	0.0232*	12.4934	0.0000
AS	C	6.1566*	5.0920	0.0000	6.1566*	5.0920	0.0000	7.5677*	235.9032	0.0000
	TREND	0.0158*	4.5891	0.0000	0.0158*	4.5891	0.0000	0.0194*	14.4175	0.0000
BI	C	5.6446*	4.2448	0.0001	5.6446*	4.2448	0.0001	8.5046*	109.7418	0.0000
	TREND	0.0005*	2.1462	0.0488	0.0005*	2.1462	0.0488	0.0010	9.3217	0.0000
HA	C	2.5955*	3.2274	0.0026	2.5955*	3.2274	0.0026	6.3746*	111.8694	0.0000
	TREND	0.0184*	2.7614	0.0088	0.0184*	2.7614	0.0088	0.0495*	20.6967	0.0000
KA	C	6.2542*	5.2415	0.0000	6.2542*	5.2415	0.0000	7.4999*	164.6396	0.0000
	TREND	0.0167*	4.4876	0.0001	0.0167*	4.4876	0.0001	0.0196*	10.2716	0.0000
OR	C	9.6465*	7.3928	0.0000	9.6465*	7.3928	0.0000	8.1980*	140.9894	0.0000
	TREND	0.0193*	5.3127	0.0000	0.0193*	5.3127	0.0000	0.0157*	6.4229	0.0000
PU	C	0.9097*	2.6976	0.0104	0.9097*	2.6976	0.0104	7.3052*	76.6365	0.0000
	TREND	0.0018*	2.1846	0.0456	0.0018*	2.1846	0.0456	0.0589*	14.7116	0.0000
TN	C	4.9724*	3.9296	0.0003	4.9724*	3.9296	0.0003	8.5211*	135.7891	0.0000
	TREND	0.0031	2.2870	0.0424	0.0031*	2.2870	0.0424	0.0047***	1.7675	0.0848
UP	C	3.4264*	2.3282	0.0256	5.2170*	4.1860	0.0002	8.2713*	132.2051	0.0000
	TREND	0.0129*	2.1790	0.0462	0.0210*	3.6108	0.0009	0.0341*	12.9611	0.0000
WB	C	4.1102*	3.4000	0.0016	4.1102*	3.4000	0.0016	8.6400*	212.8127	0.0000
	TREND	0.0129*	3.0833	0.0038	0.0129*	3.0833	0.0038	0.0272*	15.9800	0.0000

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.3 Results of decade-wise growth analysis

STATES	1970–80	1980–90	1990–2000	2000–2013	1970–2013
AP	4.202298	2.513571	1.906343	3.805524	3.106934
AS	0.732369	1.083831	2.571199	2.639227	1.756657
BI	0.295636	4.135318	4.299877	1.002795	2.433406
HA	11.2804	2.248915	4.583959	3.236677	5.337489
KA	1.440781	0.236279	3.629826	3.217683	2.131142
OR	−1.43412	3.978192	−0.93064	0.662082	0.568879
PU	18.49967	6.741944	2.50127	1.793697	7.384146
TN	0.477838	3.863048	3.487951	3.7527	2.895384
UP	1.644577	5.673821	4.066091	1.757058	3.285386
WB	0.779523	6.827906	3.495402	−0.83529	2.566885
OVER ALL	3.791898	3.730282	2.961128	2.103215	3.146631

16.3.2 Results of Multiple Structural Break Analysis

The results of multiple structural break analysis are presented in Table 16.4.

From the results of Table 16.4, one can conclude that both UD Max and WD Max statistic are significant at 5% level for all the states. This implies that for all the states there exists at least one break in the deterministic trend. Now after getting the results that there exists at least one break in the deterministic trend one has to apply the sequential test to find out the actual numbers of breaks and the break dates.

The exact number of breaks for each of the states can be visualized from Table 16.4.

Table 16.4 Results of multiple structural breaks analysis

	AP	AS	BI	HA	KA
UDMax statistic	47.24276*	125.0536*	63.22945*	250.8927*	35.45126*
WDMax statistic	75.36502*	171.5747*	86.75142*	295.1527*	69.50872*
SupF(1 vs. 2)	43.79196*	23.51387*	40.29158*	16.33524*	8.149574
SupF(2 vs. 3)	14.92035*	28.13661*	6.884679	15.21037*	
SupF(3 vs. 4)	8.116933	8.599473		22.08581*	
SupF(4 vs. 5)				2.835856	
Estimated break dates and their corresponding Sign	1984	1990	1994	1976	1995
	Positive	Positive	Negative	Positive	Negative
	1991	1998	2004	1987	
	Negative	Positive	Negative	Positive	
	2002	2004		1993	
	Negative	Negative		Negative	
				2005	
				Positive	

(continued)

Table 16.4 (continued)

	AP	AS	BI	HA	KA
	OR	PU	TN	UP	WB
UDMax statistic	26.36988*	2429.206*	75.28616*	117.9542*	82.05325*
WDMax statistic	34.47889*	2857.743*	147.6124*	119.1343*	160.8805*
SupF(1 vs. 2)	23.17205*	159.3957*	18.28168*	51.52672*.	65.84835*
SupF(2 vs. 3)	24.34527*	12.41234	49.78477*	107.6672*	22.73957*
SupF(3 vs. 4)	14.87488*		9.004365	1.900478	10.09125
SupF(4 vs. 5)	13.50913				
Estimated break dates and their corresponding sign	1977	1977	1977	1978	1982
	Negative	Positive	Positive	Positive	Negative
	1983	1983	1984	1988	1987
	Negative	Positive	Positive	Negative	Positive
	1996		2002	2002	2001
	Negative		Positive	Positive	Negative
	2003				
	Negative				

*Significant at the 0.05 level; Bai and Perron (Econometric Journal 2003a) critical values

16.3.3 Results of Least Square Regression Analysis

The results of the least squares regression analysis with structural breaks are presented in Tables 16.5, 16.6, 16.7, 16.8, 16.9, 16.10, 16.11, 16.12, 16.13 and 16.14.

From the regression analysis, it can be found that in the case of AP growth rate increase after 1984 but significantly decreases after 1991 and 2002. In case of AS, growth rate increases after 1990 and 1998 but falls after 2004. The rate of growth of rice production significantly decreases after 1994 and 2004 in the case of BI. In the case of HA, the rate of growth significantly increased after 1976 and 1987 but decreases after 1993. But in the case of HA, the rate of growth of rice production significantly increased after 2005. In the case of KA, this rate of growth of rice production decreased after 1995 and in the case of OR this rate decreased significantly after 1977, 1983, 1996 and 2003. In the case of PU, the growth rate increased significantly after 1977 and further increased after 1983. In the case of TN, the rate of growth of rice production increased significantly after 1977, 1984, and 2002, respectively. In the case of UP, growth rate increased after 1978 and 2002 but decreased after 1988. Lastly, in the case of WB, the rate of growth of rice production decreased after 1982 and 2001 but increased after 1987.

So, in conclusion by visual inspection of the graph of rice production for ten states having stationary trend (see Annexure-I) or from the least square regression analysis with structural breaks, it can concluded that:

- **Breaks in Positive Direction**: AP (1984), AS (1990, 1998), HA (1976, 1987, 2005), PU (1977, 1983), TN (1977, 1984, 2002), UP (1978, 2002) and WB (1987).
- **Breaks in Negative Direction**: AP (1991), AS (2004), BI (1994, 2004), HA (1993), KA (1995), OR (1977, 1983, 1996, 2003), UP (1988) and WB (1982, 2001).

Table 16.5 Results of least square estimation with structural breaks in case of AP

Variable	Coefficient	*t*-statistic	Probability
1970–1983			
C	8.359988	19.60414*	0
T	0.04711	14.06269*	0
1984–1990			
C	8.498944	46.83104*	0
T	0.07024	11.08236*	0
1991–2001			
C	9.21784	28.95887*	0
T	0.00651	3.616667*	0
2002–2013			
C	5.143652	22.16967*	0
T	0.001153	12.00792*	0
Adjusted R-squared	0.891689		
F-statistic	87.09446*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.6 Results of least square estimation with structural breaks in case of AS

Variable	Coefficient	*t*-statistic	Probability
1970–1989			
C	7.532909	10.1508*	0
T	0.018798	7.6852*	0
1990–1997			
C	7.959929	14.69164*	0
T	0.05992	16.41644*	0
1998–2003			
C	9.221852	32.3041*	0
T	0.09655	14.65099*	0
2004–2013			
C	5.276225	18.64595*	0
T	0.04825	7.054094*	0
Adjusted R-squared	0.930121		
F-statistic	51.8218*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.7 Results of least square estimation with structural breaks in case of BI

Variable	Coefficient	*t*-statistic	Probability
1970–1993			
C	8.393836	16.30504*	0
T	0.007686	6.051969*	0
1994–2003			
C	10.08886	44.57076*	0
T	−0.04529	−5.63998*	0
2004–2013			
C	6.135546	8.132195*	0
T	−0.09603	−5.13255*	0
Adjusted R-squared	0.38932		
F-statistic	49.916186*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.8 Results of least square estimation with structural breaks in case of HA

Variable	Coefficient	*t*-statistic	Probability
1970–1975			
C	6.133244	6.351744*	0
T	0.021647	12.99106*	0
1976–1986			
C	6.406942	9.225657*	0
T	0.07598	15.9354*	0
1987–1992			
C	6.64532	17.58742*	0
T	0.0913	5.57115*	0
1993–2005			
C	7.461437	70.46537*	0
T	0.012987	3.538692*	0.0012
2006–2013			
C	7.316154	61.97084*	0
T	0.041199	14.71393*	0
Adjusted R-squared	0.972831		
F-statistic	172.0742*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

16.3.4 Possible reasons behind the multiple structural breaks

By analyzing the results of multiple structural breaks, one can find that in case of Punjab, Haryana, UP and Tamil Nadu first and second breaks occured around 1977 and 1984–85. Now, according to Centre for Monitoring Indian Economy (CMIE)

Table 16.9 Results of least square estimation with structural breaks in case of KA

Variable	Coefficient	*t*-statistic	Probability
1970–1994			
C	7.564333	8.384598*	0
T	0.09498	4.352887*	0
1995–2013			
C	7.658784	9.372785*	0
T	0.01501	7.52381*	0
Adjusted R-squared	0.773189		
F-statistic	49.86161*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.10 Results of least square estimation with structural breaks in case of OR

Variable	Coefficient	*t*-statistic	Probability
1970–1976			
C	8.330089	9.194054*	0
T	−0.0123	−2.42671**	0.0207
1977–1982			
C	8.658753	34.39015*	0
T	−0.09164	−5.45899*	0
1983–1995			
C	9.534863	57.22383*	0
T	−0.10777	−16.4685*	0
1996–2002			
C	10.69419	18.45404*	0
T	−0.1538	−7.685*	0
2003–2013			
C	9.406173	22.03114*	0
T	−0.2856	−4.02044*	0
Adjusted R-squared	0.654103		
F-statistic	10.03496*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

data (**source: CMIE Vol 2; States, Sept.** 1987) percentage of HYV seeds in the total area under food grains is highest for these sates in 1974–76 and again in 1983–85. So, one can conclude that adoption of HYV technology may affect the growth of rice production of these sates. Again AP makes a significant improvement in terms of percentage of HYV seeds in the total area under food grains from 1974–76 (39%) to 1983–85 (66%). It may be possible that due to this significant improvement in the adoption of HYV technology the first breaks occur in 1984 in the case of AP.

Table 16.11 Results of least square estimation with structural breaks in case of PU

Variable	Coefficient	*t*-statistic	Probability
1970–1976			
C	6.458698	7.890896*	0
T	0.039348	7.032708*	0
1977–1982			
C	7.097913	11.41419*	0
T	0.094332	28.10009*	0
1983–2013			
C	8.187368	43.91587*	0
T	0.098772	14.04609*	0
Adjusted R-squared	0.993039		
F-statistic	1227.913*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.12 Results of least square estimation with structural breaks in case of TN

Variable	Coefficient	*t*-statistic	Probability
1970–1976			
C	8.487337	9.175499*	0
T	0.004889	13.32153*	0
1977–1983			
C	8.164179	5.666138*	0
T	0.005971	22.70342*	0
1984–2001			
C	6.275957	4.622226*	0.0001
T	0.023857	2.525619*	0.0169
2002–2013			
C	7.931879	8.712368*	0
T	0.05257	17.39001*	0
Adjusted R-squared	0.077969		
F-statistic	43.636201*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

In case of KA, the Karnataka government introduced the New Agricultural Policy (NAP) in 1994 and this policy has been criticized by many scholars as being anti-farmer and anti-labour. This New Agricultural Policy by Karnataka Government may affect the growth of rice production in a reverse way and one can get a break around 1995 in the growth of rice production in case of Karnataka in the negative direction. Our result also supports the existence of a negative break.

Table 16.13 Results of least square estimation with structural breaks in case of UP

Variable	Coefficient	*t*-statistic	Probability
1970–1977			
C	8.078949	10.73413*	0
T	0.046247	19.4152*	0
1978–1987			
C	11.36133	5.763159*	0
T	0.094027	8.639011*	0
1988–2001			
C	12.22921	8.995042*	0
T	0.015266	7.99267*	0
2002–2013			
C	8.394543	43.9613*	0
T	0.025594	5.2222*	0
Adjusted R-squared	0.897966		
F-statistic	127.1426*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Table 16.14 Results of least square estimation with structural breaks in case of WB

Variable	Coefficient	*t*-statistic	Probability
1970–1981			
C	10.0261	5.716796*	0
T	0.008912	0.693745*	0.4942
1982–1986			
C	11.72598	5.017855*	0
T	−0.06585	−4.89116*	0
1987–2000			
C	9.397712	25.99634*	0
T	0.074888	3.769699*	0.0009
2001–2013			
C	6.600416	2.953063*	0.0068
T	0.021238	4.533889*	0.0001
Adjusted R-squared	0.957395		
F-statistic	56.51808*		
Prob(*F*-statistic)	0		

*Significant at 1%, **Significant at 5%, ***Significant at 10%

Again, in case of Bihar due to abnormally low rainfall in 1991–92 and 1992–93, the growth of rice production is low in the first half of the 90s decade (Jha and Viswanathan, 1999) and one can get a break in 1994 in case of Bihar.

In the case of Assam, the growth of rice production has increased significantly in 90s decade. According to the Report of the Advisory Committee on Flow of Credit to Agriculture and Related Activities from the Banking System, Reserve Bank of

India (RBI), Mumbai, 2004 flow of institutional agricultural credit has been increased significantly in case of Assam during 90s decade (42.4% per annum). As the availability of institutional agricultural loan increased, the growth of rice production had increased significantly in case of Assam in the 90s decade and one can find the structural breaks in a positive direction in the 90s decade in case of Assam.

In the case of West Bengal after the successful implementation of the land reforms policy in 1977 and the three tires Panchayat Raj system, the growth of rice production has increased significantly in the 80s decade. In the post–Operation Barga period, rice yields in West Bengal are substantially high (Banerjee et al. 2002) in 80s decade except for 1981 and 1982, when West Bengal experienced two successive years of severe droughts, among the worst experienced in the century (Government of West Bengal *Economic Review,* 1983). Thus, one can get a negative structural break in the growth process of rice production in the case of West Bengal for the year 1982 may be due to the existence of drought. The fall in the rate of growth of rice production in 1982–83 may be recovered by positive indirect effect of the three tires Panchayat Raj system (such as village-wide impacts of land reforms and agricultural input supply programs and infrastructure spending administered by local governments) (Bardhan and Mookherjee 2007, 2008). For these reasons, one can find an upward jump in the rate of growth of rice production in West Bengal for the year 1987.

In case of Orissa, there were severe drought in 1976, 1995 and 2002 and severe drought, flood and cyclone in 1982 (**Department of Agriculture, Govt. of Odisha**). For these natural calamities, the growth of rice production in case of Orissa was affected badly and thus one can get structural changes in negative direction in the case of rice production for the year 1977, 1983, 1996 and 2003.

Apart from this in July 2000, the Government of India had introduced a policy in the agricultural sector which is known as the "New agricultural Policy, 2000". The introduction of the New Agricultural Policy, 2000 may affect the rice production through greater private sector participation, price protection for farmers, different national agricultural insurance schemes and capital inflow because eight among the ten major rice-producing states have one break in the first decade of this century.

Thus, it can be also concluded that the decline in Government investment in agricultural infrastructure may cause the negative structural break in 90s decade for most of the states as revealed by the analysis. So, in case of growth of rice production of different major rice-producing states, the policies pursued by the government in the post-liberalization era may have a negative effect. The growth of rice production may mainly be affected by the state's policies towards agriculture or by the natural calamities.

16.4 Conclusion

This paper applies a recent development in estimation and testing of multiple structural breaks in the econometric time series model to measure the growth performance of rice production in Indian agricultural sector. This study also tries to

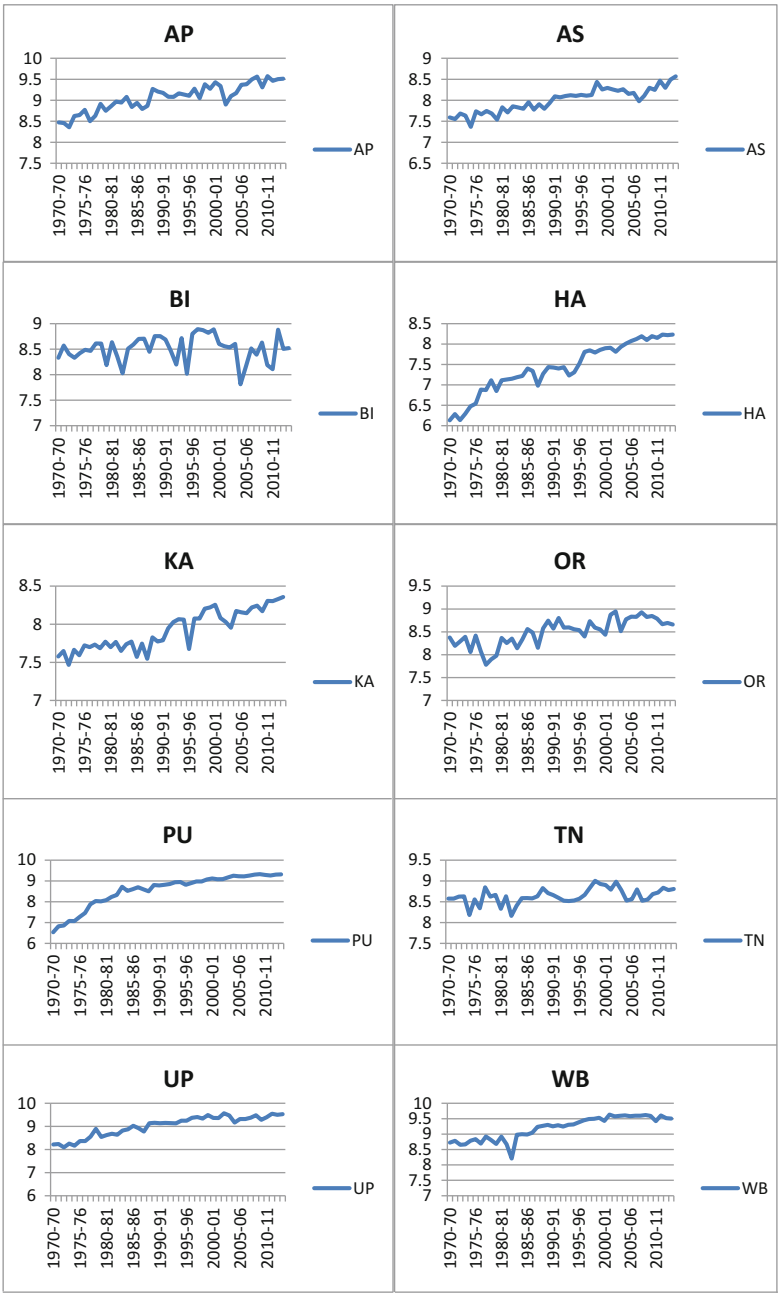
find out the reasons behind the occurrence of these breaks. While the existing studies relating to growth performance in agricultural sector are relied on conventional econometric analysis of curve fitting; attempt to establish a structural break by performing the test for statistically significant difference in parameters across two periods, the present study is based on the rigorous trend analysis procedure of the time series econometrics developed in the past two decades. The distinguishing feature of the method is that the break points are not dependent on the prior belief of the researchers rather it is determined endogenously within the system. The study uses the data on production of rice in Indian Agriculture in case of 11 major rice-producing states for the period 1970–71 to 2013–14 and tested multiple structural breaks in the series by applying Bai and Perron (1998, 2003a) method. The following conclusions emerge from the analysis:

- The results support the existence of multiple structural breaks.
- Regional variation is very much prominent among the states in terms of multiple structural breaks analysis. For example in the case of PU and HA breaks occur at mid-70s and this may be due to the effect of the Green Revolution. On the other hand, successful implementation of land reforms policies may affect the rice production in case of WB because in case of WB after a fall in the growth rate in 1982 one can get an upward jump in the growth in 1987.
- The growth of rice production of different major rice-producing states decreased because the policies pursued by the government in the post-liberalization era may have a negative effect.
- Also the introduction of the New Agricultural Policy, 2000 may affect the rice production because eight among the ten major rice-producing states have one break in the first decade of this century. Among these eight states, five states namely AP, AS, BI, OR, and WB have a negative effect on the growth of rice production after the introduction of the New Agricultural Policy, 2000 and for the three states namely, HA, TN and UP have a positive effect on the growth of rice production.

Therefore, it can be said that there exists a strong regional variation among the states in terms of multiple breaks and also the policy of Liberalization may have either no or negative effect on the growth of rice production. This is because from the results of multiple structural break analysis it is evident that for five states namely AP, BI, HA, KA and OR the rate of growth of rice production has been decreased just after the introduction of liberalization policies or in the first half of the 90s decade. Also, the introduction of the New Agricultural Policy, 2000 may affect the rice production because eight among the ten major rice-producing states have one break in the first decade of this century, out of which five states namely AP, AS, BI, OR and WB have a negative effect on growth. For the states like AP, BI and OR, the rate of growth of rice production have decreased both after the introduction of liberalization policies and also after the introduction of the New Agricultural Policy, 2000. Thus, the growth of rice production may mainly be affected by state-specific agricultural policies, Agricultural policies adopted by the Government of India or by the natural calamities.

Appendix

Rice Production of Ten Major States of India Following Stationary Trend



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Part X
An Alternative Solution

Chapter 17
Holistic Globalization—Alternative Socioeconomic Model

Aleksandar Milanov

17.1 Introduction

We are witnessing unprecedented challenges of the above national character, which are a result of the current way of conducting globalizations. These problems cannot be fully resolved by using the modern paradigm of national egoism and corporate domination.

Examples of such challenges are the global warming; labor exploitation of most of the population; economic poverty of billions of people and the prescent conflict attitudes among different nations. There is a common feature to all of these problems and it is that they are a result of the functioning of the present sociopolitical system. There is an institutional infirmity and lack of motivation of the leading states and many of the large private corporations to face those global issues and this is the reason for not applying long-term solutions.

Now, more than ever, there is a need to rethink the principles and attitudes which are catalyzing these challenges and creating obstacles for a harmonious life for all.

Today, we are seeing that the world leadership is neglecting the harsh consequences of its own actions and people are not given the opportunity to choose a higher path of development. It has become almost impossible for a human being to avoid triggering a chain of human rights violation and pollution in all actions, even if the person is good hearted and genuinely caring for people and nature. Behind every product that we are creating and consuming, there is a colossal and traceable violation of rights. The desire of a political and economic control of a few had led to the inability of formulating clear aims in front of all nations. A thorough definition of the public interest does not exist until today.

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At the same time, parallel with these processes, we are witnessing an unprecedented access to information and knowledge. The personal development of separate individuals in order to find a balance in their relationships with others and with nature has become a prerequisite to rethink the social roles of human beings in society. This positive personal transformation requires a global replacement of the present model of egoistic globalization and provides the opportunity of emerging of new principles of globalizations, which will manifest into new social structures which will be capable to relate to the world without exploiting it.

17.2 Driving Forces of Globalization

Presently, all states are structuring their economies, applying a capitalistic economic model which is egoistic in its nature, because its main driving force is service to self. This driving force is present in the political life, international relations, economics, healthcare system, education, jurisdiction, religion and so on. One of the main effects of modern globalization is that the egoistic systems and their imminent principles have spread like a virus to all countries and to most of their private organizations.

Every religious, political, economic, or other forms of social organization, which instills fear for survival and encourages particular behavior with material rewards or provision of status, while regulating unwanted behavior with punitive sanctions is a type of system in service to the self-egoistic system. This conclusion is evident because it is relied on encouraging or restraining the certain behavior of an individual or a group of people by influencing their ego and not by using measures for supporting the process of becoming aware of the consequences from their actions for the whole environment. One of the easiest ways to determine whether a social system is in the service to self is to look at the principles of distribution of the goods between its members.

The most propagandized untruth in these systems is that egoism and self-interest are the deepest motivators for development and this attitude is maintained for thousands of years.

Significant part of the people who have preserved their humane attitudes are reluctantly participating in an egoistic system mainly for two reasons: The first is because there is not an alternative proposal of a system in service to the whole and the second is that the goods that they are receiving for their work can be used for supporting close relatives and for the material secure of desired projects. Therefore, for this large group of people, this participation is a compromise in which there is major ideological conflict, and not a choice, based on common principles for development. The acceptance of this delusion that egoism is the strongest motivator for an absolute and irrefutable thesis premised limited set of instruments for the way that globalization is directed. Influencing the ego of the members of every social group, including nations and global corporations leads to the obscurity of the aims

of these communities. The result is a gradual social self-destruction, confining of the worldview and mutual alienation between the members of the group and of society in general.

What could be the alternative driving force and consequently the alternative principles on which societies are formed?

If service to the self, namely egoism, is a well-known characteristic of the individual and programmed way of thinking in governing the social processes, the service to the Whole requires a more thorough description. The known approaches and methods for managing a state or a private business unjustifiably ignore this guiding force.

Can we define rationally what the Whole is? Who is the subject, whose interest we protect as supreme and with priority over all others? What is placed as a core ideal in the center of the social system? How are we supposed to organize a society in order to be called holistic (in service to the Whole)? Do we have examples of social models which are developed by this driving force?

Let us define the Whole through its parts, which means through understanding who the subjects in it are. These are all living beings that the members of the corresponding system are aware of and for whom it is reasonable to assume that will emerge. It consists of all human beings, animals, plants and other creatures that we are finding. The Whole comprises also the Cosmos, all universes, galaxies, planets, Earth. Among its subjects are the living beings from the past, those in the present and those that might be in the future. The concept of a living being usually is associated with a biological creature. If it is scientifically proven that do exist other conscious beings that do not have the known biological structure from Earth, they should also be considered as part of the Whole and subjects of the holistic model.

In order to provide proper answers to the questions above, it is necessary first of all to clarify what motivation stands in the core of the driving force service to the whole and what attitude it creates for the individual and for the society.

At the deepest level and in the center of this driving force stands the knowledge about the unity of all, the existence of a common Source of life and the ability of the individual to perceive itself as its unique manifestation. This knowledge and intuitive feeling form an aspiration for building harmonious relationships among the participants, which will support the optimal development of all. This type of development should be distinguished from the concept of sustainable development which is legally defined in different countries. In Bulgaria, for example, sustainable development is described as "*development, which meets the needs of present, without restricting and damaging the ability and the opportunity of future generations to satisfy their own needs. The sustainable development unites two basic strives of society: (a) achieving of economic development, ensuring increasing living standard; (b) preservation and improvement of environment now and in future.*"[1] The main difference can be seen in the aim of both types of development

[1]Article 50, Paragraph 1 of the Additional Provisions of the Bulgarian Environmental Protection Act, State Gazette, No. 91 of 2002.

and the consideration of animals, plants, and Earth not just as useful and valued objects which can be utilized as resources for humans, but as subjects of the holistic model which should be regarded.

This unity does not deprive of individuality of the subjects, neither standardizes them, but recognizes their equal importance and encourages their creative and unique development in a direction which is respectful for others. It should be distinguished from the imperative unification, typical of the egoistic systems, which deforms the participants and turns them into survival individuals who are exploiting the environment.

Therefore, the identity, that forms the driving force service to the whole, is beyond selfish pursuing of egoistic objectives, but extends into the understanding of belonging to the whole environment.

The service to the whole should also be distinguished from the impersonal view and heartless relationship toward people. The difference with the motivation of service to self is that the person does not achieve prosperity for himself and his loved ones at the expense of others.

It is impossible and more importantly unnecessary for a person to try to resolve all problems in the world. The service to the whole does not mean to overload yourself with huge problems and responsibilities, neither is related to taking the burden of someone else. It is a timely local action in the present environment, which leads to global harmonization of the whole system.

The correct name of this driving force is "in service to the whole" and not "in service to others", because the last excludes the person from the scope. This exclusion is wrong and undesirable, because he himself bears the highest responsibility for his own development and only he has the freedom to choose its direction.

On the basis of the knowledge of the unity of all, the individual develops his attitude not only to consider and respect the interests of others, but also adequately and altruistically to satisfy them through the exercising the relationships that they do have. This type of interaction between the individuals leads to their harmonious development and positive change of the whole environment.

One of the main distinctions between both the driving forces is that the service to the whole requires balancing one's personal interest with those of the others and satisfying it by finding mutually beneficial solutions, while the service to self is related with taking advantage from the interests of others in order to gain for yourself.

The egoistic structures rely on institutionalized authority to form the reality and attitudes in society, instead of providing proper instruments for the people to do that by themselves. In order to achieve this level of obedience among its members, the egoistic structure propagandizes absolute trust in the established sources of information, because they are controlled.

On the other hand, the social structure which is functioning in the service to the whole, on the other hand, relies on providing the necessary instruments to the participants for building wide, rich, and critical worldview. The persons who have developed an expertise in a certain area are encouraged to provide their in-depth

knowledge and point of view, but at the same time, all others are free to choose how to evaluate the conclusions of those experts. The critical thinking is required in the systems of service to the whole and neglected in the systems of the service to self. This important difference between both forms of community organizing draws the conclusion that the egoistic system is dogmatic and imposing whereas the holistic is creative and respective.

While the egoistic system values the amount of energy a person is able to take from the others, most often in the form of money, the holistic system values the quality and quantity of energy a person is providing for the whole.

On a personal level, one of the most certain ways to understand what driving force is guiding us in the choice of a specific profession is, if we can answer in the affirmative of the following questions:

1. *Do I contribute sufficiently well for the benefit of the society by conducting my work activity?*
2. *Was I going to practice the same profession, if I was financially secured and there was no economic coercion whatsoever?*
3. *Am I going to practice the same profession even if I receive a very generous offer which would provide me with more money, but the new job would benefit the interests of the society much less?*

The driving force of service to the whole is transferring the individual to new levels of self-awareness and self-realization. This is a result of cultivating the sense of unity between him and the environment which can be perceived as an expansion of consciousness.

Until today there is no historical evidence which can show that a state is governed by the stimulation of the driving force of the service to the whole. Despite that fact, we can find one particular social structure which functions very successfully by implementing this force of inspiration. It is the loving family.

There are many types of families in which are build harmonious relationships between their members. In the family that serves as a good example of a social structure exists love, mutual respect, recognition of the interests of its members, trust and good communication. In short, this family is referred to as loving. This form of social organization is known to many people. For it is typical that is avoided the rivalry between the members and it is substituted with cooperation and finding the proper family role for every member. The relationships in it are firm and are characterized by a high level of trust. The motivation for developing the relationships and improving them is high among all participants. The loving family manages to function well when selfish attitudes of its members are not leading and such actions are avoided. The satisfaction and joy from the unselfish service which benefits the whole family and all its members are giving us the grounds to consider this social structure as an example of a community, which builds its internal relations in service to the whole.

The qualities which every participant is developing in the loving family include honesty, respect, care for others, kindness and others. Therefore, it is visible that the

proper functioning of this social system builds a positive character among its members in a way that their spiritual potentials are revealed. It is possible to use partial aspects of this social model as an example of structuring bigger communities, including private corporations and even states.

It is absolutely possible for a family to be kind and caring only about its own members and unscrupulous toward outside people. For example, a dictatorial family or exploitive family corporation may have an internal atmosphere of understanding and support, but inhumane terror to be predominant against their subordinates and the outside world. Consequently, besides internal relations, external too should be caring the positive characteristics, mentioned above, so that a community to be regarded as one of the services to the whole.

The huge problem of the way larger communities are functioning until the present day is that there are not well-designed global social models and macro-social system which are led by the driving force of the service to the whole.

Every society is built on the basis of a social model which identifies different subjects, defines their position in the system, hierarchical structure, and legitimate legal interests. Every social order determines principles which generally regulate the relationships between individuals and collective entities. The formal embedding of these principles in the state is conducted by the law. Therefore, in order to understand the model, it is necessary to review several of the most important legal institutes.

The social model predetermines to a very high extent the attitudes of the participants towards themselves and everything else, which was briefly pointed out in the previous chapter. The model shapes the behavior of the participants in a very deep way. It serves more often as a catalyst of attitudes than as a natural result of already existing ones.

The creation of a new social model provides the opportunity to identify new subjects as well as conduction of a transformation of the relationships between already identified actors. This change is on a very deep psychological level and it brings with itself a new vision of the direction of social development, new priorities and adoption of new filters of world perception.

The holistic model considers all living beings as its subjects who are manifestations of the Absolute and part of the Whole. It includes all the relations that arise between them. The most efficient satisfaction of their interest is the most important designation of the holistic system.[2]

It is important to note that the holistic community is equally responsible for the human development and for the harmonious evolution of all other subjects of the holistic model, who are examined below. This characteristic illustrates that the holistic model is universal and exceeds just human relations. It is not just humanistic but also respectful for all life in general.

The necessity to identify the subjects in the frame of the whole is the first condition for the proper satisfaction of their interests. Without differentiating them

[2]Milanov (2016), pp. 15–45.

and without knowing them well, it is impossible to conduct a rational action which aims to fulfill the needs of everyone in the system and to refine their environment.

Exhaustively, we can define the following main subjects of the holistic model:

1. Humankind
2. Animals
3. Plants
4. Planet Earth.

In the near future, celestial bodies and outer space environment together with all discovered living being outside Earth should be considered as subjects of the holistic model as well.

The subjects of the holistic model should be constantly studied, because it is necessary their interests to be intertwined in such a way that they are optimally protected. Every existing bond between subjects and every activity should be considered in their variety, taking into account that they influence the whole environment. The planning of the activities in an organization, which functions according to the holistic model, is carrying out by finding the optimal way for mutual satisfaction of the interests of all subjects. These interests are arranged in hierarchical order, which will be examined below.

The holistic model embodies an ideology of respect for life and an attitude for cooperation between all living beings, so that the interest of the whole is satisfied in the best possible way. As a basic systemic model, it defines the principles and ground rules for the emerging and functioning of all future holistic organizations.

If we wend look back in the history, we will see that every positive social change in the world had come after protests, collective demands, organized movements, and very often after many lost lives. This is evidence that until now the established political and social systems are conservative, stiff and with clumsy mechanisms for internal improvement.

The egoistic system perceives itself as a supreme and its participants as controlled resources. Therefore, the system, represented by its managers, does not consider it necessary to be improved and its governing methods and approach further developed. Every major positive change of state governance had come from the bottom up, after the refusal of participation and clearly formed requests from the governed people.

The holistic model is created with the aim to avoid phenomena like violation of rights, cultural decline, social degradation, dissatisfaction of participants from the system. To overcome these challenges, it is necessary to adopt clear working mechanisms for improving the holistic community. The most important condition for the efficiency of these mechanisms is to implement concrete criteria to determine when the direction of social development is better for the service of the whole and when it is worse than other options.

The most visible result from the efforts of developing the society is the economy. The economic basis of the holistic model corresponds to the principle of respectful treatment of living beings.

17.3 Holistic Globalization Leads to Holistic Economy

The adoption of the holistic model means that animals are treated first as conscious beings, which are manifestation of the Absolute and after that some of them—as a needed resource for human beings and other animals. This guiding principle requires a new type of economy which is called holistic.

The organization of the production process in a holistic economy requires excellent knowledge of the interests of humankind, animals, plants, and Earth, because it aims to satisfy them in the best possible way. This means that before the certain product is manufactured, distributed, used, and recycled, it is absolutely necessary to be made estimations how all planned activities would affect these four interests.

Capitalistic system, on the other hand, does not aim to satisfy the interests of these subjects, including those of humankind. It is completely enough to look at how Earth, plants, or animals are used and whether the created products are equally accessible to all people on the planet.

The main purpose of the holistic economy is to facilitate the satisfaction of the interest of the whole. This means that a balance should be found between abundance and sufficiency. Elimination of overconsumption and the building of more and more harmonious relationships between the subjects of the holistic model is another objective of the holistic economy.

Regarding plants and animals as commodities, which are a necessary source of energy for human beings is inevitable, but the holistic approach foresees to think of them first as other manifestations of the Absolute, which deserve a good life. Our interaction with them should be respectful as to living beings and only after that as to a resource, if necessary. In the consideration of the interests of other biological species, it is important to take into account the amount of goods, which are produced and those which are substituted on their place.

In the holistic economy, optimal production is not the one which is capable to bring profit. It is not the one which can be consumed in the biggest possible quantities. Optimal production is a combination of ecological obtaining of goods, avoidance of overproduction or scarcity, the creation of high-quality products by humanely usage of labor, balanced consumption of the participants and equal access to goods for everyone.

In order to achieve such production, it is necessary to conduct large-scale research of the needs of the members of the holistic organization. It should be followed by planning of the whole economic process, so that enough goods are created, overproduction is prevented and depletion of the corresponding resources is avoided.

Another huge difference with the capitalistic system is that the holistic does not rely on a free market initiative to satisfy the needs of the people, but does not forbid it or limit it, as it happened in authoritarian communistic regimes in the past. The reasons are plain and simple: the entrepreneur in the capitalistic state does not aim to satisfy in the best way the needs of the population, to think of the future

generations, or to acknowledge the interests of animals, plants, and Earth's environment. Even if he is socially responsible and ecologically oriented businessman, he is not capable to respond in the best possible ways to the needs of the environment, because it would increase his costs incredibly and this could jeopardize his survival as an economic subject in the competitive conditions.

What are the main problems that the capitalistic production process is causing which globalization is spreading?

If we examine from different perspectives a concrete example of economic production of a good, we will see how the whole process is affecting living beings. The production of chickens in a modern capitalistic state illustrates visibly the way the modern economy functions and the problems that it creates. In this example, it is presented briefly the economic, trade, and labor process in the most developed country in capitalistic sense—the United States of America.

If we use a holistic approach for the objectives of the present analysis, we can conclude that in modern-day poultry had been initiated many social challenges and are violated the interests of the subjects of the holistic model:

17.3.1 Violated Interests of Humankind

Below are pointed out some of the most significant violation of the interests of humankind.

1. The health of the workers in poultry factories is seriously affected. As a result of performing their routine activities, the health of the workers is irreparably harmed.[3] Respiratory diseases, infection, caused by the animals, as well as musculoskeletal injuries are just some of the negative effects on which are subjected the workers in the poultry factories.[4]
   Despite that this information is well known to the corresponding corporations and responsible state institutions, real actions towards better protection of the human rights of the workers have not be taken. The health of humans and quality of life of the workers are issues, which are largely ignored in the whole economic branch of poultry and poultry products.
2. The labor which is performed does not develop enough the potentials of the workers and efforts on behalf of the employers in this direction are missing. One of the main duties of the worker in a poultry factory is to hook up 35 living chickens to metal shackles in 1 m. This type of activity is performed between 8 and 12 h a day. It is visible that this profession is not only very hard to work physically, but also contributes very little to the personal and social development of the individual.

[3]Bureau of Labor Statistics (BLS), United States Department of Labor. Occupational Injuries and Illnesses and Fatal Injuries Profiles database queried by industry for Agriculture, Forestry, Fishing and Hunting (GP2AFH), Accessed May 2018.

[4]www.osha.gov/dsg/topics/agriculturaloperations/hazards_controls.html.

3. The continuation of the working time and the low salaries of the workers in the poultry factories lead to diminished opportunities for access to goods and services as well as to limited possibilities for other entertaining or self-developing activities. Because the labor is not qualified, the workers are remunerated with minimum or close to minimum wages in all states.
4. The continuation of the working time significantly limits the possibilities for positive social contact with their families and closed ones. If the worker is a parent and this hard labor takes 12 h per day (including with the transportation) for him it would be much harder to communicate and bond with his children and his family partner. This could more often lead to problems in the family and in the process of raising the children. Considering the low wages of the workers, their families are put under stress of economic deprivation.
   The governors of the capitalistic system are aware of all these effects of the economic process and their disrespect towards human life is blatant. The managers of the poultry factories are also aware that the low wages and harmful environment are damaging the life of the workers which means are a violation of the interests of humankind. If people are willing to live in harmony, they should renounce this inhumane system and apply its alternative—the holistic model.
5. The interest of humankind is violated also in relation to the provision of healthy food for all people. On a worldwide scale, livestock breeding has become an economic branch which is endangering the health of the people more and more. It is already proofed that the ways that some of the species are raised lead to meat, which is not healthy for consumption.[5] Their organisms are becoming more resistant to the antibiotics, with which they are injected and according to a detailed research on Antibiotic Resistance and Food Animal Production this is endangering the health of people.[6] When the producers of meat are aiming to maximize their profits, the health of animals and even people are always placed in the background. These are violations of the interest of humankind and of the concerned animal species.
6. According to the Food and Agriculture Organization of the United Nations, the registered production of chicken meat worldwide is around 108 million tones for 2014.[7]
   The loss of production, which means edible meat that does not find its final consumer, is about one-third of all worldwide meat industry. In the regions with a population with high-income losses of meat reach two-thirds from the production.[8] The total loss of food, including fruits and vegetables is at least 1.3 billion tons per year. This large quantity of edible food is more than enough to feed all malnourished people on the planet.

[5]Silbergeld et al. (2008).

[6]"Antibiotic Resistance and Food Animal Production: a Bibliography of Scientific Studies (1969–2012)" (PDF).

[7]www.fao.org/ag/againfo/themes/en/meat/background.html.

[8]www.fao.org/docrep/018/i3347e/i3347e.pdf.

7. The direction of scientific research and development is oriented toward the selfish interests of large corporations, which are disregarding those of humankind and animals. Therefore, instead of improving the quality of life of humans and animals, involved in the meat industry, it is deteriorating. Scientists are funded to research and conduct unnatural genetic modifications of animals, creating stronger antibiotics and not to work on solving challenges of the relationship between humans and animals.

17.3.2 Violated Interests of the Animals

1. The life of the chickens, which are raised in poultry factories, is on average of 6 weeks. They are placed in dark spaces, often without windows, and this is causing fear and makes their short life into a prolonged agony.
2. The chickens are subjected to genetic modifications and on them are used drugs for faster and bigger growth. The obesity is so large that until the sixth week 90% of them are unable to walk.
3. In some of the larger factories, the chickens are subjected to mutilations in the first 10 days of their life. Their beaks are cut in order to avoid hurting other animals in this stressful environment. In many cases, while the chicken is alive are cut its limbs and combs. All these manipulations are performed without the usage of anesthetics, because it is cheaper.

This terrible attitude toward billions of living beings is a result of ruthless competition between corporations, which strive for survival and prosperity, because they are functioning in a capitalistic system. The disregard of the interests of the animals is done in the name of the service to the self and in pursuit of larger profit at all costs.

17.3.3 Violated Interests of Earth

1. The production of food worldwide is the third largest polluter of the environment of Earth and it stands behind the whole economic production of the United States and China. From the food wastage footprint report of FAO Globally, the blue water footprint (i.e., the consumption of surface and groundwater resources) of food wastage is about 250 km^3.[9]
2. At the world level, the total amount of food wastage in 2007 occupied almost 1.4 billion hectares, equal to about 28% of the world's agricultural land area.[10]

[9]Food wastage footprint. Impacts on natural resources, FAO report (2013) www.fao.org/docrep/018/i3347e/i3347e.pdf.

[10]Ibid.

These statistical numbers illustrate that the cycle of the egoistic capitalistic economy is very ineffective and violates the interests of all four subjects of the holistic model.

Many more examples can be given by professionals in the corresponding areas —humanists, ecologists, animal rights defenders, resource management experts, climatologists, economists, etc.

It is well known that in order for corporations to sell a product, they need to influence the demand through advertisement campaigns and complicated marketing strategies. At the same time, every salesman is avoiding to inform his customers the inconvenient information about the product and the process by which it is created. Low levels of consumption are not good for the economy and for the state. Everything in this picture is wrong!

We have to outline that corporations themselves are a controlled product, which is raised in the competitive waters of capitalism. Therefore, states are the subjects, which are responsible for the creation of all these complex problems. The state is maintaining the economic environment and it stimulates the selfish attitudes of everyone in it. The corporation is the subject which implements the model and its actions are regulated by the law, the ethics of its management and by the market.

We have to point out clearly that despite the capitalistic environment of competition and constant risk from bankruptcy, it is precisely the private initiative of many people and of private corporations, which have created and provided many of the goods which are developing the humankind. Most of the goods and services that we use today are achieved because of private initiative and efforts of the employees of a corporation. The holistic approach does not aim to dismantle corporations and free private initiatives, but to support them by ennoblement of the environment. Improving the economic climate, social and ecological guidance of private subjects, provision of state guarantees, if they are directed toward policies of service to the whole, are measured in this direction.

How would look like the process of poultry production, organized in the service to the whole?

In order to achieve the optimal satisfaction of the interests of the subjects of the holistic model, the management activities, related to production and distribution of chickens should be conducted by applying the holistic approach on every stage. This means that the effect from every activity should correspond in the best way to the interest of humankind, animals, plants, and Earth. Below are presented the principles and guidelines of the organization of this production process, so that it satisfies the interests of the whole. Many additional measures and guidelines can be adopted, which would improve the overall economic process. It is important to describe briefly the course of establishing the relationships between the participants and how to create such bonds which are satisfying their interests in the best possible way.

17.3.4 Satisfied Interest of Humankind

In order to be satisfied the real need of humankind from consumption of chicken meat, first should be collected detailed information how many participants of the holistic organization would like to consume the corresponding species for a certain period of time. In this way, the resources which are allocated for advertisement of poultry products, aiming to artificially increase their demand can be used for other purposes, which are more important for the holistic economy. Simple notification and informing of the population that poultry products with specific characteristics are available is required to evaluate the real needs of the final consumers.

After collecting this information, the holistic organization is ready to initiate the management process for the production and delivery of different poultry products for those participants, who desire to consume them. Applying this approach will simultaneously eliminate overproduction and shortage of food. At the same time, animals would not be killed without purpose, or the environment would be polluted for the production of food, which nobody consumes in the end. Human labor for the production of products which do not have their consumer would also be saved.

The management of the holistic organization is supposed to plan additional food for reserves and for other purposes.

Organization of the labor process of the employee

To achieve real protection of human rights of the employee in the best possible way, it is necessary to determine such length of the working process, which is comfortable for him and provide enough time for other activities, social contacts, entertainments, etc. The guiding principle for norming of the working day is to provide the opportunities for the employee optimally to exercise his non-working activities. Therefore, in the holistic organization should be legally regulated the shortest possible time in which the planned activities can be performed. In the example of the poultry factory, this means to determine the number of working hours per person, based on the job descriptions and involved employees and to produce the planned poultry goods.

Dividing the working process of compulsory and voluntary time is significant for acknowledging the free will of all involved employees. On the stage of negotiating the contract with the employee, he has to agree to work during the compulsory time and he would be free to choose to work voluntarily in addition or not.

A detailed research is needed to determine the amount of compulsory time that the system requires from the employees. It should not be more than 6 h per day. Every holistic organization will fix the compulsory time and it may be less than 6 h, but should not be more than that. The employees would receive all public rights, including economic access to public goods which the organization is providing. This access is equal for all participants, without regards of their type of job position, hierarchical level, and working experience, because the holistic model considers access to all public goods to be a legal right for the people and not a form of reward. Labor relations are reviewed separately in Chap. 6.

Working in a poultry factory would probably be unpleasant for most of the people and an unattractive job for them. The stimulus should not be by provision of larger access to goods, because this would be a violation of equality to such access with others. The solution for the holistic organization is to reduce the compulsory time for this job position and making it as much attractive and pleasant as possible for the employees.

If we accept that a working day of 6 h is a reasonable balance between labor in service to the community and personal time, working in poultry factory should be less than that. The management of the holistic organization should estimate the needed amount of employees for this economic activity. For example, instead of two shifts of 6 h per day, there can be three shifts of 4 h per day. For comparison, presently 375,000 people are working in the field of poultry production only in the United States. They are producing around 9 billion chickens per year.[11]

The health of the workers is of primal importance for protecting the interest of humankind and it is an absolute necessity their work to be organized in such a way to avoid the high risks for health, which exists presently in capitalistic production.

Second, to satisfy the interest of humankind, the poultry should be healthy products for all consumers and they should not carry high risks of infections, because of genetic modifications and harmful drugs which are present in the meat.

The next step of improving the satisfaction of the interest of humankind is related to reducing the loss of food and distributing it to those in need.

In a well-developed holistic economy, all participants would receive equal access to goods against their main responsibility to provide specific labor, which is beneficial for the whole.

17.3.5 Satisfied Interest of the Animals

In order to achieve optimal protection of the interest of the animals, it is important to approach them with respect, kindness, and humane treatment. This attitude is especially needed for those species, which are going to be used as a resource for humans. The responsibility of humankind is to protect the corresponding animal species in sufficient quantity as well as in its best quality—by preserving its natural genetic heritage.

The interaction with animals in a holistic organization should be with respect as with living creatures, which are emotional and not as if they are senseless objects what we see in the present.

First of all, animals are part of the whole and second—some of them are a necessary resource for the survival of humankind. After we tune ourselves to this vision, it is logical to improve the way of life animals are having, including those which are set for consumption. Holistic production requires the creation of an

[11] https://www.uspoultry.org/economic_data/.

environment, which is optimally pleasant for them; providing normal length of life, feeding them with healthy food and using the most painless ways of ending their lives. It is in the interest of animals their genetic heritage not to be modified.

17.3.6 Satisfied Interest of the Plants

In the process of raising chickens, it is necessary to be regarded the interest of affected plant species. If some of the activities are jeopardizing the life of a particular plant, they should be changed in such a way so that is avoided. An example of such activities is building a poultry factory on a territory, which is very suitable for the life of particular plants. In the process of reducing CO_2 emissions and the water imprint from the production, it would have a direct positive effect on the preservation of plants.

17.3.7 Satisfied Interest of the Earth's Environment

The interest of Earth is the next, which should be taken into consideration in the system of service to the whole in the management of every process, including poultry production. Experts in the corresponding fields should prepare clear criteria for maximum allowed levels of pollution, when it is inevitable for the particular time period and technological development. In the concrete example, it would be needed to choose the most suitable land on which should be built the factory. Many factors should be taken into account, so that the interests of the other subjects of the holistic model are also respected. It is necessary to make an analysis whether a particular area is not more needed for other purposes with higher priority, whether it is large enough for providing living space for the animals, whether the workers would have easy access to the factory, etc.

By organizing the manufacturing process in a way which significantly reduces the CO_2 imprint, the interest of Earth would be much better protected than it is today. This means that a new type of ecological production should be implemented with new technologies. This need would have to direct the scientific studies and research focus instead of corporate greed.

Protection of Earth's environment means also to reduce the water imprint in all of the production processes.

Applying a holistic approach in the economy and respecting the interests of humankind, animals, plants, and Earth, would lead to the gradual integration of all economic branches and to reducing the pollution of Earth. For example, if the management of the holistic organization is directing the scientific development toward discovering ecological ways of transportation, this would be beneficial for the environment of the particular area, but also for the ecological condition of the world.

Presently, there is not a legal or technological impediment to be massively introduced renewable energetic resources in all economic sectors. This act would have lower the manufacturing costs of all products and would be beneficial for the environment. The preservation of the modern capitalistic system in which one of the richest corporations are the oil companies, cannot lead to such positive actions.

The advantages of the holistic production over capitalistic one are obvious and some of the most important can be listed as follows:

1. The energetic balance of Earth remains intact, biological species are not destroyed, soils, water, and air are not polluted, or at least polluted in minimum.
2. Plants and animals which are set to be used as part of the food industry of humankind and animals would be far less than they are today. Those which would be placed in farms and factories shall receive respectful treatment and the opportunity for a good life. Their species would not be threatened from extinction or harmful genetic manipulation. The holistic economy has the purpose to maintain equilibrium and to preserve all species.
3. The production of all goods and services is made with the aim to answer concrete needs, expressed by the individuals and to be beneficial and healthy for the people. This means that compromise with the quality that we see today for most products would not be necessary. It would not be needed to use dangerous chemicals and genetic modifications in order to create meat with the more pleasant look. It would not be necessary to create a dependence of the consumers upon certain products to guarantee corporate survival. It would not be necessary to create food with greater durability at the expense of good taste, because every product would be on demand.
4. Efforts would be made to organize the production and distribution of food, which is desired and healthy by the participants.
5. Through the introduction of the holistic economy would be limited overproduction, which means better management of resources. This includes better management of human labor on issues which are with priority for the organization. Good governance would lead to less workload for the employee. In the absence of overproduction and ecological provision of needed goods, Earth would be used efficiently. The result would be the calm existence of other biological species on Earth.
6. Classifying the needs and not the people will provide an opportunity to use public resources to create those goods and services which are most pertinent at the time. This is a true equality in which public goods are accessible for everyone in the same way. The global implementation of this principle will result in avoiding starvation and malnutrition of billions of people.
7. Another important advantage of the holistic economy over capitalistic one is the inclusion of sufficient amount of people in the economy, using the most advanced technologies and acknowledging the limitations of compulsory working time which cannot be more than 6 h per day.
8. In a holistic economy, there is no unemployment and people are not exploited for the selfish desires of someone to have more things.

9. Scientific development is not jeopardizing job positions and the survival of people. It would be directed to achieve the better satisfaction of the interests of the whole and not to increase the gap between rich minority and poor majority.

Modern capitalistic model is building social relationships by purposefully creating shortages and economic holes, which are used to cripple the development of ordinary individuals and whole nations. Problems are created in order to find temporary solutions. The result is services which can be afforded by one group of people and remain unaffordable for another. The division of society on the basis of the goods, they own, polarizes poor and rich people. Both groups are fighting for their survival and are encouraged to live in service to the self.

The holistic model is presented as an alternative of the capitalistic one, and not as the creation of a new social role or humanization of already existing in the frame of the capitalistic system. It is because of the different aims, placed in the systems, different approaches and methods that are used in them.

How would function the economy of a society, when stimulated by the driving force of service to the whole?

The responsible attitude toward the natural resources and their balanced use in the manufacturing process and consumption are of primal importance for preserving them for the future generations of humankind. This is the main priority of the holistic economy. From the viewpoint of humankind, Earth should be regarded as a superior being, which has accommodated many life forms, including humans. This vision guides us toward care for the planet for its own good and resource management, which does not violate drastically its energetic balance. Therefore, the interest of humankind should never contradict the interest of Earth. On this principle is based the holistic economy—from production, logistics, consumption to recycling. It is necessary to be conducted many multidisciplinary researches in order to determine the right methods and technologies to perform all the processes. One of the most important principles should be the use of renewable energy sources and technologies which are nature friendly at every stage of the economic processes. Their application should be widened to the point of becoming the only sources of energy. Finding the balance in the production process includes also nurturing animals and plants not only as a human resource, but caring for them as beings in a gentle ecological environment. The need to consume some of the species is undisputed at this point of human development, but it is very important to implement the principle of minimum violation of their interests in performing all human activities.

The development of technologies and the wide introduction of renewable energetic sources in capitalistic society would not lead to a cardinal social change in the states and to the improvement of the life of the majority of people. Such technologies might be friendly to Earth, but they would still remain an economic burden for people because capitalism requires constant dependence and carefully managed the exploitation of everyone. People would never receive something, if they do not pay for it in egoistic system. Even when the energy comes from the Sun, for the ownership of needed devices a tax would be introduced, or they would

be designed to be too expensive or for short-term usage, so that dependence is maintained and people are not free.

The conclusion is that the introduction of new technologies in the civilization today would be positive for the humankind only if social changes are following them. Without such a transformation of the social model, humans would remain economic slaves in an inhumane caste system.

Another basic principle in the holistic economy is that the products should be durable, the maximum time of use and easily upgraded. Presently, many of the corporations are stimulated to develop non-durable products, to use materials with low quality and not the optimal technologies, which are available in order to be competitive for decades ahead and to provide cheap and new products as planned. Products of high quality which are durable are more expensive for most customers and less profitable for business, because the customers will not return for the new product next year.

Every reader is capable of finding many items, which were durable decades ago unlike their counterparts today. Behind this change relies on economic logic and businesses are not supposed to be blamed for following it, because the market requires it. This economic logic is unfavorable and sometimes harmful for the users and it leads to negative impact on natural resources of Earth and unnecessary prolonging of retention of people in the production stage of the economy. Typical examples of such products are automobiles and mobile devices. Contemporary capitalism and, particularly, the global market are forcing corporations to introduce innovation with a much slower step and with many new products in order to maximize the profits of their shareholders for generations. In the holistic economic model, this compromise with innovations and useful life of items not only is unnecessary, but it is extremely undesirable, because much more natural resources and human resources are used in order to satisfy the same needs.

Holistic production includes the most ecological way of manufacturing of every product in a quality, which is optimal in a matter of functions and as much possible to endure.

The implementation of these conditions would lead to much less use of natural resources with technologies which are much favorable to Earth.

The next advantage is that in all economic processes will be used much less human labor, because technological optimization would not lead to deprivation of basic goods for people, because products will be much durable and much easier for upgrade. In order to achieve these positive results, the economic activities should be planned presciently on an unseen scale until now and by completely different criteria than bigger profit for corporations.

The holistic organization has the authority to determine what type of goods should be produced and what kind of services provided with public resources, in order to satisfy the interest of the whole and to be fulfilled in the best possible way the needs and desires of the participants of the organization. The selection of these items is made after gathering the preferences of all participants. At first glance, this approach may seem limited and contradictory of the principles of the free market, but it is not correct and below is explained why.

What are the principles on which basis is produced one item in the capitalistic system? The cornerstone is whether there will be demand and who is capable to afford it and keep buying this type of products from the same corporation in the future. This leads to distortions and vicious practices in the relationship between a merchant and a customer. It is well known that good merchants are succeeding in influencing the desires of customers to acquire the certain good. Modern marketing and maintained attitudes for social status impact the people significantly and shape their culture of increasing consumerism and desire to have more and luxury goods.

The holistic economic model changes the prism and focuses on determining the real natural need of the consumer and to classify them by priority. It is an individually oriented economic model which satisfies the needs of the people at the same level and at the same time. The goods and services are produced, following the above-mentioned principles of ecology, durability, and optimal technical functionality.

Logically, determining the needs includes regarding the preferences of all participants and estimating the potential of the holistic organization to satisfy them. If the organization is unable to provide specific good, because it is from a higher class, too luxurious, or does not correspond with the interest of the whole, the person is free to acquire it on the free market as it happens in capitalistic societies today. The holistic system does not enforce a more rigid regime of limitations than capitalism, but through good governance of the public resources, it creates much bigger opportunities and much larger access to high quality of goods and services.

17.4 Classes of Needs Instead of Classes of People

Satisfying the interest of humankind requires to be made a detailed estimate of the needs of the participants in the holistic organization. The matching of individual preferences of all participants with the optimal capabilities of the holistic organization includes the right of the person to choose what to consume, in what quantities and how often to change the object with a new one. As was already mentioned above, the holistic system foresees freedom of entrepreneurship and private initiative and allows everyone to pursue satisfaction of their desires, if this is not bringing harm to the person or to others and is legally allowed. It can be achieved by commercial activities in the same way as it is done in capitalistic societies. The essential difference is that a large part of the public resources is going to be managed and allocated in a way to achieve equal access to goods and services for all participants in a stepwise character of satisfying separate classes of needs.

The classes of needs define which needs and desires are with a priority over others. This classification is necessary for satisfying the interests of the community, because through it can be achieved prioritization of the use of resources and their distribution to guarantee equal access to goods and services. It is of primal importance for good governance of human labor, which is provided by the participants in service to the whole. The result is that the labor process in the holistic

economy is directed to answer directly to the needs of the individuals and the community of the present moment. The same cannot be stated for the capitalistic system in which private corporations are the main employers and they are choosing the direction of labor for their employees by the criteria to profit from a specific demand, not necessarily a public need. Private corporations are trying to survive in a harsh competitive environment and human labor is their means, without trying to develop a society in the best possible way.

Classification of the needs requires a separate and thorough research, which comprises all types of needs, which the holistic organization should be responsible to satisfy. This classification is a reflection of the understanding that the society has about human beings. The precise prioritization would determine the types of goods and services, which would be distributed for every participant.

It is important to clarify that differentiating the needs on classes does not regard art, entertainments, tourism, science, sports, or other undoubtedly important activities as less significant than the provision of home, food, and water. Differentiation is made in relation to priorities of the conditions for living and not with the aim to evaluate which economic branch is more important than other. Classes of needs can be defined as different elements of a house, where basic needs represent its walls, ground floor, and roof, whereas higher class needs are symbolizing its painting and furnishing.

Before starting to distribute public goods and services by class, it is necessary to decide which products the holistic organization would provide for free, which would be on the free market for trade with external parties and which would be forbidden for trade. Such an assessment of the regime of commercial goods is conducted today too in capitalistic societies, where some products are sold without restrictions for the buyers, some require special approval and others are forbidden for all. In a capitalistic society, there are not clearly defined criteria what products to be available on the free market. In most cases, if there is a demand, there would be a supply and for the state, it is more profitable, if it is legally regulated. The social impact of products and the effect they are causing to the health of people is of secondary importance, if there is a strong demand for them. The same example with cigarettes can be pointed out, because they are causing damages for health and at the same time are creating addiction. Another example of the lack of criteria is the liberal regime of buying automatic guns in many states, which are considered as developed. If a person has to defend himself with automatic weapons in his home and in his town, this means that the state is not having good policies in many fields and the society is in the very low level of development.

The holistic system, unlike the capitalistic one, is caring for the health and positive social development of its participants. It creates much more opportunities for freedom of expression and satisfies directly the economic rights for all people, but only if the products are healthy and cannot easily bring harm to society.

As this is performed presently, every particular product would have to be reviewed by an expert commission, but the criteria would be to serve the consumers and the whole in the best possible way. It would not be legal to lobby for the distribution of low quality and dangerous products, because someone could profit

from them. If the holistic organization is governed well, the results would be the free provision of much more useful goods and services, than are sold in the most developed capitalistic states for their middle classes.

The second aspect of forming responsible consumer demand is related to education and information campaigns. In capitalistic systems, it is visible that if such activities are organized well, they have an enormous positive impact to limit unhealthy dependencies. The mere fact that capitalistic states consider letting go of unhealthy and dangerous products to the market is presenting the inhumane face of egoistic economy.

In the holistic system after determining which goods are useful and can be included for free and equal distribution, they should be prioritized in the corresponding class of needs in the holistic organization.

The classification of the needs is not connected with the capabilities of the holistic organization to satisfy them in a particular moment. For example, if there is poor management in a holistic organization and it cannot provide a diversity of healthy food for the people, it does not change the fact that they need healthy food.

The main principle for achieving equality in the distribution of public goods is that first class (basic) needs are satisfied first and for every participant. After everyone in the holistic organization can exercise his right to order and receive goods and services from first class, the organization is eligible to move on to the next stage of satisfying needs from a higher class. Needs from second class are those which are not directly required for the survival of the individual, but they are an absolute necessity for his ethical, cultural, scientific and spiritual development and from the improvement of his ways of self-expression in life.

After describing and classifying the needs, the holistic organization has to regulate the access to which goods and services would lead to their satisfaction. Among the basic needs of all participants, it is fair to place their feeding and healthy food as the good which can satisfy this need. What would be the food, that the person is going to consume will decide himself of course. The holistic system will have to provide the opportunity for a much larger variety of useful products for every participant, which is not possible for capitalistic and communistic societies. The reason for this is because only in the holistic society the human labor and the other resources will be directed towards achieving this variety and selfish desire for profit would not hinder the production of goods, as it the case in egoistic systems. The production of low quality, unhealthy, and even dangerous food, with the aim to reduce costs would become bygone—bad habit, intrinsic for the capitalistic food industry.

The aim of the holistic economy is to satisfy the individual needs of all participants and this is what distinguishes it significantly from capitalistic and communistic ones. The last two limit access to the goods and services for most of the people in order to provide the highest quality of products to a minority of the privileged. To achieve the satisfaction of the needs of the participants of the holistic organization it has to be conducted simultaneously for everyone as regards to one class of needs.

If we accept that entertainments fall into second and higher class of needs, because they are not directly related to the immediate survival of the individual, it is fair to initiate their satisfaction after guaranteeing that the lower class of needs of all participants are met. This principle guarantees the humane, harmonious, and balanced development of the community and implements in practice the value that every human being is an equally important individual manifestation of the whole humankind.

The equal access to public goods will gradually lead to the elimination of the economic social stratification. The subjective estimate that one job position deserves more or less goods and services than others will not be applied. In modern days many people do not want to be part of such society in which economic status is not used for diversification. Those people are programmed to think that classes of people are a natural phenomenon for society and this is the "normal" way to establish a working order. Even more belonging to a specific economic class have become basic fundament for psychological developing of the personality. Capitalism requires people to think themselves mainly from the perspective of their social class, because in this way is maintained division among people. Division of people is the cornerstone for ruling people in the prisons of egoistic societies.

Despite the fact that one job position requires more knowledge and skills than another, the access to goods and services should not be changed and to be used as an incentive for the participants and stimulus for applying for a job in the holistic organization. The desire and the abilities of a person to be useful to others and to the whole with the performance of a specific labor is the main stimulus, which is encouraged in the working process in the holistic society. Economic privileges, granting larger access to goods and services for a particular job position or for a particular group of people are a gross violation of the principles of building a holistic organization. Norms and actions, which are causing this type of division and social conflict, would be considered as a form of corruption and violation of the ideals of the holistic society. People, who would conduct such actions or who are trying to implement such policies, are demonstrating their lack of understanding of the grounding principles of the holistic system. When there is not understanding of these principles, the person should not be able to grow in his career development in the holistic organization, because his actions and general approach for personal motivation and encouragement of other colleagues would be contradictory to the principle of economic equality of all participants and the driving force of service to the whole.

A good example of the absence of division, based on an economic reward for people, who possess different skills and knowledge, we can find today in the loving family. A good parent does not provide healthy and more expensive food for the child, who is bringing home better grades in school, than the other, who did not cope so well. The food in such families is distributed by taste and not by merit. Goods and services in loving families are not used as a reward, but as a form of expressing family care for the development and joy of the particular member.

The next fundamental difference between the egoistic and holistic models is visible in the attitude towards the participants and particularly whether the

organizations are considering them consequently as dependable resources, or as unique and indispensable manifestation of the Absolute. This distinction marks the completely different purposes of existing of both systems. In the first type, the organizations are exploiting the participants and sucking their energy in order to feed the higher echelon, while the second facilitates the relationships between them and manages and distributes the energy in the interest of everyone.

The holistic model is considering, preserving, and developing the unique features of the participants in a holistic organization. The freedom of everyone to determine his own path of personal development is a value for the person and for the holistic community. The purpose of the holistic organization is to support this free choice to be in the service to the whole, because this would lead to the most beneficial results for everyone.

Capitalistic model perceives all participants by the prism of the social class in which they are. The personal achievements are valued (including in money) by the abilities of the subject to procure different types of energy and to direct public opinion. Regarding humans as a replaceable resource for the economy leads to significant problems for human survival, but also blocks the sensation of the people that they are spiritual entities with a higher purpose, who are a manifestation of the whole Absolute.

The capitalistic system builds and maintains the extremely limited vision of the human being. If the person accepts it, he is doomed to create unhappiness for himself and others around him.

When we review the uniqueness of every participant in a holistic organization, this means that we adapt the whole system towards his needs to the level in which this is optimal for the organization. If the organization is governed well, the result would be better and more comprehensive adaptation of the system to the participants. It can be achieved in all stages of the economic process and for all products. For example, it can be present in the individual architecture and design of the house, automobile, design of the clothes, variety of healthy food, quality entertainments and reaches flexibility of the working time, personal satisfaction of the labor, etc.

17.5 Commercial Relations in Holistic Globalization

Commercial relations from the viewpoint of a holistic globalization can be differentiated into three separate groups:

(1) Internal trade—between members of the holistic organization;
(2) External trade—between holistic organization and external subjects;
(3) Trade between holistic organizations.

1. *Principles of internal trade relations*

The holistic organization exists with the clear aim to create a harmonious environment for its participants in order to provide the conditions for their positive self-expression and happiness. As in the loving family, it is not accepted its members to trade between each other, so in the holistic community, it is not encouraged a selfish trade interaction between its participants. The reason is that in most cases trade is aimed at profit and interest of the self. The next consideration of not encouragement of internal trade is related with the creation of products. As was pointed above, the holistic organization is responsible for the protection of the interests of humankind, animals, plants, and Earth from resource extraction, to production, distribution, consumption, and recycling. For a private corporation or a sole merchant, these conditions and global interests are negligible, because they are increasing the costs, overpricing the products, and reducing the profit. The desire of a person to create goods which are beneficial for society and for the whole is the guiding motivation which is stimulated in the holistic society. This is the economic motor that will move the holistic organization and its participants. Commercial relations inside holistic organization should be allowed and to them, it is prudent to be applied the principles of taxing in capitalism. However, taxes should not be the main source of income for the holistic organization, as it has to manage its public property in the service to the whole.

2. *Principles of external trade relations*

Important, but not exclusive, is the function of the trade relations with an external subject to provide needed goods and services for the holistic organization and its participants. These are goods which the organization is unable to produce at this particular moment. Trade and not free access to public goods should be the norm with external persons, because they have expressed the desire to live according to the principles of capitalism and to remain foreign for the holistic society. At the same time, all external subjects are perceived as part of the whole and potential members of the holistic society. For these reasons, even though that the holistic organization is not responsible for these states, international organizations, private corporations, and people, trade with them should be conducted in a way which is in the interest of the whole. Therefore, relationships have to be built with careful consideration of the interests of the members of the holistic community and those of the external subjects. The motivation of the representative of a holistic organization for trade should never be just for profit, but should include humanitarian and ecological aspects. This means that are needed much more evaluations to determine whether to trade with someone and what would be the overall effects of such actions. A precondition for trade with external partners is access to information about their economic and labor process and ecological practices. This information is needed in order to evaluate the effect of the corresponding organizations and to determine whether interests of the whole would be better satisfied in eventual commerce. This form of mutual monitoring is extraneous for capitalistic relationships, because corporations are protecting the trade secrets of their products. This

privacy allows them to conceal a violation of human rights. Capitalism requires trade secrets, because all subjects are in a state of rigorous competition and every innovation and good practice can lead to a strategic advantage in an economic or political sense. The holistic system is structured on completely different fundament and it is related to mandatory transparency. This free access to information is needed for all trade partners and consumers in order to justify in front of them that the economic process is holistic. Otherwise, trade partners could be corporations which are committing violation of human rights and the economic chain would become contaminated.

In the example of the cocoa production, the holistic organization should avoid supply with cocoa from corporations and states in which there are evidence of violation of human rights and particularly children's rights, low wages, and low level of ecological innovation. If a corporation or a state desire to trade with a holistic organization, they have to reorganize their whole production processes on a holistic model. This requirement makes trade as an instrument for positive political transformation and development with respect to the living beings and the planet. Sovereign rights of all states are acknowledged and guaranteed by the international law and the holistic organizations should always respect this primal institute which protects the right of every country to choose its own path of development.

The holistic organization is responsible to evaluate what would be the consequences of supplying certain goods to capitalistic subjects and the effect of buying specific goods from them. If the overall effect is in the service to the whole such commercial activities should be allowed.

3. *Trade relations between holistic organizations*

Trade relations between holistic organizations are at the same time external, but also with a subject which has declared appurtenance to the satisfaction of the interest of the subjects of the holistic model. These relations are part of the holistic system and it is justified to have status *sui generis*. They are not entirely external and internal for a holistic organization.

Logically, the existence of such relations is possible only when there is more than one holistic organization. If the organizations have declared the common goal of service to the whole, it is important to initiate cooperation between them. If there is unity in the understanding of their common values, it is natural to move toward gradual integration of their economies and societies in general. This means that commercial activities would be the first step in establishing strong relationships. The process of integration is voluntary and should be based on agreements. An important principle in its developing is to retain complete or almost complete independence from capitalistic subjects—corporations or states.

In the beginning, holistic organizations would be created in capitalistic states which do have their own tax policy and it has to be observed. Legality, transparency, and high ethical code should be intrinsic features of all holistic organizations.

In order to achieve its long-term goals and short-term objectives, the holistic society should develop itself, applying the principle of economic self-sufficiency, efficient, and ecological management of the public resources. Trade relations with other holistic organizations should lead to the growing of their economies, but should not be created risks from these actions. This means that trade relations should not be made in currencies of states, not to use securities which are bound with capitalistic subjects and all other instruments which are hiding risks from destabilization of the economies of the holistic organizations.

Petroleum products and oil as a main energetic commodity in the capitalistic societies should be completely replaced as a good, when its alternatives are well developed, because it is the resource from which emerge the unhealthiest economic, political, and even religious dependencies.

The implementation of the principle of economic self-sufficiency is of crucial importance for the protection of the independence of the economy of the holistic organization, but also for the other subjects, it is bond with.

It is fair to assume that trade relations between holistic organizations would be based on the much bigger level of trust and closer cooperation, than relations with capitalistic subjects. The biggest problem which generates the social stratification, based on economic criteria, is the formation of identification of the human being according to his property and not according to his spiritual nature and positive input for society. When self-affirmation in society is based upon the accumulation of wealth, this means that people and organizations perceive their colleagues as competitors and this is a barrier for natural cooperative efforts and common actions for solving common challenges. The absence of internal peace and the lack of higher purpose in life lead to the impossibility for harmonious inclusion in society and to blockage of the positive creative spark in the person. People, who are rising on the social ladder in capitalistic societies, often degrade as persons, if they accept the inhumane values, which the social stratification is imposing on them. Many of them start behaving as primitive predators, which are seeking for their economic preys and not as people, who desire to solve social problems and to improve the social environment. The self-assurance that a person can "succeed" by victimizing others will always create conflicts, divisions, and will maintain poverty in the system. Capitalism leads to a deepening of the pathology among people, who accept domination and exploitation as necessary conditions for social prosperity.

17.6 Conclusion

The vision of conducting a holistic form of globalization which results into the formation of holistic organizations and later into a holistic society is higher than those for national or religious domination of one civilization or an alliance of states. It stands above the idea of united humankind, which is going to be egoistic toward other living beings, including Earth.

The strength of a holistic society is not the present in the skill to use several of its members to subjugate the others, but it is in the ability to develop a harmonious environment to all, who are willing to live with regards to the interests of to the whole. This alternative form of globalization will not lead to the detrimental effects to the planetary environment, nor to human rights violations or horrendous treatment of animals and plants. This could be achieved if more people have become driven by the force of service to the whole.

The nations and other organizations, based on the holistic model and principles should be able to become islands of peace and harmony, which are capable to protect themselves from the negative effects of modern globalization. They have to be able to achieve these tasks without violating the principles of respect towards other subjects and in regard to their sovereign rights to choose their path of existence. Global planning and management of all economic processes in a way which satisfies the interests of the whole will change completely the fundaments of the current economy. The principle of economic self-sufficiency, provision of public goods and services as a form of right and not as a reward, the absence of internal struggle for survival, and the careful choice of external partners will make the holistic organizations capable and strong economic subjects. The vision of life, based on spiritual self-awareness and on relations of regarding the interests of all living beings, is the cornerstone around which will be established a holistic economy.

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