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Paramita Mukherjee *Editor*

Revisiting the Indian Financial Sector

Recent Issues and Perspectives

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Editor
Paramita Mukherjee
Narsee Monjee Institute of Management
Studies
Hyderabad, Telangana, India

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Dedicated to

My beloved parents, late Mr. Prabhat K. Adhya and Mrs. Rekha Adhya

Preface

I have been teaching courses on financial markets to business students for quite some time. In India, the orientation of business students, who are mostly freshers without much of industry experience, in general, is more towards practice and legitimately so, as they are employment-focused. However, I did come across a handful of students with notable research acumen and enthusiasm to explore, read and analyse for better grasp and understanding of a topic. During such discussions, I felt that if books on financial economics are not complemented by the discussion on ongoing issues in the financial sector in India, it would be very difficult for such students to nurture their interests further. Journals are there, but that comes at a later stage after someone narrows down to a particular topic to look at. Also, a financial analyst should be aware of the ongoing research related to current issues in the sector. To begin with, one needs to have a preliminary idea about the contemporary and relevant topics related to financial sector in India and the direction of research on those topics. I felt there is dearth of such books in recent times. There are a number of textbooks on financial products, institutions and markets in India, but not a book an ardent researcher or analyst should look at to have some idea about the current problems and issues from which one may get a clue about further research ideas or topics to explore. I approached some senior professors and researchers who have worked on issues in Indian financial sector and wanted to include their perspectives as critical assessment is an important aspect in research.

The book would not have seen the light of the day without the encouragement and support I received from a number of persons from my professional as well as personal acquaintances. I sincerely thank my colleague Dr. Sahana Roy Chowdhury for her encouragement. I am also grateful to IMI Kolkata for providing a stimulating research environment during my association with the Institute. I thank all the authors for contributing to the volume and completing it on time, even during the pandemic. I am grateful to one of my ex-students, Snigdho Sundar Kundu, who are in touch with me for intellectual discussions. On personal front, I thank my son, Ritayan, and my brother, Prabal for being supportive to me and keeping my spirits up in such an endeavour during these difficult pandemic times. And last but not the least, I

extend my thanks to my husband, Professor Vivekananda Mukherjee, for meaningful discussions, valuable suggestions and continuous emotional support.

I hope this edited volume will provide valuable insights to the academic researchers and financial analysts alike on the recent phenomena in the Indian financial sector.

Hyderabad, India Paramita Mukherjee

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Editor and Contributors

About the Editor

Paramita Mukherjee is Professor (Economics) at Narsee Monjee Institute of Management Studies, Hyderabad. Prior to that she was associated with International Management Institute Kolkata as Professor of Economics for nearly a decade. She has handled the responsibility of Dean (Academics) at IMI Kolkata. She has completed her Bachelors in Economics from Presidency College, Kolkata and MS in Quantitative Economics from Indian Statistical Institute, Kolkata. She completed her Ph.D. from Jadavpur University. She has twenty three years of experience in industry, research and academics, with stints at AC Nielsen (formerly ORG MARG) as Research Associate, ICRA as Junior Economist and renowned business schools as faculty member. She has been in academics for more than sixteen years. She teaches courses on managerial economics, financial institutions and markets, financial risk management, applied econometrics and business forecasting. Her research interest lies in financial economics, applied econometrics and macroeconomics. She has worked on contemporary issues in financial sector and authored a number of research papers in international journals of repute. She has worked on issues such as foreign institutional investors, mutual funds, stock market integration, volatility in stock markets, gold market, share repurchase and financial integration in Asian countries. She has also authored research papers involving macroeconomic issues like inflation, public finance issues like efficiency of stamp duty revenue collection etc. She has publications in journals such as *Applied Financial Economics*, *Emerging Markets Finance and Trade*, *Journal of International Trade and Economic Development*, *Economic Change and Restructuring*, *Resources Policy*, *Asia-Pacific Development Journal*, *Journal of Emerging Market Finance*, *Economic and Political Weekly*, *Global Business Review* among others. She has been awarded with research grants from organisations like India Gold Policy Centre sponsored by World Gold Council. She has also handled consulting assignments in the energy sector.

Contributors

Puneet Kumar Arora Department of Economics, Indian Institute of Foreign Trade, New Delhi, India;
University School of Management and Entrepreneurship, Delhi Technological University, New Delhi, Delhi, India

Aditya Banerjee Finance and Accounting, Indian Institute of Management Ranchi, Ranchi, India

Samaresh Bardhan Department of Humanities and Social Sciences, Indian Institute of Technology, Ropar, Punjab, India

Sankarshan Basu Finance and Accounting, Indian Institute of Management, Bangalore, India

Jaslene Bawa Finance and Accounting, FLAME University, Pune, India

Poulomi Bhattacharya Department of Economics, Jadavpur University, Kolkata, India

Ranajoy Bhattacharyya Indian Institute of Foreign Trade, Kolkata, India

Gagari Chakrabarti Department of Economics, Presidency University, Kolkata, West Bengal, India

Bibek Ray Chauhduri Indian Institute of Foreign Trade, Kolkata, India

Shantanu Ghosh Department of Commerce, Vidyasagar University, Midnapore, India

Poulomi Lahiri ICSSR-IDSK Post Doctoral Fellow, Institute of Development Studies Kolkata (IDSK), Kolkata, West Bengal, India

Sanket Mohapatra Indian Institute of Management Ahmedabad, Ahmedabad, India

Jaydeep Mukherjee Department of Economics, Indian Institute of Foreign Trade, New Delhi, India

Paramita Mukherjee Narsee Monjee Institute of Management Studies, Hyderabad, India

Samit Paul Finance and Control, Indian Institute of Management Calcutta, Kolkata, India

Abhijit Roy Dr. Bhupendra Nath Dutta Smriti Mahavidyalaya, Burdwan, West Bengal, India

Malabika Roy Department of Economics, Jadavpur University, Kolkata, India

Sahana Roy Chowdhury Department of Economics, International Management Institute, Kolkata, India

Tarak Nath Sahu Department of Commerce, Vidyasagar University, Midnapore, India

Rajesh Sharma University School of Management and Entrepreneurship, Delhi Technological University, Delhi, India

Introduction

Paramita Mukherjee

1 Background

Financial sector in an emerging economy like India has come a long way since the liberalization measures have been implemented in the 1990s. Notable changes include significantly improved market discipline after the regulations are in place in sectors like banking, insurance and non-banking financial companies (NBFCs), higher participation of retail investors in stock markets through mutual funds, increased transparency in stock trading, participation of foreign investors in the Indian capital market, emergence of new markets like derivatives, etc. Also, starting from the recommendations of Narasimham Committee Report (1991) to the Financial Sector Legislative Reforms Committee (FSLRC) in 2013 and the Insolvency and Bankruptcy Code (IBC) in 2016, the implementation of the regulatory framework of banks, financial institutions and capital market participants has witnessed remarkable transformations over the last three decades.

Financial sector encompasses a large number of financial markets, institutions and products. Financial sector reforms and liberalization measures are aimed at having greater development of the sector. However, the development of the financial sector is a continuous process, and the sector is still evolving. That is why, the surfacing issues and concerns relating to the sector are also changing with the passage of time. For example, in the banking sector, India has been able to put the prudential norms in place, which was once the major focus of the reforms during the nineties. But currently being part of the drive of financial inclusion or access to financial services, we need to assess the progress of financial inclusion and the possible implications of such an initiative on the operations of financial institutions such as banks. Since a well-functioning financial sector is the prerequisite for achieving higher economic growth and the stability of financial sector is of utmost importance in sustaining high economic growth, it is pertinent to assess where the sector stands now and what

P. Mukherjee (✉)
Narsee Monjee Institute of Management Studies, Hyderabad, India

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the relevant issues are. Different perspectives on the issues concerning the financial sector need to be discussed and debated.

Though it is really difficult to assess the same in its entirety given the expanse of the financial sector, it is desirable that one has a fair idea about the key issues the sector is currently pressed with and what the possible new emerging dimensions are that are going to play a significant role in further development of financial sector in an emerging economy like India.

2 Current Issues in Indian Financial Sector

In the last three decades of several transformations, financial sector in India has recorded considerable development. As per the financial development index of International Monetary Fund (IMF) that lies between 0 and 1, the index for India has increased from 0.29 in 1980 to 0.35 in 1990 and to 0.44 in 2018. The two components of the index, viz. the index of financial institutions and the index of financial markets, also have recorded substantial progress, with the former from 0.25 in 1980 to 0.27 in 1990 and to 0.38 in 2018 and the latter from 0.34 to 0.41 and finally 0.48 in the respective years. It may be noted that in terms of the financial markets index, India fared better compared to financial institutions. For a detailed assessment of development of different segments of financial sector, see Krishnan (2011). In a more recent paper, Mohan and Ray (2017) argue that there has been significant progress in making interest and exchange rates largely market determined, as an outcome of the reforms. They also observe that in the banking sector, though public sector banks still dominate, competition has been introduced through new private sector banks. Also, considerable progress is made in contractual savings systems though pension funds are still in their infancy. Similarly, expansion of coverage of insurance is likely to provide greater depth to Indian financial markets. The paper concludes that the extent of development along all the segments of the financial market has not been uniform, e.g. the equity market is quite developed while the private debt market is not. They suggest that measures like "further reduction of public ownership in banks and insurance companies, expansion of the contractual savings system through more rapid expansion of the insurance and pension systems, greater spread of mutual funds and development of institutional investors" will enable the equity and debt markets gain greater breadth, depth and domestic liquidity.

The role of financial sector is to channelize savings of the economy into productive investment. Access of individuals as well as business entities to financial products and services offered by the financial sector, for transactions, savings, credit, insurance and such other purposes, is an important issue. Does the financial sector in India provide easy access to all? How much awareness do the residents of India have regarding the financial services? The issue of financial inclusion is a widely discussed topic in the Indian financial sector for quite some time now. It is widely acknowledged as a means for boosting economic growth and sustaining it. There have been initiatives like Pradhan Mantri Jan Dhan Yojna (PMJDY) and Pradhan Mantri Suraksha Bima Yojana (PMSBY) to extend the financial services to more people.

There are a few studies in the Indian context that focuses on financial access. For instance, Bhavani and Bhanumurthy (2012) examine the extent of financial resource gap, i.e. they analyse availability and adequacy of financial resources from the formal financial system at different levels—household, sector (agriculture, industry and services), segment (unorganized and organized) and the economy. In addition, the study compares India with selected countries like Brazil, China and United Kingdom, and also, it compares financial access between private sector banks with public sector banks within India. They find that there exists not only limited financial access but also unequal access across households in Indian villages across states. Based on estimates for the year 2004–05, they further observe that the financial resource gap persists for agriculture despite priority sector lending, while a sizable proportion of unorganized enterprises in manufacturing and services were outside the formal financial system. The financial resource gap was the largest for agriculture (49%) followed by service sector (41%); for the unorganized segment of the economy, it was 68%, whereas at the economy level, the gap was around 39%. In the international front, their evidence indicates that the Indian financial sector has the least depth and breadth among the four countries. Compared to the situation nearly a decade back, what are the major issues in financial inclusion now is an important aspect that requires attention of researchers. In this context, the role of microfinance institutions and self-help groups has also gained significance and needs to be discussed as there are many problems they are still facing.

The period of 1970–1990 is commonly called the period of financial repression. The reforms in the nineties focused on development of financial institutions, market microstructure, instruments for mitigating risk and building of regulatory and technical infrastructure (Ray & Virmani, 2012). They conclude that financial liberalization has led to improvement in the allocation of funds. However, with more liberalization of markets, India has become more financially integrated to global financial markets. For example, Sinha and Pradhan (2008) observe that increased financial market integration is reflected in increasing co-movements in interest rates, bond yields and stock indices. Evidence from price-based measures of financial integration suggests increasing financial market integration in Asia. In a similar work, Mukherjee (2017) observes that though financial integration in East and Southeast Asia is far ahead of that of South Asia, India, apart from the already leading role of Japan, is likely to play a significant role in the entire regional financial integration. In this context, a pertinent question is, did liberalization and integration help the process of development of the financial sector? Given this background, it is interesting to gauge where India stands now with respect to financial liberalization and development vis-à-vis other emerging markets. It is also an important aspect to look at the linkage between the financial sector and the external sector, i.e. how the foreign policy developments are influencing the functioning of the financial sector in India at this moment or whether the domestic financial sector is actually capable of facilitating the functioning of the external sector, i.e. trade with the rest of the world.

The process of financial liberalization in India started in 1991. Gangopadhyay and Shanthi (2012) argue that though there has been an increase in the efficiency of the Indian financial markets in the post-reform phase, the bond market in India needs to be more active and dynamic, and also, the bankruptcy market needs to become more efficient. They also suggest that during the global financial crisis of 2007–2009, the chain of causation was more from the direction of real sector to the financial sector rather than the other way round. Hasan and Saha (2014) look at the financial system in India during 1990–2010 and observe that financial system in India is dominated by financial market rather than financial institutions and so, well-developed stock market is not able to compensate for the underdeveloped financial institutions. Banking sector is the most prevalent form of financial intermediation in India, and NBFCs are in focus now for their potentially substantial role in the financial sector. Financial institutions and their problems are one of the pertinent issues that need attention.

Another way of looking at the transformations in financial sector is from the viewpoint of the corporates that are important stakeholders of the financial sector. Corporates have recorded phenomenal growth since the 1990s. With their growth and the financial development process, the regulations brought by SEBI tried to put more discipline and transparency in the markets through higher disclosure and other means related to practices and standards of corporate governance in line with the international norms. Regulatory authorities are continuously reviewing norms pertaining to issues like promoters' shareholding owing to risks arising from excessive leverage and the linkages between financial intermediaries. With Companies Act 2013 and IBC in place, corporate governance is in forefront now. The key areas in the Companies Act 2013 include the board structure and responsibility, disclosure and reporting, risk, control and compliance, related party transactions (RPT); loans and investments; audit and auditors and corporate social responsibility. With such changes, new trends in corporate finance practices are also observed, e.g. share repurchases are increasing substantially in the current decade compared to the previous one, possibility of earnings management practices is now being discussed and researched, and corporate social responsibility norms as per the Companies Act 2013 are already in place. The performance of firms is closely linked to these functional aspects, and at this backdrop, it is interesting to look at some recent issues related to the linkage between corporate governance practices and standards and firms' performance and emerging strategies and norms in corporate finance.

Given the scenario, a major disruption in the global economy and financial sectors was created by the COVID-19 pandemic in 2020. Indian economy has been showing signs of recession, and the financial sector is no exception. With COVID-19, financial markets like the money, stock and bond markets also faced disruptions, credit growth had a setback, and their linkages might also have been impacted. Though it might be little early to gauge whether the pre- and post-pandemic linkages among the markets have transformed or not, such an exercise would be definitely interesting.

FSLRC is an important report that covers not only the functional aspect, but also the regulatory and legislative aspects of financial sector in India. Though there are debates about some recommendations,[1] the progress on the implementation of the same has been dismal. Very few have been implemented so far, like the IBC, Monetary

[1] For details, see speech of Raghuram Rajan, Governor of the Reserve Bank of India on Financial Sector Legislative Reforms Committee Report (FSLRC)—what to do and when? At the First State

Policy Committee in the inflation targeting regime, etc. For detailed critical analysis of the recommendations and progress of implementation of FSLRC, see Khan (2016). That is why, time is not ripe to evaluate the impact of FSLRC, though it would have been an interesting issue to look at, had it been implemented properly by now.

3 Summary of Chapters

Based on the current issues discussed in the previous section, this volume incorporates some very contemporary topics in Indian financial sector, some of which are not well explored so far. Some of the topics present new perspectives. There are four parts in this volume. The first part is on *financial inclusion*, the second part focuses on *financial liberalization, development and the economy*, the third part is themed on issues related to *financial intermediation* with focus on financial institutions, viz. banks and NBFCs, and the final part is on issues related to *corporate finance, corporate governance* and the impact of COVID-19 on financial sector. The pertinent issues discussed in the previous section form the basis of the topics chosen in the chapters.

Part I includes two chapters. The first chapter is a critical survey on how financial inclusion is perceived by different researchers and how it is measured. One set of studies pertains to macroeconomic studies that concentrate on the experience of a single country or compare cross-country experiences. The second set is survey-based micro-econometric studies that focus on issues related to the extent of financial inclusion in specific survey area. However, in both the cases, measuring financial inclusion plays a very important role. The chapter describes the variables considered and the methodologies of constructing the measurement and discusses the potentials and limitations of alternative measurements. The second chapter measures the degree of financial inclusion in twenty-four selected economies in Asia and Europe including India, based on a widely accepted measure of financial inclusion in the recent past. The findings point to the fact that European countries have higher ranking in terms of financial inclusion. The chapter discusses how, over time, financial inclusion has significantly improved within a country, too.

Part II, in three chapters, focuses on the linkage of the financial liberalization and development with the external sector and the financial sector in relation to global factors. One chapter in this part is an insightful case study of the Indian textile sector, one of the major export-oriented industries in India, to provide micro-level evidence of the impact of financial factors on export participation. Based on firm-level data, the study finds that financial factors have a significant role to play and makes a compelling case for government intervention in supporting the entry of the domestic firms into foreign markets by enhancing their access to external capital. The next chapter looks at the spillover effect of monetary easing to fight global financial crisis

Bank "Banking and Economic Conclave", Mumbai, 17 June 2014, https://www.bis.org/review/r140617a.htm, accessed on 4 January 2021.

of 2007–08 and the COVID-19 crisis in developed countries on developing countries in general and on India in particular. It is observed that such spillover effects may be reflected in greater volatility in foreign portfolio flows, changes in equity valuations and exchange rate movements. The last chapter in this part is a comparative study among BRICS countries. It not only presents an account of the financial liberalization process in each of the five countries chronologically for the last few decades but also examines whether the pace of financial development across BRICS economies post-liberalization is same or not. In other words, it tests whether "convergence" exists in the process of financial development, especially after liberalization, within the BRICS. Access, depth and efficiency of both financial institutions and markets are taken into consideration. The convergence is the fastest in case of financial markets in India, and this corroborates with the previous findings that development of financial markets is higher and faster than that of financial institutions. Most importantly, India, the only lower middle-income country among BRICS, is catching up quite fast with the rest of the BRICS economies.

Part III looks at financial intermediaries or institutions such as banks and NBFCs in four chapters. Whether a bank is contributing to economic growth in a sector by extending credit to that sector is a very pertinent issue. The first chapter in this part estimates the dynamics of the relationship between sectoral growth and sectoral credit across Indian states during last four decades and presents an in-depth analysis of financial intermediation and growth. Findings suggest that in the decade of 2000, financial intermediation exerts positive and significant effect on growth. The next chapter is more of a theoretical one on a very important issue, i.e. group loans. The chapter tries to explain why group lending has been less successful in backward areas compared to more advances area. The authors argue that in backward regions the proportion of safe borrowers and the probability of success of projects are expected to be low, and the model in the chapter, with adverse selection, shows that lending under group contracts in that case may come down in backward areas. It further shows that group lending as in self-help groups may not necessarily lead to higher lending. The third chapter is again related to banks' role of intermediation with respect to policy changes on part of the central bank. It tries to find out how monetary policy decisions of the central bank in India are transmitted to the commercial banks. More specifically, the chapter focuses on examining the effect of central bank's repo rate changes on commercial bank balance sheet items at the level of individual bank. The findings suggest that monetary policy decisions have positive and significant impact on banks' annual borrowings and loans. The last chapter in the section highlights the role of NBFCs in the Indian financial markets. This topic is also not much explored so far. It discusses the status of shadow banking in the context of NBFCs, some of the recent problems in this sector in the Indian market and suggests some potential solutions.

The final part of the book contains four chapters. It focuses on a number of some pertinent issues related to corporate finance and governance and also financial markets. The first chapter explores the effect of the largest shareholders on dividend payout policy. The relationship between promoter ownership and dividend payout from the perspective of the largest shareholder is important. The impact of the largest shareholder on dividend payout may be explained by different theories. For example, in widely held corporations, the largest shareholders with a substantial level of the shareholding, dividend could be used as a cost-effective signal to mitigate agency problems, whereas the efficient monitoring theory suggests that the largest shareholder on the management of a firm would make dividend less viable options to address agency conflicts. In family owned business groups, the largest shareholder with a low level of shareholding in the corporate firm could force the managers to distribute higher dividends to mitigate the horizontal agency problems. Indian firms are broadly divided into business groups that exhibit the concentrated ownership structure and stand-alone with dispersed ownership structure. The chapter therefore examines the relationship in the Indian context. It further looks at whether the presence of other shareholders especially the second-largest shareholder makes any difference in the existing dividend payout policy through active monitoring over the largest shareholder.

The second chapter deals with an issue related to stock market. It analyses the nature of time-varying currency exposure. It is observed that any currency appreciation has been associated with sharp increase in exposure; this raises the risks of having significant and persistent escalation in currency exposure even in a tranquil period. This might make hedging difficult. The study finds currency exposure to be significantly volatile. The chapter covers post-pandemic period too and observes that historically the impact of foreign exchange market on time-varying exposure has been stronger than that of the stock market, with escalated risk like that during the stock market crisis. The results have important implications for the policymakers too as the recent pandemic situation is witnessing significant increases in exposure. The third chapter in Part IV links the performance of firms with the sustainable environmental practices adopted. It formalizes the relationship between corporate environmental performance and disclosures in relation to the allocation of resources for such purposes. The last chapter is an attempt to gauge the impact of the COVID-19 pandemic on the linkages among financial markets, viz. the stock prices and the prices of two mostly traded commodities in the derivatives market, crude oil and gold in the Indian context. The analysis includes a pre- and post-pandemic analysis of the relationships, and it is observed that the stock returns and the commodity prices are closely linked with each other. Interestingly, the results indicate that the pandemic has altered the relationship. In the pre-COVID period, the stock, gold and crude oil prices were not moving together, but during the pandemic, evidence of co-movement is there.

The volume has thus attempted to present the issues in financial sector which are the burning issues at the moment; they are being discussed and debated and are going to have important implications in future. The book is going to provide the researchers some food for thought for further research on some contemporary issues and some more perspectives on the current issues pressing the sector in India now. As the financial sector is too broad an area, it is indeed difficult to narrow down to a few particular problems. The book, therefore, does not claim to be offering an exhaustive set of problems and issues, but it covers considerably large number of very relevant topics on some new and upcoming areas of research in financial sector.

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Financial Inclusion

Measuring Financial Inclusion: A Survey

Malabika Roy

1 Introduction

It is widely agreed that to be effective and acceptable, high rate of economic growth is inadequate for well-being of the populace. The process of growth should be such that it is inclusive: a growth process that offers equality of opportunity to different segments of population and maintains equality in the distribution of the fruits of economic growth. Financial inclusion is undeniably an important factor in ensuring inclusive growth. One of the main hurdles the deprived section of population faces is fund constraint: the lack of access to fund at appropriate time and at acceptable terms. So, access to fund is a very important component of financial inclusion. In their seminal paper, Banerjee and Newman (1993) have identified financial market imperfection as a potential source of low level of development.

Financial inclusion, however, is not only about fund constraint. Rangarajan Committee on Financial Inclusion (2008)[1] has provided an encompassing definition of financial inclusion in the following quote: "*Financial inclusion may be defined as the process of ensuring access to financial services and timely and adequate credit where needed by vulnerable groups such as weaker sections and low income groups at an affordable cost.*" According to this definition, there is an element of multi-dimensionality in the concept of financial inclusion. Similarly, Rajan (2009)[2] has pointed out that "financial inclusion is not only about credit, but involves providing a wide range of financial services, including saving accounts, insurance, and remittances. An exclusive focus on credit can lead to undesirable consequences such as over indebtedness and inefficient allocation of scarce resources." Demirgic-Kunt

[1]Rangarajan (2008).

[2]Rajan (2009).

M. Roy (✉)
Department of Economics, Jadavpur University, Kolkata, India

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et al. (2008) offer another definition of financial inclusion or “broad access to financial services” as “an absence of price or non-price barriers in the use of financial services. Thus, properly quantifying financial inclusion is an important issue.”

The present chapter aims at providing a critical survey on how the different researchers have perceived financial inclusion and quantified it. Since the degree of financial inclusion is an important dimension of an economy’s progress, an appropriate and well-formulated yard stick is needed to measure financial inclusion. Such a yard stick should be able to measure a country’s or a region’s progress towards financial inclusion over time as well as make cross-country comparisons in this regard. A unified measurement is also important if we want to analyse and identify the contributing factors towards higher degree of financial inclusion. The scholars have realized the importance of quantifying financial inclusion, and a substantial amount of literature has developed, which addresses the issue of measuring it. The studies that have quantified financial inclusion can be classified into two sets. The first set of studies adopt individual indicator approach. These studies identify and use either a single indicator or a set of indicators to measure financial inclusion, without combining them in an index. The second set of studies not only identify the indicators of financial inclusion but also develop an index of financial inclusion by using these indicators. It is understandable that in both cases measuring the financial inclusion plays a very important role. The present chapter will cover both types of studies, while focusing on issues related to measurement of financial inclusion, the potentials and limitations of alternative measurements.

The chapter is organized as follows. In Sect. 2, we discuss the studies that attempt to measure the degree of financial inclusion by using either a single dimension or multiple dimensions separately without combining them in a single index which we call individual indicator approach. In Sect. 3, we explore the studies that measure the degree of financial inclusion by constructing an index of financial inclusion, which we call index approach. Section 4 concludes the chapter.

2 Financial Inclusion: Individual Indicator Approach

In the present section, we review the studies that have used a single indicator to measure financial inclusion or used multiple indicators without converting them to an index. Researchers have very often focused on specific aspects of financial inclusion either due to their overriding importance or due to the easier availability of data. In the following sections, we will explore the alternative ways in which financial inclusion has been proxied in the existing literature by indicator variables.

There is an extensive body of literature on financial inclusion which is very difficult if not impossible to include in a single survey. The list is obviously non-exhaustive and provides a snapshot view of the vast literature developed around the issue of financial inclusion. Here, the primary aim is to give a flavour of how the different studies have attempted to use different indicators to measure financial inclusion. Another point to note is that in the present chapter we are more interested in how financial inclusion has been measured. So, we have focused on that aspect and have not discussed the results reported in the papers. For a more elaborate non-specific survey, Gupta (2017) can be consulted.

In this context, it will be highly enlightening to refer to the Financial Inclusion Manifesto (2010), which very succulently identified "core financial needs "of a consumer. They were as follows:

- A transactional bank account that functions well
- Access to fair and affordable credit sources for income smoothing
- Insurance against income shocks
- An adequate pension source to provide for a comfortable retirement
- Access to fair and affordable mortgage-based loans
- "financial provision for social/long-term care"
- Proper financial advice and information enabling consumers to make appropriate choices
- Savings instruments to generate "income and assets to maintain a reasonable standard of living and participate in society."

Further the conditions required to fulfil these "core financial needs" were identified as follows:

- equivalent rights of access to appropriate products and access to redress if things go wrong
- access to the necessary information, support and advice to make appropriate choices and decisions and
- the necessary financial capability to use these products and services effectively.

This list gives us a fairly good idea about the lines in which the concept of financial inclusion or financial exclusion should be developed. However, access to credit and access to savings instruments have been identified as a major factor in financial inclusion literature. So, in many of the earlier works, financial inclusion has been captured by access to formal/bank credit and bank accounts.

The initial studies focused on financial exclusion rather than financial inclusion. While studying the extent of financial exclusion in Britain, Kempson and Whyley (1998) and Kempson et al. (2004) identified financial exclusion with absence of bank account or banking exclusion. They also pointed out that this basic level of financial exclusion can lead to further financial exclusion, e.g. exclusion from formal loans and other savings and investment product. However, Kempson and Whyley (1999) and Kempson et al. (2000) have defined financial exclusion using a more inclusive approach. The dimensions considered for defining financial exclusion were: (a) current account and/or building society account; (b) a savings/investment product; (c) insurance policies: life insurance and home content insurance; (d) access to credit from a main stream provider; (e) pension product. The degree of financial exclusion of a household was measured by the number of these facilities that a household lacked.

However, as Kempson et al. (2000) have pointed out there is an inherent multidimensionality in the concept of financial exclusion itself. Financial exclusion can occur due to any of the following reasons: (i) access exclusion: individual is denied access due to risk assessment; (ii) condition exclusion: individual fails to satisfy the conditions attached to a financial instrument, (iii) price exclusion: the price of the financial product is too high for the individual, (iv) marketing exclusion: targeted marketing excludes certain individuals from information; (v) self-exclusion: individual self-selects not to use the financial product. Later literature was influenced by this classification of financial exclusion and identified the factors in defining financial inclusion along similar lines.

Demirgic-Kunt et al. (2008) have discussed in detail the reasons behind different kinds of financial exclusion, which fall outside the purview of the present chapter. However, Demirgic-Kunt et al. (2008) and Honohan (2008) also discuss the problems associated with measuring financial inclusion. While macro-level data on number of credit and deposit accounts are available with the financial institutions and can be aggregated to arrive at a macro-value, they may not accurately reflect the actual use of financial services availed by the households as a household may have accounts with more than one bank/financial institution or accounts might be dormant. Such data can be generated through large-scale household surveys, which are limited in number and lack comparability across countries due to use of different definitions. But they also point out that several studies have shown that indicators combining deposit and credit accounts data, which have been obtained from household surveys are highly correlated with the actual users of financial services.

Beck et al. (2006) conducted a survey in 193 banks in 58 countries and analysed access to financial services and barriers to it. They consider three sets of indicators, viz. deposit services, credit services and payment services. For each of the services, they consider three aspects: physical access, affordability and eligibility. The details of each indicator and the three aspects in each case are given in Table 1.

Demirgic-Kunt et al. (2008) also discuss the same set of indicators in the context of sources of financial exclusion. Point to note is that financial inclusion or exclusion is primarily defined in terms of the access to services provided by the banks and exclusion therefrom.

Global Financial Inclusion (Global Findex) Database is a worldwide survey data base that gives user side survey data on financial inclusion. Demirguc-Kunt and Klapper (2012) and Demirguc-Kunt et al. (2015) discuss this database in great detail. The main indicators for financial access identified and included in this database are as follows:

- Account penetration; frequency of accessing the account (deposits and withdrawals); debit card ownership; different payment methods used to make payments from the account/receive payments in the account
- Savings behaviour; its determinants; alternative modes of savings
- Credit: sources of credit; ownership of credit cards; main purposes of loans
- Insurance.

From the paper, we find that in this database also primary focus is on banking and related services.

Next, we very briefly discuss a few country studies and reports focusing on how they define financial inclusion or financial exclusion. Corr (2006) in her exploratory

Table 1 Different aspects of indicators

Indicators	Aspects		
	Physical access	Affordability	Eligibility
Deposit services	Locations to open a checking/savings account	Minimum balance needed to open a checking/savings account as a proportion to GDP per capita	Number of documents required to open a checking/savings account
Checking and savings account		Fees required to maintain a checking/savings account	
Credit services	Locations to submit a loan application	Minimum amount of consumer loans/SME loans (where relevant) received as a proportion to GDP per capita	Number of days required to process a loan application
		Fees on consumer loans as a percentage of minimum consumer loan amount	
Business loans, consumer loans, mortgage loans and SME loans		Fees on SME loans	
Payment services	Not relevant	Not relevant	Costs of transferring small funds internationally
Transfer of small funds internationally			
Use of ATM cards			Fees associated with ATM transactions

Source Beck et al. (2006)

study of financial exclusion in Ireland used four indicators to identify financial exclusion: absence of a bank account, absence of regular savings, absence of home insurance and absence of life insurance. Allen et al. (2016) analyse the determinants of financial inclusion using cross-country data from Global Findex database. They use four indicators: account ownership (account with bank, credit union, cooperative, post office or microfinance institution), use of accounts to save, frequency of account use and reported barriers to account use. Zarazua and Copestake (2008) in studying financial inclusion and its link to vulnerability and actual use of financial services in Mexico City consider use of savings and credit services as indicators of financial inclusion of households. Camara and Tuesta (2015) examine the financial inclusion of households based on the survey data from Peru. They consider a household/enterprise to be financially included if "it receives interest on one or more financial products, it has a mortgage loan, or it carries out online banking transactions." Baqui Khalily (2016) considered deposits with various types of banks and credit from various banks as indicators of financial inclusion while examining the financial inclusion in Bangladesh.

Russel et al. (2011) study the relation between over indebtedness and financial exclusion of households in Ireland. They include four dimensions of financial exclusion: banking exclusion (current account), credit exclusion (credit from formal sources. Overdraft facilities, credit/store card), savings exclusion (regular savings) and insurance exclusion. Devlin (2005) studied the financial exclusion of households in UK. He considered five types of exclusions: current account, savings account, home insurance, life insurance and pension. Of all the studies on financial exclusion, his coverage is most exhaustive.

Owen et al. (2016) studied the relation between banking concentration and financial inclusion using cross-country analysis covering 83 countries. They use seven indicators to identify financial inclusion in separate regressions. The indicators are as follows:

- Number of depositors,
- Household depositors,
- Household deposit accounts,
- Borrowers,
- Household borrowers,
- Loan accounts,
- Household loan accounts.

Kim et al. (2018) study the impact of financial inclusion on economic growth by using a dynamic panel analysis on data from 55 Organization of Islamic Cooperation (OIC) countries. The proxies for financial inclusion they use are number of ATMs per 100,000 adults as a proxy for account ownership, bank branches per 100,000 adults as a proxy for penetration, borrowers from commercial banks per 1000 adults as a proxy for credit and life insurance premium volume to GDP as a proxy for insurance. Kumar (2013) studied the determinants of financial inclusion across 29 states of India using panel data analysis. He used two measures of penetration indicators as measure of financial inclusion for states: number of deposit accounts as a percentage of population as the number of credit accounts as a percentage of population. What we can surmise from these studies is that though a few studies included insurance products most of the studies identified financial inclusion with availability and access to bank-related services.

The Little Data Book on Financial Inclusion (2012) reported data on seven aspects to capture financial inclusion:

- Account at a formal financial institution,
- Access to formal account,
- Use of formal account.
- Mobile payments,
- Savings and savings with a formal financial institution in the past year,

- Different types of loans from a formal financial institution in the past year and
- Personally paid insurance.

Rangarajan (2008) emphasized the role of micro-insurance and self-help groups in developing financial inclusion. The dimensions of financial inclusion considered were on similar lines. Global Financial Report (2014) studied the extent of financial inclusion across countries of the world. The indicators for financial inclusion used were as follows:

- account ownership (deposit account and loan account)—adults with accounts in a formal financial institution; by both households and firms;
- savings and savings held with formal financial institutions;
- adults receiving new loans from formal financial institutions; households and firms;
- payments made using non-cash modes of payments (credit card, debit card, mobile device and electronic payments);
- demographic penetration: commercial bank branches per 100,000 adults, ATMs per 100,000 adults;
- Geographic penetration: commercial bank branches per 1000 km^2, ATMs per 1000 km^2;
- Insurance: percentage of adults, who purchased health insurance and percentage of adults who purchased other insurances.

In 2012 at Los Cabos Summit, G 20 leaders endorsed a set of indicators for financial inclusion developed and recommended by the platform Global Partnership on Financial Inclusion. The set of indicators is a most comprehensive and exhaustive one. The list is provided in Appendix 1.

From the discussion above, two points are quite evident. First, primarily financial inclusion has been identified with the supply side of different bank-related services. Though most scholars realized that financial inclusion is not only about access to banks, the choice of indicators was always severely limited by data availability. With country-wide micro-level surveys, the data availability improved, and the choice of indicators also widened, which included incorporation of demand-side indicators. There is another reason behind using bank-related services as indicator of financial inclusion. The access to banking services is the first major step towards financial inclusion, and access and use of other financial services are highly correlated with it. Second, it was increasingly becoming clear that financial inclusion had to be measured as a multidimensional indicator. So, the next logical step was to combine the multiple dimensions and form a single index of financial inclusion. In the next section, we discuss the different methods that were adopted to construct an index of financial inclusion.

3 Financial Inclusion: Index Approach

In the present section, we review the different methods that have been adopted to combine different dimensions of financial inclusion into a single comprehensible index. As pointed out by Chakrabarty and Pal (2013), individual indicators of financial inclusion can behave in different ways across regions and across countries. While a particular region may be performing very well with respect to one of the dimensions, its performance may be abysmally poor in another dimension. It is then difficult to understand the overall performance or position of a country by examining individual dimensions. So, the logic for constructing an Index of Financial Inclusion (IFI) is the same as that for constructing human development index: the index should be able to capture an overall picture of the country taking into account all the dimensions. Therefore, constructing an index is unambiguously an improvement over examining individual dimensions. There are two issues involved here: the dimensions that should be included in the index and the appropriate methodology that should be adopted. We will discuss and compare the different IFIs developed along these two lines.

In this context, it is important to point out the desirable properties of such an index. Sarma (2008) opines that a good index should obey the three properties, viz. ease of computation, comparability across countries and inclusion of maximum possible dimensions.

The methodology of constructing the index of financial inclusion has evolved along two distinct lines: application of parametric methods and application of non-parametric methods. The parametric methods are discussed in Sect. 3.1, and non-parametric methods are discussed in Sect. 3.2.

3.1 Index of Financial Inclusion: Parametric Method

The parametric methods are based on either the use of distance measures or method of means (arithmetic/geometric mean). In this method, the weights when used are given exogenously based on either some economic rationale or arbitrarily chosen.

Sarma (2008) adopts the methodology earlier used by UNDP for construction of indices like human development index (HDI) and gender development index (GDI). Each dimension indicator was first reduced to a fraction and made unit free using the following method of normalization:

$$d_i = \frac{A_i - m_i}{M_i - m_i} i = 1, \ldots\ldots n \tag{1}$$

Here,

A_i actual value of the ith dimension.
m_i minimum value of the ith dimension and.
M_i the maximum of the ith dimension $0 \le d_i \le 1$.

Here, (0, …., 0) can be the worst scenario, and (1, 1, 1, …, 1) is the best scenario. The IFI for the jth country is then constructed by taking the Euclidian distance of each dimension from its ideal value and then subtracting the resulting value from 1.

$$\mathrm{IFI}_j = 1 - \frac{\sqrt{(1-d_1)^2 + (1-d_2)^2 + \cdots + (1-d_n)^2}}{\sqrt{n}} \tag{2}$$

The methodology was originally developed by Nathan et al. (2008), as an alternative approach to the construction of HDI. They show that this index obeys certain axioms:

Normalization: The index has a maximum and a minimum value [0,1] in this case.

Symmetry/anonymity: The value of the index remains unchanged if the values of two dimensions are interchanged.

Monotonicity: The value of the index increases with the increase in the value of any dimension, other dimensions remaining unchanged.

Uniformity: Given a mean value of the index, higher dispersion implies lower value of the index.

Signalling: The index has a unique optimal path to reach a higher value.

Sarma (2010) further modified the IFI by attaching a weight w_i to each dimension i, and then, the dimensions given by Eq. (1) become

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} i = 1, \ldots n \tag{3}$$

Now, $0 \leq d_i \leq w_i$. The index of financial inclusion for country j now becomes

$$\mathrm{IFI}_j = 1 - \frac{\sqrt{(w_1-d_1)^2 + (w_2-d_2)^2 + \cdots + (w_n-d_n)^2}}{\sqrt{w_1 + w_2 + \cdots + w_n}} \tag{4}$$

It is to be noted that the IFI given by Eq. (4) reduces to IFI given by (3) if all the dimensions are allotted equal weights, that is $w_i = 1 \forall i$. Attaching different weights to different dimensions allows one to differentiate across dimensions according to the importance of the dimensions. This index was used in two separate studies (Sarma, 2010; Sarma & Pais, 2011).

However, in all the three studies, the measures of dimensions used were the same three variables. The dimensions were: *banking penetration, availability of banking services and usage of banking services*. In all the three studies, usage was measured by the sum of total credit and deposit as a proportion of GDP. Accessibility or penetration was measured by bank accounts as a proportion of total adult population in Sarma (2008, 2010) and by number of bank accounts per 1000 population in Sarma and Pais (2011). The measure of availability has varied across the studies. Sarma (2008) has used bank branches per 1000 population as a measure of availability. In Sarma (2010) and Sarma and Pais (2011), two separate indices of availability dimension have been constructed one using the number of ATMs per 100,000 populations and the other using the number of bank branches per 100,000 populations. Then, in the next step, the availability index is constructed by a weighted average of these two availability dimensions, with 1/3 weight given to the ATM dimension and 2/3 weight given to the bank branches dimension.

Sarma (2010) and Sarma and Pais (2011) both have used the weighted formula given by Eqs. (3) and (4). The weights used in both the papers were the same: 1 for penetration, 0.5 each for availability and usage. The logic behind using lower weightage for availability and usage was that both the usage and availability need to be captured by multiple dimensions, which could not be done due to lack of available data. No other statistically or mathematically rigorous justification was provided.

Yorulmaz (2013) also creates an index of financial inclusion for regions of Turkey following the methodology developed in Sarma (2008). The indicators used are deposit accounts, savings, commercial bank deposits and other institutional deposits by region as a proxy for penetration/outreach; branches of commercial banks and other financial institutions, e.g. post offices, for availability and the volumes of credit and deposit for usage.

The index developed by Sarma (2008) does not suffer from the problem of perfect substitutability inherent in the indices constructed by simple average. However, Chakraborty and Pal (2013) criticize the index on account of indecomposability. To quote them "the overall index cannot be broken down into dimension-wise components for calculating the individual percentage contributions. This in turn makes her index unsuitable for identifying the dimensions that are more/less susceptible to overall financial inclusion."

Chakraborty and Pal (2013) develop an alternative index for financial inclusion, which is decomposable. At the first step, the dimension index was converted into a power function:

$$f_r(A_i, M_i, m_i, r) = \left(\frac{A_i - m_i}{M_i - m_i}\right)^r = (d_i)^r \quad 0 < r \leq 1.$$

The index of financial inclusion is then constructed by averaging the individual indicators:

$$I_r = \frac{1}{n}\sum_{1}^{n}(d_i)^r$$

This index also satisfies the axioms of normalization/boundedness, symmetry/anonymity and monotonicity. Additionally, the index also satisfies two other properties, viz. property of homogeneity implying that the index function is a homogeneous function and the property "lower difference in gain at higher levels of attainment difference" implying that the improvement in the index function is more from an increase in individual A_i at lower values of A_i as compared to higher values of $A_{i.}$ This second property holds only for values of $r < 1$. The index of financial inclusion developed by Chakrabarty and Pal (2013) allows for calculation of the percentage contribution of the contributing components, which is an improvement over Sarma (2008, 2010).

Sarma (2008, 2010) and Sarma and Pais (2011) have used the index of financial inclusion primarily for cross-country comparison. Chakrabarty and Pal (2013) use their index primarily to compare across states in India over time. They use six indicators to construct the index of financial inclusion:

- Geographical penetration measured by number of bank branches per thousand kilometres of area
- Demographic penetration measured by number of bank branches per lakh of people similar to Sarma's (2008, 2010) measure of availability
- Number of deposit accounts per thousand people similar to the measure of accessibility/penetration as in Sarma and Pais (2011)
- Credit accounts/number of loans per thousand people
- Average size of deposits as a ratio to per capita net state domestic product
- Average size of loans as a ratio to per capita net state domestic product.

It is to be noted that Sarma (2008, 2010) and Sarma and Pais (2011) have combined the last two indicators as a measure of usage. Other researchers adopted these two primary methodologies. Faruk et al. (2013) also adopted the methodology of Sarma (2008) to study the financial inclusion at the district level in Bangladesh. Chattopadhyay (2011) adopted the methodology and measures developed by Chakraborty and Pal (2013) to study the level of financial inclusion of the districts of West Bengal.

Figure 1 shows the inherent multidimensionality of the concept of financial inclusion. While Sarma (2008, 2010) used single indicator approach, where one dimension of financial inclusion is captured by one indicator, Arora (2010) considers three dimensions of financial inclusion, viz. outreach, ease of access and cost of access. She uses a multiple indicator approach where each dimension is captured by more than one indicator. For instance, outreach is captured by both geographical as well as demographic penetration. Table 2 lists the variables.

Each indicator variable under each dimension is normalized using the same method as Sarma (2008). Then, each dimension D_i is calculated by taking the arithmetic mean of the indicator variables: $D_i = \frac{\sum_1^n d_{ij}}{n} i = 1, 2, 3,$. Finally, index of financial inclusion is created by taking the weighted arithmetic mean of the three dimensions:

$I_r = D_1 w_1 + D_2 w_2 + D_3 w_3$ where w_i is the weight assigned to the ith dimension. Aurora (2010) assigns arbitrary weights $w_1 = 2$, $w_2 = 1$, and $w_3 = 1$. The index is then used to rank countries based on financial inclusion.

Kumar and Misra (2011) study the level of financial inclusion across states of India. Two sets of indices are constructed. First is the index based on bank outreach. To this end, they adopt six indicator variables to create a supply side index of financial inclusion. They are number of deposit accounts per person (access/demographic penetration/outreach); number of credit accounts per person (access/demographic penetration/outreach); number of bank offices per person (availability); average saving amount per deposit account (usage/depth of the financial system); average

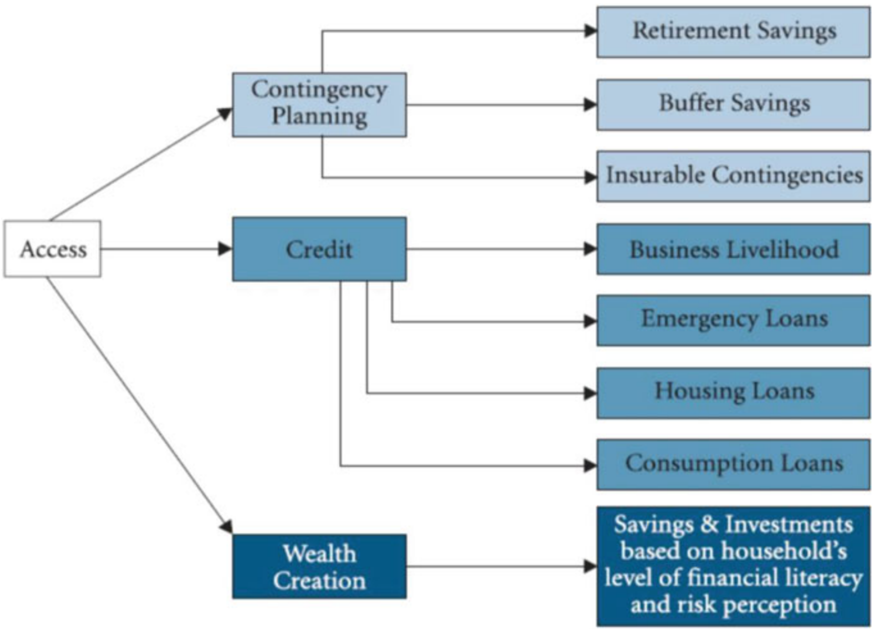

Fig. 1 Multidimensionality of financial inclusion. *Source* A Hundred Small Steps: Report of the Committee of Financial Sector Reforms (2009)

credit amount per credit account (usage/depth of the financial system); proportion of credit utilized to credit sanctioned in the state (usage).

Each variable is normalized by dividing it by the average value:

$$d_q = \frac{A^t_{qs}}{A^t_q} \quad q = 1, 2, \ldots 6$$

where

A^t_{qs} value of indicator q at time point t in state s;
A^t_q average value of the indicator variable q across all states.

Then, the supply side index of financial inclusion is obtained by averaging the indicator variables:

$$\mathrm{FII}^B = \frac{1}{6}\sum d_q$$

The second index they calculate is the index of household-level access. The indicator variables are described in Table 3[3].

[3] Data source for household access was *All India Debt and Investment Survey* (AIDIS) for 2002–03.

Table 2 Multiple indicators approach by Arora (2010)

Outreach (D_1)	Ease of access (D_2)	Cost (D_3)
Geographic branch penetration (number of branches per 1000 km^2	Locations to open deposit account	Fees consumer loan (% of minimum loan amount
Demographic branch penetration (number of branches per 100,000 people)	Minimum amount to open checking account	Fees mortgage loan (% of minimum loan amount)
Geographic ATM penetration (number of ATMs per 1000 km^2)	Minimum amount to open savings account	Annual fees checking account
Demographic ATM penetration (number of ATMs per 100,000 people)	Minimum amount to be maintained in checking account	Annual fees savings account
	Minimum amount to be maintained in savings account	Cost to transfer funds internationally (% of $250)
	Number of documents to open checking account	Amount of fees for using ATM cards (% of $100)
	Number of documents to open savings account	
	Locations to submit loan applications	
	Minimum amount of consumer loan	
	Minimum amount of mortgage loan	
	Days to process consumer loan application	
	Days to process mortgage loan application	

Source Aurora (2010)

The indicators were all in percentage terms, hence obviating the need for normalization. Two financial inclusion indices for households were created using the method of simple arithmetic mean separately for formal and informal access with three indicators for FII-formal and two indicators for FII-informal as data on informal insurance were not available.

Gupte et al. (2012) combined the indicators adopting from both Sarma (2008, 2010) and Aurora (2010). Table 4 summarizes the indicators.

For outreach and usage dimension, indices are simply the average of the constituent dimensions since the indicators are all positively related to the dimension indices:

$D_i = \frac{\sum_1^n d_{ij}}{n}$ where D_i: ith dimension $i = 1, 2$.

For the third dimension ease of transaction, the indicators physical locations of deposits and loans are positively related to the dimensions, while all the other

Table 3 Indicator variables for the index of household-level access

Indicator	Definition
Formal savings	Sum of deposits with formal financial institutions (banks, cooperative societies, and NBFCs) investment in shares, bonds and debentures
	Investment in government securities and certificates
Formal insurance	Insurance premiums, annuities and provident funds
Formal loans	Loans payable by the households to the institutional agencies
Informal savings	Savings with chit funds, deposit with individuals cash in hand, promissory note, mortgage of real estate, pledge of bullion and ornaments/other moveable property, receivable unsecured loan, receivable professional dues, trade credit and kind loans and others
Informal credit	Cash loans payable by households to informal lenders
Informal insurance	No data available

Source Kumar and Misra (2011)

indicators are negatively related. So, there are two sub-components:

$$D3a = \frac{\sum_1^n d_{3aj}}{n} \quad \text{and} \quad D3b = 1 - \frac{\sum_1^n d_{3bj}}{n}$$

For the fourth index dimension, the indicator variables all negatively affect the dimension, and therefore, $D4 = 1 - \frac{\sum_1^n d_{4j}}{n}$.

The final index of financial inclusion is created by taking the geometric mean of the five dimension indices:

$$I_r = \left(D1^{\frac{1}{5}}.D2^{\frac{1}{5}}.D3a^{\frac{1}{5}}.D3b^{\frac{1}{5}}.D4^{\frac{1}{5}}\right)$$

Sarma (2015) criticized the use of PCA methodology discussed below and further refined her Euclidian distance-based measure where “the location of the achievement point X vis-à-vis the worst point O and the ideal point W will together determine a country’s level of FI.” This is achieved in the following way:

In an n dimensional Euclidian space, $O = (0, 0, 0\ldots, 0)$ is the worst case scenario, and $W = (w_1, w_2, \ldots, w_n)$ is the best case scenario. X_1 below measures the distance of $(d_1, d_2, \ldots d_n)$ from O:

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + d_3^2 + \cdots + d_n^2}}{\sqrt{w_1^2 + w_2^2 + \cdots + w_n^2}}$$

In a similar vein, X_2 measures the inverse of the distance of $(d_1, d_2, \ldots d_n)$ from $W = (w_1, w_2, \ldots, w_n)$:

Table 4 Summary of indicators by Gupta et al. (2012)

Outreach $D1$	Usage $D2$	Ease of transaction $D3a$, $D3b$	Cost of transaction $D4$
Geographic branch penetration: the number of branches of scheduled commercial banks per 1000 km^2	Volume of deposit + loans as a % of GDP	Deposits' physical access: measures by number of locations to open the deposit account	Loan transaction costs: fees consumer loan % of gross domestic product per capita (GDPPC) Fees mortgage loan % of GDPPC
Geographic penetration of ATM: the number of ATMs and point of sale terminals per 1000 km^2		Deposit affordability: measured by Minimum amount required to open a checking account Minimum amount required to open a savings account Minimum balance to be maintained in checking account Minimum balance to be maintained in savings account	Cost of holding accounts: annual fee checking A/c (% of GDPPC) Annual fee savings A/c (% of GDPPC)
Demographic branch penetration: the number of bank branches per 100,000 people		Document requirement: number of documents required to open a checking account Number of documents required to open a savings account	Cost of ATM transaction: fees for using ATM cards % of $ 100
Demographic ATM penetration: the number of ATMs per 100,000 people		Loans physical access: measured by number locations to open the loan account	Cost of transfer of funds internationally % of $250
Number of deposit accounts per 1000 adults		Loans affordability: minimum amount of consumer loans as percentage of GDP per capita Minimum amount of mortgage loans as percentage of GDP per capita	
Number of loan accounts per 1000 adults		Convenience: days to process Consumer loan application Days to process Mortgage loan application	

Source Gupte et al. (2012)

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + \cdots + (w_n - d_n)^2}}{\sqrt{w_1^2 + w_2^2 + \cdots + w_n^2}}$$

Sarma (2015) defines her refined index of financial inclusion as the average of X_1 and X_2.

$$I_r = \frac{1}{2}(X_1 + X_2)$$

In the special case where $w_i = 1 \; \forall \; i = 1, \ldots, n$, the index reduces to

$$I_r = \frac{\sqrt{d_1^2 + d_2^2 + d_3^2 \cdots + d_n^2}}{\sqrt{n}} + \left[1 - \frac{\sqrt{(1-d_1)^2 + (1-d_2)^2 + \cdots + (1-d_n)^2}}{\sqrt{n}}\right] \tag{5}$$

This index satisfies all the desirable properties of an index. Here, "an average of the normalized distance between O and X and the inverse normalized distance between W and X is the IFI of the country."

Again, Sarma (2015) uses three dimensions: penetration, availability and usage. Indicators are the same as in Sarma (2008, 2010). She argues that though all the three dimensions are equally important and should ideally have equal weights, usage and availability are only partially covered due to lack of available data. So, the weights are 1 for penetration, and 0.5 for availability and usage, respectively.

3.2 Index of Financial Inclusion: Non-parametric Method

The indices of financial inclusion that have used non-parametric methods share the common feature that the weights attached to the dimensions are endogenously determined. This takes care of the arbitrariness of the weights suffered by the indices developed using parametric methods. We discuss several studies that have used non-parametric methods like principal component analysis (PCA) and factor analysis.

Amidzic et al. (2014) use factor analysis to develop an index of financial inclusion. They identify four indicators of financial inclusion, viz. for usage: total number of resident household depositors with ODCs per 1000 adults, total number of resident household borrowers with ODCs per 1000 adults, for outreach dimension proxied by geographical penetration: number of ATMs per 1000 km^2, number of branches of ODCs per 1000 km^2. The variables are normalized using the formulae: $\frac{A_i}{M_i}$. Then, the indicator variables are reduced to two factors/dimensions using factor analysis. Factor1 includes the two geographical penetration indicators, and factor 2 consists of two usage indicators. Dimension 1 is created from factor 1 by combining the two geographical penetration variables, and dimension 2 is created by combining two usage variables. Weight attached to each indicator variable within each factor is determined by proportion of variation explained by the indicator variable. Then again, the financial inclusion index is created by combining the two dimensions where weights are obtained by the proportion of total variation explained by each dimension. The formulae for aggregation used for obtaining the dimensions as well as for obtaining the aggregate are the weighted geometric mean as geometric mean is free from the problem of perfect substitution. Thus, the formulae for index is

$$= \exp\left(\frac{\sum_1^n w_i \log x_i}{\sum_1^n w_i}\right)$$

So, most of the macro-studies have used bank-based data to construct the index of financial inclusion. One reason for it is that bank-based data are more easily available both across country and across time. To include other aspects of financial inclusion, survey data are required.

Factor analysis requires the variables to follow certain restrictions that are certain distributional properties. Camara and Tuesta (2014) have adopted the principal component analysis method, which is relatively free from such restrictions. They combine both demand-side and supply-side variables to arrive at the index of financial inclusion, whereas earlier studies have mostly concentrated on demand-side variables. Like Sarma (2008, 2010) and Aurora (2010), Camara and Tuesta (2014) also adopted the three indicators approach. The three indicators they considered are usage, barriers and access. While usage and access have been considered by other authors, inclusion of barriers is their unique contribution. Like Aurora (2010), they also adopted a multi-indicators approach. The indicator variables used to capture the three dimensions are described in Table 5.

Camara and Tuesta (2014) used two-stage principal component analysis to calculate the index of financial inclusion. At the first stage three sub-indices for usage,

Table 5 Indicators used in Camara and Tuesta (2014)

Usage (demand-side variable)	Barriers (demand-side variable)	Access (supply-side variable)
An individual uses at least one of the following financial services	Reasons for involuntary exclusion	
Bank account	Distance of the access points	ATM per 100,000 adults
Mobile banking	Documentation requirement	Commercial bank branches per 100,000 adults
Debit and/or credit card	Lack of trust	ATM per 1000 km^2
	Affordability	Commercial bank branches per 1000 km^2

Source Camara and Tuesta (2014)

Table 6 Indicators used by Park and Marcado (2018)

Access	Availability	Usage
Adult population with financial account as a percentage of total population (2011, 2014, 2017)	Number of commercial bank branches per 100,000 population	Proportion of adult population with deposit in a financial institution
Proportion of total population with credit and debit cards. (2011, 2014, 2017)	Number of ATMs per 100,000 population	Proportion of adult population with loans from a financial institution
Percentage of population with mobile money account (2014, 2017)		Domestic credit to GDP ratio

Source Park and Marcado (2018)

barriers and access are calculated. In the second stage, the index of financial inclusion as well as the weights is calculated combining the three dimension indices. The indices are then used to rank 82 countries.

Similar to Camara and Tuesta (2014), Park and Marcado (2018) also use a two-stage principal component analysis method to construct an index of financial inclusion with multiple indicators. However, first they normalize the variables using Eq. (1). Then, they follow the two stage principal component method to calculate the weights at each stage. They also use three dimensions but slightly different from Camara and Tuesta (2014): access, usage and availability. The indicator variables under each dimension are also slightly different as described in Table 6.

Banerjee et al. (2020) examined the relationship between financial inclusiveness and financial literacy applying the structural equation modelling (SEM) methodology and using primary survey data from two districts of West Bengal, India. The weights are calculated using the measurement model where financial inclusion and financial literacy are treated as latent variables. Four indicator variables are used as latent variables related to financial inclusiveness. A sample household is considered financially included, if they hold at least one of the following:

- a savings bank account
- an insurance product (like life insurance/health insurance/general insurance or others)
- a loan from a formal or semi-formal institution
- a social security or a pension or provident fund.

Thus, Banerjee et al. (2020) create an index of financial inclusiveness taking into account demand-side factors. But the uniqueness in their approach lies in bringing in insurance products and social security products within the ambit of financial inclusiveness and also in applying SEM methodology to derive the index of financial inclusiveness.

As mentioned already, Sarma (2015) criticized the principal component-based methods on two grounds: first, in PCA analysis, the weights are calculated to maintain the variance–co-variance structure of the dimensions. However, an index, which is required to measure the achievement levels, should be based on level values that is first moments rather than the second moments. Secondly, an index developed using PCA methodology need not necessarily satisfy the properties of boundedness, homogeneity, monotonicity desirable in a good index. She modified the distance-based index developed by her, which has already been discussed in the previous section.

Banerjee and Donato (2020) construct a hybrid index by marrying the methodology based on Euclidian distance developed by Sarma (2015) with the two-step PCA method adopted by Camara and Tuesta (2014). They distribute 23 indicators (Table 7) into three dimensions: usage, access and quality. Then, a two-stage procedure is adopted. All the indicators are standardized using Eq. (3). In the first stage, PCA is applied to get the weights and to combine the 13 indicators to create the dimension of availability, to combine the seven indicators to create the dimension of usage and to combine the three indicators to create the dimension of quality. However, in the second stage, the three dimension indices: availability, usage and quality are combined into an index of financial inclusion using Sarma's Euclidian distance method following Eq. (5).

The hybrid index avoids the problem of assigning arbitrary weights to the indicator variables in creating the three dimension indices. At the same time, the final index of financial inclusion satisfies the desired properties/axioms. However, arbitrariness still remains in assigning equal weights to the three dimension indices in the second stage. Also, the dimension indices may suffer from problem of not obeying the desired properties.

It is well established that the concept of financial inclusion is inherently multidimensional. So, using an index as a measure of financial inclusion is possibly the more appropriate approach. However, as the discussion in this section reveals, the appropriate methodology of developing such an index is still in the making, and a several controversies still exist regarding the appropriate methodology for constructing such an index. So, there is a scope for further empirical and theoretical research.

4 Summary and Conclusion

The present chapter is an attempt to trace the evolution of the concept of financial inclusion and its measurement. We find that in the literature two alternative approaches have been developed. First approach is using a single indicator or a number of indicators but separately. Second approach is combining a number of indicators in to an index of financial inclusion. Since financial inclusion is essentially a multidimensional concept using an index to capture its essence seems to be a more appropriate approach. However, as with the development of other indices, finding the appropriate weight has been a critical issue. Both parametric and non-parametric methods have been used to address the problem of finding the appropriate weights, but some controversies still remain, making the issue of index of financial inclusion a fertile area of future research.

Table 7 Indicators used by Banerjee and Donato (2020)

Usage	Access	Quality
Percentage of adult population with a single or joint account with a formal financial institution or mobile money provider	Number of bank branches per 100,000 population	Financial knowledge score. It measures the basic understanding of people about financial matters like inflation, interest rate, money illusion, risk diversification, insurance premium, etc.
Percentage of adult population with a formal financial institution or mobile money provider to make or receive digital financial payment	Number of ATMs per 100,000 population	Use of savings for emergency funding:
Deposit accounts per 1000 adults	Number of POS terminals per 100,000 population	Distance to frontier: "it is a credit barrier measure, which measures the distance of each economy to the frontier about the strength of their credit reporting system and absolute level of regulatory performance."
E-money account per 1000 adults	Number of mobile agent outlets per 100,000 population	
Retail cashless transactions per 1000 adults	Number of debit cards per thousand adults	
Outstanding loans per 1000 adults	Percentage of adults with an access to mobile phone or any other device with Internet access at home	
Percentage of adults who receive wages or government transfers into account with any formal financial institutions or mobile money provider	Agents of payment service providers per 100,000 adults	
Percentage of adults using a debit card to make a payment from an account		
Payment using a mobile phone		
Payments using Internet		
Percentage of adults with at least one loan outstanding formal financial institution		
Percentage of adults, who saved with a formal financial institution in the last one year		
Number of mobile money transactions per 100,000 adults		

Source Banerjee and Donato (2020)

In majority of the studies, access to and usage of banking or formal institutional finance has been identified as one of the most important dimension of financial inclusion and rightly so. Having a deposit account and ability to access bank credit when required is definitely the first step towards a more financially inclusive economic system. Especially in emerging economies, the access and use of banking services are primary measures of financial inclusion. Another important factor influencing the choice of banking services as an indicator of financial inclusion is the availability of comparable cross-country data as ascertained by many authors. However, as many a researcher has acknowledged, financial inclusion should ideally include many other dimensions like different types of insurance, access to alternative investment products, etc. These other products are not in wide use especially in the emerging market economies. So, from the studies considered in the chapter, we can summarize financial inclusion for an individual as: access and regular usage of bank accounts, access and usage of different insurance products, access to and availability of choice across different formal saving mediums at affordable cost, access to convenient payment services both national and international and finally access to an affordable pension fund for retirement and social security.

So to advance the research on financial inclusion, we need more information regarding the use of different types of financial products or the reasons behind non-use. This information should be collected not only about access and usage of banking services, but also about other aspects of financial inclusion for instance insurance products, pension funds. The data need to be generated at two levels, and the relevant financial institutions can generate the supply-side availability data. But the demand-side usage data can only be generated through large-scale household level surveys like the National Sample Survey in India or the surveys conducted to generate the Global Findex database.

The issue of financial inclusion holds a great potential for future research. The present survey throws light on one particular aspect of the diverse issues involved, namely the issue of measuring a complicated concept like financial inclusion. The chapter is an attempt to cover the different aspects of the problem involved in quantifying financial inclusion, and it is hoped that the survey will be of some help to the future researchers.

Appendix 1: G 20 Financial Inclusion Indicators[4]

- Access to a mobile phone (% age 60+)
- Access to a mobile phone (% ages 15–34)
- Access to a mobile phone (% ages 35–59)
- Access to a mobile phone, female (% age 15+)
- Access to a mobile phone, income, poorest 40% (% age 15+)
- Access to a mobile phone, income, richest 60% (% age 15+)
- Access to a mobile phone, male (% age 15+)
- Access to Internet (% age 15+)
- Access to Internet (% age 60+).
- Access to Internet (% ages 15–34)
- Access to Internet (% ages 35–59)
- Access to Internet, female (% age 15+)
- Access to Internet, income, poorest 40% (% age 15+)

[4] Source: http://datatopics.worldbank.org/g20fidata/.

- Access to Internet, income, richest 60% (% age 15+)
- Access to Internet, male (% age 15+)
- Account (% age 15+)
- Account (% age 60+)
- Account (% ages 15–34)
- Account (% ages 35–59)
- Account, female (% age 15+)
- Account, income, poorest 40% (% age 15+)
- Account, income, richest 60% (% age 15+)
- Account, male (% age 15+)
- Active account (% age 15+)
- Active account (% age 60+)
- Active account (% ages 15–34)
- Active account (% ages 35–59)
- Active account, female (% age 15+)
- Active account, income, poorest 40% (% age 15+)
- Active account, income, richest 60% (% age 15+)
- Active account, male (% age 15+)
- Agents of payment service providers per 100,000 adults
- ATMs per 100,000 adults
- Borrowed from a financial institution in the past year (% age 15+)
- Borrowed from a financial institution in the past year (% ages 15–34)
- Borrowed from a financial institution in the past year, female (% age 15+)
- Borrowed from a financial institution in the past year, income, poorest 40% (% age 15+)
- Borrowed from a financial institution in the past year, income, richest 60% (% age 15+)
- Borrowed from a financial institution in the past year, male (% age 15+)
- Borrowed from a financial institution or used a credit card (% age 60+)
- Borrowed from a financial institution or used a credit card (% ages 35–59)
- Branches per 100,000 adults
- Debit cards per 1000 adults
- Deposit accounts per 1000 adults
- Disclosure index (0–5)
- Dispute resolution index (0–1)
- E-money accounts per 1000 adults
- Financial knowledge score (0–3)
- Getting credit: Distance to frontier (0–100)
- Has a national identity card (% age 15+)
- Has a national identity card (% age 60+)
- Has a national identity card (% ages 15–34)
- Has a national identity card (% ages 35–59)
- Has a national identity card, female (% age 15+)
- Has a national identity card, income, poorest 40% (% age 15+)
- Has a national identity card, income, richest 60% (% age 15+)

- Has a national identity card, male (% age 15+)
- Insurance policy holders per 1000 adults (life)
- Insurance policy holders per 1000 adults (non-life)
- Interoperability of ATM networks and interoperability of POS terminals (0–1)
- Made or received digital payments (% age 15+)
- Made or received digital payments in the past year (% age 60+)
- Made or received digital payments in the past year (% ages 35–59)
- Made or received digital payments, (% ages 15–34)
- Made or received digital payments, female (% age 15+)
- Made or received digital payments, income, poorest 40% (% age 15+)
- Made or received digital payments, income, richest 60% (% age 15+)
- Made or received digital payments, male (% age 15+)
- Made payment using a mobile phone or the Internet (% age 15+)
- Made payment using a mobile phone or the Internet (% age 60+)
- Made payment using a mobile phone or the Internet (% ages 15–34)
- Made payment using a mobile phone or the Internet (% ages 35–59)
- Made payment using a mobile phone or the Internet, female (% age 15+)
- Made payment using a mobile phone or the Internet, income, poorest 40% (% age 15+)
- Made payment using a mobile phone or the Internet, income, richest 60% (% age 15+)
- Made payment using a mobile phone or the Internet, male (% age 15+)
- Main source of emergency funds: savings (% age 15+)
- Main source of emergency funds: savings (% age 60+)
- Main source of emergency funds: savings (% ages 35–59)
- Main source of emergency funds: savings, (% ages 15–34)
- Main source of emergency funds: savings, female (% age 15+)
- Main source of emergency funds: savings, income, poorest 40% (% age 15+)
- Main source of emergency funds: savings, income, richest 60% (% age 15+)
- Main source of emergency funds: savings, male (% age 15+)
- Mobile agent outlets per 100,000 adults
- Mobile money transactions per 100,000 adults
- Outstanding loans per 1000 adults
- POS terminals per 100,000 adults
- Received wages or government transfers into an account (% age 15+)
- Received wages or government transfers into an account (% age 60+)
- Received wages or government transfers into an account (% ages 35–59)
- Received wages or government transfers into an account (% ages 15–34)
- Received wages or government transfers into an account, female (% age 15+)
- Received wages or government transfers into an account, income, poorest 40% (% age 15+)
- Received wages or government transfers into an account, income, richest 60% (% age 15+)
- Received wages or government transfers into an account, male (% age 15+)
- Retail cashless transactions per 1000 adults

- Saved at a financial institution (% age 15+)
- Saved at a financial institution (% age 60+)
- Saved at a financial institution (% ages 15–34)
- Saved at a financial institution (% ages 35–59)
- Saved at a financial institution, female (% age 15+)
- Saved at a financial institution, income, poorest 40% (% age 15+)
- Saved at a financial institution, income, richest 60% (% age 15+)
- Saved at a financial institution, male (% age 15+)
- Saved for old age (% age 15+)
- Saved for old age (% age 60+)
- Saved for old age (% ages 15–34)
- Saved for old age (% ages 35–59)
- Saved for old age, female (% age 15+)
- Saved for old age, income, poorest 40% (% age 15+)
- Saved for old age, income, richest 60% (% age 15+)
- Saved for old age, male (% age 15+)
- SME deposit accounts (as a % of non-financial corporation borrowers)
- SME loan accounts (as a % of non-financial corporation borrowers)
- SMEs with a proportion of loans requiring collateral
- SMEs with an account at a formal financial institution
- SMEs with an outstanding loan or line of credit
- SMEs with at least one female owner with a proportion of loans requiring collateral
- SMEs with at least one female owner with an account at a formal financial institution
- SMEs with at least one female owner with an outstanding loan or line of credit
- Used a debit or credit card to make a purchase in the past year (% age 15+)
- Used a mobile phone or the Internet to check account balance in the past year (% age 15+)
- Used a mobile phone or the Internet to check account balance in the past year (% age 60+)
- Used a mobile phone or the Internet to check account balance in the past year (% ages 15–34)
- Used a mobile phone or the Internet to check account balance in the past year (% ages 35–59)
- Used a mobile phone or the Internet to check account balance in the past year, female (% age 15+)
- Used a mobile phone or the Internet to check account balance in the past year, income, poorest 40% (% age 15+)
- Used a mobile phone or the Internet to check account balance in the past year, income, richest 60% (% age 15+)
- Used a mobile phone or the Internet to check account balance in the past year, male (% age 15+)

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Financial Inclusion: Measurement and Comparative Analysis of Countries from Europe and Asia

Shantanu Ghosh and Tarak Nath Sahu

1 Introduction

Expanding the contours of finance is believed to be an important factor that fuels the development of an economy (Demirguc-Kunt, 2006). However, empirical evidence shows a mixed (i.e., positive or negative or no relation) and inconclusive relationship between financial inclusion and economic development (Bist, 2018). Literary documentations also put evidence of a bi-directional causality between financial inclusion and economic growth. Yet a consensus is not reached about the definition of what indicators portray about the extent of development in regard to the expanse of the formal financial system. Easy access to affordable financial services helps to increase formal savings and capital formation, thereby leading to growth (Abu-Bader and Abu-Qarn, 2008; Pal, 2011; Bittencourt, 2012). Simultaneously, enhanced clientele base stabilizes the service provider and strengthens the inherent capacity of the economy to absorb unprecedented shocks (Levine, 1997; Yang & Yi, 2008). Experience of Bank Rakyat Indonesia (a government owned development bank) in this connection shows that with extensive client coverage especially in the rural areas helped the bank to manage profit even at the crucial time of financial crisis around the world. Considering the unattended part as an opportunity to explore further, service providers become more efficient by curtailing the costs and extending a variety of services at an affordable or simply cheaper price to its clients.

Including the excluded part within the ambit of the formal financial system or alternatively financial inclusion as a concept got recognition in the early 1990s while addressing the issue of limited access to bank branches in the wake of liberalization of financial sector (Leyshon & Thrift, 1995). Initially, the focus had been around controlling for financial exclusion which often tends to be exploitative through predatory lending practices. In India, the idea was germinated under the pronouncements of

S. Ghosh · T. N. Sahu (✉)
Department of Commerce, Vidyasagar University, West Bengal, Midnapore, India
e-mail: taraknathsahu1982@gmail.com

P. Mukherjee (ed.), *Revisiting the Indian Financial Sector*, India Studies in Business and Economics, https://doi.org/10.1007/978-981-16-7668-0_3

the former RBI governor Y. V. Reddy in 2005 highlighting on reducing the informal sources of finance (Reddy, 2015). Further, considering the achievement in sustainable long-run economic growth on the global agenda, financial inclusion turns out to be an effective tool. Central banks across both the emerging and developed nations have come forward with different initiatives to address the issue of exclusion (mainly involuntary exclusion). The *Community Reinvestment Act* (1977) as introduced by the United States of America and further ensuring wider outreach of basic banking services in 1996 through a voluntary code as initiated by the *German Bankers' Association* were among the prominent measures. Additionally, the initiatives by way of introducing the *Law on Exclusion* (1998) by the French Government to expand the outreach of banking services and further making provisions to extend a low-cost bank account (popularly known as *Mzansi*) by the *South African Banking Association* (South Africa) deserves mention (Maity, 2018). Likewise, a *Financial Inclusion Task Force* was formed in 2005 to track the progress of financial inclusion across the United Kingdom.

However, the conceptual framework of financial inclusion in India evolved under the recommendations insisted upon in reports by the *Khan Commission* (2006), the *Rangarajan Committee* (2008) and the *Mor Committee* (2013) (Ghosh & Sahu, 2020a). Different global bodies like the International Finance Corporation (IFC), G-20, IMF, the Alliance for Financial Inclusion (AFI) and the Consultative Group to Assist the Poor (CGAP) took the responsibility for collecting data at micro-level to set up a basis of evaluation and comparison of financial inclusion achievements across the nations. However, there was a lack of consensuses on measuring such achievements across the countries or provinces within a geographical territory to effectively draw a comparison across the nations and over time.

In this connection, the present chapter focuses on developing an index of financial inclusion across 24 countries from both the continents of *Europe* and *Asia* for 2013–16 and further making comparisons between the continents, across income-based groups and over time. It introduces a data-driven weighing scheme using factor analysis. This resolves the long debatable issue of perfect substitutability among the dimensions and subsequently applies the nonlinear aggregation for computing the financial inclusion achievements. Simple averaging of dimensions assigns equal weightage to each dimension and thereby presupposes that each of the dimension considered is a perfect substitute of the other.

The remaining part of the chapter is structured as follows: Sect. 2 discusses some previous literature on the subject matter. Section 3 introduces the data and elaborates briefly on the methodological framework considered. Section 4 shows the empirical findings, and finally, Sect. 5 presents the conclusion and policy implications of the present study.

2 Review of Literature

Provision of finance as a means to promote economic development has been among the most debatable academic discussions. While revisiting the Schumpeterian view of finance-led growth hypothesis, King and Levine (1993) report for a contemporaneous and significant positive association between development of finance and economic growth in 80 countries over 1960–89. Similar views across a different context stand valid in the empirical findings of Goldsmith (1969), McKinnon (1973) and Shaw (1973). However, contrasting with the views of literature in support of finance-led growth hypothesis, Lucas (1988) shows finance to be an *overstressed* element while attaining a particular degree of economic development. Further, Robinson (1952) finds evidence of reverse causality showing that financial development follows economic growth.

How financial inclusion influences the development of an economy is also studied in the literature (Buckland et al., 2011; Beck et al., 2007a, b). For example, extending the basic banking services especially to the vulnerable sections of society influences the existing levels of poverty as well as inequality (Sahoo et al., 2017). Evidence of negative associations between access to financial services and poverty (Burgess & Pande, 2005; Galor & Zeira, 1993) as well as with inequality (Clarke et al., 2006; Honohan, 2004; Jeanneney & Kpodar, 2011) corroborates further in the findings of a number of literature drafted in this regard.

Serving the excluded section of the society helps the formal financial system to extend the existing services as well as introduce some customized services (related to deposits, credits, insurance or payments) and thereby protect them from informal predatory service providers which often tends to be exploitative (Rangarajan Committee, 2008; Mohan, 2006; Leyshon & Thrift, 1995; Conroy, 2005; Carbo et al., 2005).

Financial exclusion mainly concerns for the people those are deprived from the access to mainstream financial services (Kempson & Whyley, 1999). In particular, it suspects the ability to access necessary financial services in its very basic form (Sinclair, 2001). In this connection, measuring how inclusive (or conversely exclusive) an economy is in terms of extending the provisions of finance is of a vital issue of inspection.

While incorporating the suggestions as extended by Nathan et al. (2008) and concept as introduced by Zeleny (1974), the pioneering work of Sarma (2008) shows that for both the samples comprising 55 countries (considering all the three dimensions of banking penetration, availability and its usage) and 100 countries (considering the dimensions of availability and usage), the *OECD* members take the lead in financial inclusion achievements. The study initially normalizes the variables using the maximum and minimum values and subsequently consolidates them applying the inverse of the Euclidean distance technique to construct the index of financial inclusion. Additionally, considering financial accessibility as measurement criteria in a cross-country setup with 98 developed and developing nations, Arora (2010) finds Belgium to be placed at the top. Further, after incorporating the measure of financial access while building up of a new social development index, the study finds a significant divergence in the ranking of nations as compared to the available *HDI* rankings. The mechanism similar to Sarma (2008) continues to apply in a number of studies considering different context of which Laha and Kuri (2011), Chattopadhyay (2011) and Rahman (2012) deserve mention. Further, while assigning an exogenous weight to variables and considering the average of the Euclidean distance and the inverse of the Euclidean distance, Sarma (2012) draws conclusions that are consistent with its previous version. As part of findings from the study, it is observed that not surprisingly the Overseas Financial Centers (OFCs) like Cyprus, Singapore and Malta take a prominent position in financial inclusion ranking. However, India as a country places itself in the border line of *lower-middle IFI group* throughout the study period of 2004–10. Considering the above technique with a different variable structure across the Indian states, Gupta et al. (2014) find a positive association between financial inclusion achievement, GDP per capita and HDI. Further, a comparative view across the regions shows that the northern part takes the lead whereas the northeastern part remain at the bottom in terms of financial inclusion achievements.

Replacing the possible biasness due to the extreme values (i.e., the maximum and minimum values) in the *max–min* technique of normalization, Kumar and Mishra (2011) construct separate indexes for the demand and supply of basic financial services applying the distance from average technique. Results reveal an existence of wide disparity across the states considering the supply side indicators, which increases further especially for the rural–urban classifications. On the other hand, a review of the demand-side indicators of financial inclusion shows that 33% of the population have savings bank accounts, less than 20% hold credit accounts, and about 12.5% of the population have insurance policy; this consolidates to an average indexed achievement of 0.208. Further, uncovering the achievements in the degree of financial inclusion achieved for 2008–09, Gupte et al. (2012) consider applying the arithmetic mean for combining the set of variables considered in the study and subsequently the geometric mean to consolidate the dimensions into a final index value. Result for India shows an expansion of formal financial system but not at an expected rate. Among the studies addressing the long debatable issue of perfect substitutability across a set of financial inclusion indicators (e.g., number of bank branches per 100,000 adults, number of deposit accounts per 1000 people, etc.), Chakravarty and Pal (2013) introduce the concept of disproportionate marginal rate of substitution by incorporating an exponent to the basic max–min approach. The study argues in favor of setting up the value of the exponent lying within a range of 0 to less than 1 (rather considering it exactly equal to 1) in order to avoid the perfect substitutability condition between variables of interest. Findings of the study report a significant change in financial inclusion achievement from the *pre-social banking era* (1972–1976) to *social banking era* (1977–1990). However, the significance of such change falls rapidly from *social banking era* (1977–1990) to *post-social banking era* (1991–2009), which basically gives indication of an *enhanced inequality* while extending the provisions of finance to the prospective clients.

Regarding the effect of extreme values of variables and adjusting for the issue of perfect substitutability between them, Amidžić et al. (2014) consider applying the distance to a reference point along with the weighted geometric mean, respectively, to measure the extent of financial inclusion. Further, the study considers applying factor analysis as a technique to arrive at a data-driven weight to consolidate the achievements into a single metric. Results of the study show that countries belonging to the higher and upper-middle income group stand at the top of the financial inclusiveness, with a negligible difference across achievements, whereas countries from the lower and lower-middle group fall at the bottom of the list. Using similar methodology across the Indian states for 1984–2016, Saravanabhavan (2018) finds a slow but steady growth in the financial inclusion achievements. However, the study considers application of the max–min technique of normalization instead of using the distance to a reference point to account for the variability within the dataset. A covariation between the achievement in financial inclusion and the status of income of a particular economy has been long observed (Demirguc-Kunt and Klapper, 2013; Amidžić et al., 2014), but whether the achievement in financial inclusion of a nation significantly relies on its income status is an assertion yet to be tested. To be specific, there has been a hardly any evidence in the literature on whether countries with different income status significantly differ across their financial inclusion achievements.

With this backdrop, the present chapter tries to extend a comprehensive measure of financial inclusion across 24 countries from the continent of *Europe* and *Asia* for 2013–16. Further, it compares whether the *continents*, as well as the *income groups*, considered significantly differ from each other in terms of their financial inclusion achievements. Additionally, the study explores whether the changes in the achievement levels in financial inclusion significantly vary over the period of study.

3 Data and Methodology

3.1 Selection of Variables

The present study considers a set of 20 variables classified under the four dimensions that theoretically conceptualizes the periphery of financial inclusion. Selection of variables from among a large set of available indicators portraying the degree of inclusion achieved relies on the previous literature as well as empirical evidence based on application of the technique of factor analysis. However, due to a lack in continuity of the available datasets, the study restricts itself to be pursued only with 20 variables over 2013–16 across 12 countries each from both the continents of Asia and Europe. Extending the sample period or increasing the coverage of countries would have entailed the study done without some key variables, and we have refrained from doing the same for robustness of analysis. The upcoming section deals with the elaborations outlining a brief description of the dimensions used followed by Table 1 demarcating the classified list of variables that we propose to use for formulating the index of financial inclusion in this study. The four dimensions are as follows:

Table 1 List of variables classified under dimensions

Stability and viability		Efficiency	Depth	Service Outreach
External	Internal			
Strength of legal rights index **(LRI)**	Bank *Z*-score **(BZ)**	Bank overhead costs to total assets (%) **(OCTA)**	Private credit by deposit money banks to GDP (%) **(PRIVY)**	Depositors with commercial banks (per 1000 adults) **(DEPO)**
Depth of credit information index **(CII)**	Bank regulatory capital to risk-weighted assets (%) **(CRWA)**	Bank net interest margin (%) **(NIM)**	Deposit money banks assets to GDP (%) **(DMBAG)**	Bank deposits to GDP (%) **(BDG)**
	Bank return on assets (%, before tax) **(ROA)**	Bank non-performing loans to gross loans (%) **(NPLG)**	Liquid liabilities to GDP (%) **(LLG)**	Branches of commercial banks per 1000 km^2 **(BRAN_A)**
	Bank credit to bank deposits (%) **(CDR)**	Liquid assets to deposits and short term funding (%) **(CR)**	Bank capital to total assets (%) **(CTA)**	ATMs per 100,000 adults **(ATM_P)**
		Outstanding loans with commercial banks (% of GDP) **(LOAN)**		Automated teller machines (ATMs) per 1000 km^2 **(ATM_A)**

Source World Development Indicators and Financial Access Survey

a. Stability and Viability: This dimension tries to show how *stable* and *viable* the financial system within an economy is.
b. Efficiency: It defines how *efficiently* the financial system is operating within an economy.
c. Depth: This dimension depicts the *capacity* which the financial system has put in place.
d. Service outreach: It outlines the *degree of penetration* that the financial system has reached while delivering its services to the current as well as prospective clients.

3.2 Selection of Countries

The study considers the *World Bank* (June 2018) database where nations are classified under different categories of income, while searching for the significance of difference between the high- and low-income group of countries in terms of their

Table 2 Classification of countries as per GNI per capita on PPP terms

	Developed		Developing			Under-developed
	Europe	North America	Asia	South America	Oceania	Africa
High	37	16	14	6	7	1
Middle	13	14	29	9	11	27

Source World Bank (June 2018) database

financial inclusion achievements. Such selection procedure has been followed to trace primarily the effect of income status (measured in terms of Gross National Income (GNI) per capita on Purchasing Power Parity (PPP) terms) on the achievements in financial inclusion. Further, selection among the continents is based on the similarity of income distribution across the nations.

Table 2 outlines the number of countries across different income groups as well as continents. While performing a cross-continental comparison, the study considers 12 countries from each of the continent of Asia and Europe as part of our sample for the study.

3.3 Data Sources and Sample Period

With a view to retrieve important information on certain characteristics (e.g., *depth*, *access*, *efficiency* and *stability*) of a financial system, the *Global Financial Development Database* (GFDD) has been accessed containing for almost 109 indicators from 1960 onwards. In addition, containing data of more than 50 years for 220 economies (including regions), the *World Development Indicators* (WDI) as maintained by the World Bank Group have also been considered for accessing internationally comparable statistics. Further, the Financial Access Survey (FAS) as extended by the International Monetary Fund (IMF) has also been taken into account for obtaining data on demand-side perspectives of financial inclusion.

Comparing financial inclusion achievements over time requires a relatively longer period of study to maintain statistical integrity of the results. However, the study restricts itself to a maximum of *four* years (i.e., from 2013 to 16) of analysis due to the inaccessibility of data on selected variables for the countries considered.

3.4 Research Methodology

The present study considers a sequential approach while measuring the degree of financial inclusion achieved across the 24 nations both from the continent of Europe and Asia. Initially, it applies the max–min method of normalization to make the variables of interest invariant of a scale. Similar transformations draw reference from the widely renowned Human Development Index (HDI) that aims to track the development of a nation. A similar mechanism is observed to be followed by a number of studies attempting to measure the extent of financial inclusion in different context of which Sarma (2008), Gupta et al., (2012, 2014), Chakravarty and Pal (2013) and Kaleeswaran and Meera (2017) deserve mention.

A comparative analysis across the alternatives to the max–min approach suggests that the proposed technique (i.e., the max–min technique) in contrast to the distance from the average method allows for more independence to assume variation in the dataset and help to assign customized weights to variables based on data. Additionally, while encountering the perils of perfect substitutability among the indicators of financial inclusion, Chakravarty and Pal (2013) introduce the concept of disproportionate marginal rate of substitution[1] among the variables of interest by incorporating an inclusion sensitivity parameter (r) in the basic equation of max–min as an exponent with values ranging from 0 to less than 1 (i.e., $0 \leq r < 1$). However, assigning a constant value of 'r' for all variables considered in the study assumes the data to become convex, which may not fairly serve the objective of the concerned study. Further, comparing the technique of max–min with the distance to a reference point as applied in the study by Amidžić et al. (2014) ends up finding a normal difference.

Depending upon the theoretical relationship between a particular variable and the final index value of financial inclusion, we apply two different variants of the max–min technique. The first equation (Eq. 1) is applied for the variables with a *positive* impact on the final achievement values, whereas the second equation (Eq. 2) is followed for variables with a *negative* impact.

$$d_j = w_i \frac{A_i - m_i}{M_i - m_i} \tag{1}$$

$$d_j = w_i \frac{M_i - A_i}{M_i - m_i} \tag{2}$$

where d_j represents a particular dimension of financial inclusion, where 'j' is a discrete positive number ranges from 1 to n, such that $1 \leq j \leq n$ and n has a finite value; w_i represents the weights attached to each of the ith variable, such that $0 \leq w_i \leq 1$; A_i shows the actual value of the variable considered under the jth dimension; m_i shows the lower limit of the values of a variable considered under the jth dimension, and M_i shows the upper limit of the values of a variable considered under the jth dimension.

Associating an *exogenous* weight to variables adds up a certain amount of subjectivity in determining the dimensional index whereas with the underlying assumption of equal contribution by each of the theoretically relevant variable to its relevant

[1] Chakravarty and Pal (2013) using certain axiomatic criterion show that adjustments in the exponent value of the basic max–min approach can take care of the substitutional effects between the indicators of financial inclusion. To elaborate, we use the concept of 'disproportional marginal rate of substitution', which speaks about the unequal weights assigned to indicators of financial inclusion.

dimension ends up with raising the issue of perfect substitutability between them. As a result, the present study intends to employ the exploratory factor analysis while estimating values of the unknown parameter (i.e., w_i) for both the above equations. Application of this method leads to a data-driven estimation of weights besides meeting the qualification of parametric weight assignments. As compared to the other alternatives (i.e., cluster analysis and multidimensional scaling), the method considers the reflexes of the concerned variables in either direction (Thompson, 1992) that further verifies whether the theoretical classification of variables under different dimensions considered is justified empirically (Amidžić et al., 2014; Saravanabhavan, 2018). By simply squaring the factor loadings as obtained from either of the rotational methods, i.e., rotated component matrix applying the Varimax technique or the structure matrix applying the Direct Oblimin technique or even without considering rotation of the axes (which depends on the extent of variation contained in the dataset), the study arrives at the data-driven parametric weights.

Finally, consolidation of variables into a sub-dimension or/and sub-dimensions into a dimension is followed applying the weighted max–min approach in the present study. This kind of measure extends values for a particular dimension of financial inclusion. However, to arrive at a final index value, we apply the inverse of the Euclidean distance technique. This sort of a measure considers the distance from an ideal point of achievement while consolidating dimensions and is likely to assume that each of the dimensions considered affects almost equally the final value representing an index of financial inclusion (Nathan et al., 2008).

Based on the relation that a variable is supposed to share with the final index value of financial inclusion, we had to rely on either of the following two equations.

$$\text{For a positive relation: } \mathrm{IFI}_t = 1 - \frac{\sum_1^n \left[1 - \left\{\sum_1^n wi\left(\frac{Ai-mi}{Mi-mi}\right)\right\}\right]^2}{\sqrt{n}} \tag{3}$$

$$\text{For a negative relation: } \mathrm{IFI}_t = 1 - \frac{\sum_1^n \left[1 - \left\{\sum_1^n wi\left(\frac{Mi-Ai}{Mi-mi}\right)\right\}\right]^2}{\sqrt{n}} \tag{4}$$

where IFI_t refers to the index of financial inclusion value for the tth year, and n refers to the number of variables considered within a particular dimension.

Further, while satisfying both the conditions of normality (applying Shapiro–Wilk test) and the homogeneity of variances (applying Levene's F-test) across the comparable groups, the study appeals to the parametric analyses to uncover the significance of difference between/among them.

4 Analysis and Findings

We decompose the part of analysis as well as findings into two separate parts. The first part focusses on the measurement of the index, whereas the latter describes the comparative analyses.

4.1 Estimating the Index of Financial Inclusion

We first describe the exploratory factor analysis, followed by index construction by weighted max–min approach.

Prior to applying the technique of exploratory factor analysis (EFA), we perform a number of checks. Initially, a verification of the covariance matrix is performed applying the multivariate tests for the sample considered. Such an attempt helps to fix whether the matrix formed is diagonal or not. Further, incorporating a spherical restriction to test whether the covariance matrix obtained significantly differs from the identity matrix we consider the application of Bartlett's spherical test (Amidžić et al., 2014). Results show that the dataset considered duly satisfies the preconditions of applying the factor analysis. We then apply a two-stage principal component analysis *(*PCA) to empirically fix the relevance of each variable, sub-dimensions and dimensions considered in the study. Factor loadings obtained at the first and second stage of PCA has been squared to calculate the statistical weights of the variables and subsequently the sub-dimension/dimensions (as the case may be) are considered in the study. Table 3 provides the values of squared factor loadings duly obtained from the first stage of PCA.

With the condition of reporting factors having an *eigen*value of greater than 1, we observe four factors (R_1, $R_{2,}$ R_3 and R_4) or sub-dimensions/dimensions on which the whole set of variables load consistently throughout the study period. Surprisingly, it has been observed that variables theoretically assigned under the sub-dimension of '*Internal*' and the dimension of '*Efficiency*' consistently load on the factors R_1 & R_2 and R_3 & R_4, respectively, with an equal weight of 0.5 throughout the whole period of study. Further, results of the second stage of PCA show that the sub-dimensions named '*Internal*' and '*External*' also load on the same dimension (i.e., *stability and viability*) with an equal weight of 0.5 throughout the whole period of study.

Additionally, variables qualifying with the highest factor loading within a sub-dimension or a dimension certainly explains the majority of the variation of that particular sub-dimension or dimension they belong to. Therefore, considering the highest weight (or squared factor loading) among the average weights across 2013–16 within a dimension leads us to those specific variables that need to be specially taken care of. Considering that criteria, we observe 'Bank's *z*-score', 'Liquid assets to deposits and short term funding (percent)', 'Deposit money banks assets to GDP (percent)' and 'Automated Teller Machines (ATMs) per 1000 km^2' qualify among

Table 3 Primary weights derived from principle component analysis (first stage)

	2016	2015	2014	2013
LRI	0.50	0.50	0.50	0.50
CII	0.50	0.50	0.50	0.50
BZ	0.524	0.585	0.564	0.547
CRWA	0.503	0.546	0.528	0.508
ROA	0.496	0.453	0.471	0.491
CDR	0.475	0.414	0.435	0.452
OCTA	0.318	0.308	0.338	0.343
NIM	0.389	0.418	0.366	0.365
NPLG	0.497	0.349	0.400	0.426
CR	0.502	0.650	0.599	0.573
LOAN	0.292	0.272	0.295	0.291
PRIVY	0.275	0.270	0.266	0.262
DMBAG	0.297	0.291	0.285	0.284
LLG	0.275	0.269	0.262	0.258
CTA	0.152	0.168	0.184	0.194
DEPO	0.184	0.188	0.192	0.195
BDG	0.234	0.230	0.229	0.228
BRAN_A	0.192	0.202	0.200	0.189
ATM_P	0.130	0.130	0.134	0.140
ATM_A	0.257	0.247	0.243	0.246

Source Authors Calculation

the variables that require special attention to ensure better development in the drive of financial inclusion.[2]

Based on the theoretical relationship between the variables and the final index of financial inclusion value, we either supposed to apply Eq. 1 (for those variables having *positive* relation) or Eq. 2 (for those variables having *negative* relation) while standardizing the available set of variables and consolidating them into relevant sub-dimensions or dimensions. Additionally, while constructing the final index value of financial inclusion, we are supposed to apply either Eqs. 3 or 4 for consolidation of the dimensions considered in the study. The following section illustrates the results by way of tabulating the dimensional achievements (second, third, fourth and fifth columns) as well as year wise index of financial inclusion scores for 2013–16 in Tables 4, 5, 6 and 7. Further, we present descriptive statistics of 20 variables separately for the continents and the income groups in the appendix [Appendix Table 14].

[2] It is based on the study period considered. We draw such inferences on the basis of average weights throughout the study period. Variables identified appear to be at the top in their respective groups compared to their group averages over time.

Table 4 Index of financial inclusion for 2016

Countries/indicators	Stability and viability	Efficiency	Depth	Service outreach	IFI
Latvia	0.473	0.696	0.295	0.150	0.603
Italy	0.850	0.892	0.642	0.561	0.911
Estonia	0.593	0.697	0.475	0.236	0.721
Croatia	0.701	0.907	0.514	0.369	0.817
Czech Republic	0.247	0.735	0.366	0.333	0.629
Greece	0.891	0.440	0.722	0.369	0.800
Netherlands	0.927	0.685	0.749	0.591	0.916
Spain	0.612	0.913	0.768	0.514	0.888
Switzerland	0.590	0.495	0.917	0.765	0.879
Bosnia and Herzegovina	0.458	0.886	0.377	0.208	0.669
Macedonia, FYR	0.414	0.746	0.278	0.277	0.637
Georgia	0.512	0.929	0.278	0.195	0.647
Saudi Arabia	0.798	0.935	0.455	0.122	0.721
Israel	0.497	0.846	0.452	0.619	0.819
Japan	0.529	0.806	0.847	0.982	0.929
Malaysia	0.401	0.897	0.828	0.316	0.783
Maldives	0.996	0.873	0.182	0.570	0.782
Turkey	0.980	0.847	0.373	0.256	0.757
Armenia	0.673	0.819	0.232	0.217	0.664
Pakistan	0.512	0.994	0.079	0.054	0.504
Indonesia	0.614	0.912	0.129	0.205	0.613
Philippines	0.151	0.973	0.315	0.245	0.560
India	0.517	0.962	0.375	0.345	0.736
Bhutan	0.522	0.491	0.328	0.150	0.585

Source Authors Calculation

Considering the dimension of stability and viability, it is observed that in countries like Maldives, Turkey and Netherlands, a favorable environment promoted financial inclusion in a consistent manner over the study period. Among the neighboring countries of India, findings show that both Pakistan and Bhutan perform better except in 2016 where India surpasses Pakistan. Additionally, reviewing the dimension of efficiency shows that Japan and Pakistan are among the most efficient, whereas Bhutan and Greece are the least efficient nations throughout the study period. Further, considering the dimension of depth, we observe Switzerland and Japan to be consistently appearing at the top throughout the study period, whereas we find Pakistan to be consistently placed at the bottom. Similarly, we observe consistency in rankings across the dimension of financial service outreach where Japan and Switzerland continue to take the lead leaving Pakistan at the bottom.

Table 5 Index of financial inclusion for 2015

Countries/indicators	Stability and viability	Efficiency	Depth	Service outreach	IFI
Latvia	0.488	0.706	0.335	0.166	0.628
Italy	0.967	0.906	0.658	0.594	0.927
Estonia	0.319	0.856	0.488	0.241	0.670
Croatia	0.749	0.990	0.563	0.386	0.842
Czech Republic	0.554	0.915	0.384	0.352	0.749
Greece	0.910	0.473	0.768	0.416	0.830
Netherlands	0.966	0.739	0.754	0.636	0.934
Spain	0.635	0.996	0.793	0.557	0.907
Switzerland	0.664	0.494	0.903	0.800	0.895
Bosnia and Herzegovina	0.562	0.942	0.414	0.231	0.717
Macedonia, FYR	0.643	0.829	0.322	0.301	0.724
Georgia	0.441	0.905	0.270	0.195	0.625
Saudi Arabia	0.999	0.927	0.452	0.128	0.733
Israel	0.362	0.972	0.464	0.636	0.793
Japan	0.625	0.954	0.836	0.996	0.957
Malaysia	0.563	0.983	0.841	0.330	0.833
Maldives	0.884	0.700	0.201	0.562	0.766
Turkey	0.963	0.915	0.386	0.264	0.768
Armenia	0.798	0.774	0.249	0.225	0.686
Pakistan	0.949	0.874	0.086	0.068	0.569
Indonesia	0.721	0.944	0.161	0.217	0.650
Philippines	0.386	0.967	0.330	0.249	0.652
India	0.526	0.969	0.395	0.354	0.748
Bhutan	0.696	0.480	0.360	0.147	0.625

Source Authors Calculation

Verification of the status of India across the sample countries shows a moderate achievement in terms of the dimension of stability and viability. Further, consideration of achievements in the dimension of efficiency reveals a relatively better position for India. However, position in terms of depth and service outreach is not quite promising as achievements fall well below the average.

Simple average of the financial inclusion scores over the study period (sixth column of Tables 8 and 9) shows that *Japan* is taking the lead with a value of 0.916 and is followed by a number of countries from the continent of Europe. Further, quite surprisingly, it is observed that even placing itself at the bottom *Philippines* posits a value above the average (i.e., 0.553). Among the other *Asian* nations, *India* with a value of 0.732 places itself twelfth in terms of the overall ranking and becomes the third country from the *South Asian* region to surpass the ceiling of 0.70.

Table 6 Index of financial inclusion for 2014

Countries/indicators	Stability and viability	Efficiency	Depth	Service outreach	IFI
Latvia	0.554	0.572	0.351	0.163	0.624
Italy	0.943	0.885	0.646	0.404	0.876
Estonia	0.511	0.779	0.487	0.249	0.722
Croatia	0.713	0.969	0.596	0.314	0.821
Czech Republic	0.193	0.972	0.393	0.340	0.636
Greece	0.714	0.591	0.758	0.435	0.843
Netherlands	0.938	0.614	0.736	0.464	0.872
Spain	0.531	0.972	0.797	0.498	0.871
Switzerland	0.469	0.488	0.875	0.662	0.831
Bosnia and Herzegovina	0.314	0.881	0.431	0.262	0.662
Macedonia, FYR	0.518	0.772	0.322	0.317	0.697
Georgia	0.497	0.955	0.266	0.228	0.653
Saudi Arabia	0.798	0.970	0.349	0.179	0.715
Israel	0.355	0.942	0.458	0.434	0.742
Japan	0.330	0.989	0.819	0.784	0.868
Malaysia	0.206	0.895	0.814	0.368	0.731
Maldives	0.980	0.751	0.222	0.400	0.743
Turkey	0.950	0.948	0.396	0.316	0.790
Armenia	0.814	0.832	0.243	0.352	0.736
Pakistan	0.519	0.984	0.110	0.255	0.605
Indonesia	0.748	0.934	0.170	0.387	0.717
Philippines	0.012	0.771	0.307	0.426	0.541
India	0.330	0.914	0.392	0.525	0.737
Bhutan	0.716	0.410	0.372	0.433	0.714

Source Authors Calculation

4.2 *Financial Inclusion of Selected Nations: A Comparative View*

Initially conforming to normality (applying the Shapiro–Wilk test) and homogeneity of variances (applying Levene's F-test) across the comparable constructs established, the study appears eligible for the parametric analyses.

While satisfying the prerequisites of applying the parametric tests, the present study intends to consider the dependent samples t-test (where values of financial inclusion are assumed to depend on its previous years' achievement) to explore the fluctuations in the index of financial inclusion values over time. The study performs

Table 7 Index of financial inclusion for 2013

Countries/indicators	Stability and viability	Efficiency	Depth	Service outreach	IFI
Latvia	0.559	0.578	0.411	0.201	0.660
Italy	0.840	0.964	0.645	0.585	0.919
Estonia	0.565	0.858	0.517	0.274	0.757
Croatia	0.717	0.947	0.627	0.403	0.855
Czech Republic	0.420	0.836	0.418	0.390	0.732
Greece	0.893	0.579	0.760	0.476	0.870
Netherlands	0.985	0.525	0.714	0.668	0.895
Spain	0.728	0.952	0.811	0.597	0.931
Switzerland	0.545	0.486	0.864	0.805	0.868
Bosnia and Herzegovina	0.553	0.876	0.448	0.239	0.725
Macedonia, FYR	0.535	0.807	0.350	0.304	0.710
Georgia	0.495	0.888	0.246	0.193	0.628
Saudi Arabia	0.862	0.987	0.334	0.110	0.686
Israel	0.338	0.946	0.463	0.615	0.781
Japan	0.435	0.995	0.819	0.998	0.912
Malaysia	0.318	0.809	0.819	0.353	0.762
Maldives	0.969	0.878	0.258	0.503	0.796
Turkey	0.956	0.941	0.381	0.268	0.769
Armenia	0.813	0.647	0.258	0.206	0.665
Pakistan	0.621	0.997	0.132	0.067	0.558
Indonesia	0.704	0.875	0.200	0.205	0.656
Philippines	0.041	0.632	0.299	0.220	0.461
India	0.445	0.933	0.401	0.291	0.706
Bhutan	0.646	0.462	0.405	0.130	0.619

Source Authors Calculation

three distinct sets of dependent samples *t*-tests to outline significant changes in financial inclusion achievements over time considering all of our sample countries together (Table 10) and across the continent of Europe (Table 11) and Asia (Table 12).

Considering the movement of the mean IFI scores over time from Tables 8 and 9 above reveals a significant turbulence for 2015 and 2016 over the respective previous years at 5 and 1% level of significance.[3] The average IFI score across the sample in 2015 rises and subsequently in 2016 falls significantly pointing to a lack in stability considering policy initiatives among the selected countries. In addition while introspecting the size of the effect in the change of the mean IFI scores over time, it turns

[3] With z -values for both the skewness and kurtosis lying within a range of $\pm$ 1.96σ (Posten, 1984) and acceptance of the null hypothesis of the Shapiro–Wilk test (Shapiro & Wilk, 1965) in Table 10, data for all the sample countries together conform to normality.

Table 8 Index of financial inclusion scores for the study period (classification based on continents)

Countries	IFI (2013)	IFI (2014)	IFI (2015)	IFI (2016)	Average IFI
Latvia	0.660	0.624	0.628	0.603	0.629
Italy	0.919	0.876	0.927	0.911	0.908
Estonia	0.757	0.722	0.670	0.721	0.717
Croatia	0.855	0.821	0.842	0.817	0.834
Czech Republic	0.732	0.636	0.749	0.629	0.686
Greece	0.870	0.843	0.830	0.800	0.836
Netherlands	0.895	0.872	0.934	0.916	0.904
Spain	0.931	0.871	0.907	0.888	0.899
Switzerland	0.868	0.831	0.895	0.879	0.868
Bosnia and Herzegovina	0.725	0.662	0.717	0.669	0.693
Macedonia, FYR	0.710	0.697	0.724	0.637	0.692
Georgia	0.628	0.653	0.625	0.647	0.638
Average IFI (Europe)	0.796	0.759	0.787	0.760	0.776
Saudi Arabia	0.686	0.715	0.733	0.721	0.714
Israel	0.781	0.742	0.793	0.819	0.784
Japan	0.912	0.868	0.957	0.929	0.916
Malaysia	0.762	0.731	0.833	0.783	0.777
Maldives	0.796	0.743	0.766	0.782	0.772
Turkey	0.769	0.790	0.768	0.757	0.771
Armenia	0.665	0.736	0.686	0.664	0.688
Pakistan	0.558	0.605	0.569	0.504	0.559
Indonesia	0.656	0.717	0.650	0.613	0.659
Philippines	0.461	0.541	0.652	0.560	0.553
India	0.706	0.737	0.748	0.736	0.732
Bhutan	0.619	0.714	0.625	0.585	0.635
Average IFI (Asia)	0.698	0.720	0.732	0.700	0.713
Grand Average of IFI	0.747	0.740	0.760	0.732	-

Source Authors Calculation

out to be relatively small (Cumming, 2012; Hedges & Olkin, 1985), contending that even results turn out to be significant for the changes taking place in 2015 and 2016, they are not supposed to be large enough.

While inferring on the significance of difference in IFI over time for the continent of Europe in terms of the mean IFI scores, we find a significant movement of mean during the whole period of study. Review of Table 8 shows that the mean IFI values take an erratic move expressing a severe downturn for the years 2014 and 2016 except for in 2015.

Table 9 Index of financial inclusion scores for the study period (classification based on income groups)

Countries	IFI (2013)	IFI (2014)	IFI (2015)	IFI (2016)	Average IFI
Latvia	0.660	0.624	0.628	0.603	0.629
Italy	0.919	0.876	0.927	0.911	0.908
Estonia	0.757	0.722	0.670	0.721	0.717
Croatia	0.855	0.821	0.842	0.817	0.834
Czech Republic	0.732	0.636	0.749	0.629	0.686
Greece	0.870	0.843	0.830	0.800	0.836
Netherlands	0.895	0.872	0.934	0.916	0.904
Spain	0.931	0.871	0.907	0.888	0.899
Switzerland	0.868	0.831	0.895	0.879	0.868
Saudi Arabia	0.686	0.715	0.733	0.721	0.714
Israel	0.781	0.742	0.793	0.819	0.784
Japan	0.912	0.868	0.957	0.929	0.916
Average IFI (high income)	0.822	0.785	0.822	0.803	0.808
Bosnia and Herzegovina	0.725	0.662	0.717	0.669	0.693
Macedonia, FYR	0.710	0.697	0.724	0.637	0.692
Georgia	0.628	0.653	0.625	0.647	0.638
Malaysia	0.762	0.731	0.833	0.783	0.777
Maldives	0.796	0.743	0.766	0.782	0.772
Turkey	0.769	0.790	0.768	0.757	0.771
Armenia	0.665	0.736	0.686	0.664	0.688
Pakistan	0.558	0.605	0.569	0.504	0.559
Indonesia	0.656	0.717	0.650	0.613	0.659
Philippines	0.461	0.541	0.652	0.560	0.553
India	0.706	0.737	0.748	0.736	0.732
Bhutan	0.619	0.714	0.625	0.585	0.635
Average IFI (low income)	0.671	0.694	0.697	0.661	0.681
Grand average IFI	0.747	0.740	0.760	0.732	–

Source Authors Calculation

A significant downturn has been observed for the year 2015–16 so far as the change is concerned in mean IFI values for the continent of *Asia*.

We intend to apply the independent samples t-test as part of the parametric analyses to explore the significance of difference across the *continents* and the *income groups* (Table 13) in terms of financial inclusion achievements. As the groups based on income and continents do not share any kind of theoretical dependence, we avoid using the dependent samples/paired samples *t*-test.

Table 10 Result of paired samples *t*-test (for all sample countries)

	Skewness (*z*-value)	Kurtosis (*z*-value)	Shapiro–Wilk (Sig.)	Paired samples *t*-test (one-tailed)	Hedges *g*
2013–14	− 1.117	− 0.773	0.076	0.693 (0.247)*	–
2014–15	0.208	− 0.807	0.774	1.734 (0.048)*	− 0.189
2015–16	0.903	0.964	0.318	3.523 (0.001)*	0.226

* The values in parenthesis represent the *p*-values
Source Authors Calculation

Table 11 Result of paired samples *t*-test (for European countries)

	Skewness (*z*-value)	Kurtosis (*z*-value)	Shapiro–Wilk (Sig.)	Paired samples *t*-test (one-tailed)	Hedges *g*
2013–14	-0.108	1.577	0.535	4.353 (0.001)*	0.343
2014–15	0.11	− 0.009	0.986	2.154 (0.027)*	− 0.251
2015–16	0.780	1.042	0.240	2.158 (0.027)*	0.224

* The values in parenthesis represent the *p*-values
Source Authors Calculation

Table 12 Result of paired samples *t*-test (for Asian countries)

	Skewness (*z*-value)	Kurtosis (*z*-value)	Shapiro–Wilk (Sig.)	Paired samples *t*-test (one-tailed)	Hedges *g*
2013–14	0.408	− 1.177	0.231	1.484 (0.083)*	–
2014–15	− 0.196	− 0.952	0.659	0.608 (0.278)*	–
2015–16	0.468	0.209	0.968	2.875 (0.008)*	0.231

* The values in parenthesis represent the *p*-values
Source Authors Calculation

Result from Table 13 shows a non-significant ($p > 0.05$) difference between the continent of Europe and Asia in terms of their mean financial inclusion scores obtained from the countries contained therein for 2013–16. The difference observed in the mean values for both the continents from Table 8 is a result of a random chance. Apart from analysis, we can infer that countries across the continents of both Europe

Table 13 Result of independent samples *t*-test

Comparison between continents

	Skewness (*z*-value)	Kurtosis (*z*-value)	Shapiro–Wilk (Sig.)	Levene's *F*	Mean	S.D.	Independent samples *t*
Europe	– 0.03	– 1.543	0.056	1.045 (0.318)*	0.776	0.109	1.432 (0.083)*
Asia	0.159	0.198	0.655		0.714	0.103	

Comparison between income groups

	Skewness (*z*-value)	Kurtosis (*z*-value)	Shapiro–Wilk (Sig.)	Levene's *F*	Mean	S.D.	Independent samples *t*	Hedges *g*
High income	– 0.863	– 0.917	0.149	1.89 (0.183)*	0.808	0.099	3.52 (0.001)*	1.387
Low income	– 0.6	– 0.555	0.313		0.681	0.076		

* The values in parenthesis represent the *p*-values
Source Authors Calculation

and Asia seem to be more or less alike in terms of their mean financial inclusion achievements at least for the sample we have considered.[4]

Further, we find a significant difference ($p < 0.01$) in terms of mean financial inclusion achievements between the high-income and low-income group of countries for 2013–16 besides satisfying the tests of normality and homogeneity of variance as a prerequisite to perform such kind of parametric analysis. A high value of effect size of 1.387 validates the existent differences in mean financial inclusion achievements between income groups as evidenced earlier in Table 9. Therefore, the significant differences in mean financial inclusion scores between the high- and low-income group of countries affirm the impact of income on financial inclusion achievements as documented earlier in literature by Demirguc-Kunt (2006) and Ghosh and Sahu (2020b).

5 Conclusion and Policy Implications

While addressing the issue of some persevering criticisms of the extant literature that intends to measure financial inclusion in a country by way of constructing an index, the present study puts forth certain qualifications on the measurement process to formulate an index that represents the true phenomenon. The study initially computes the degree of financial inclusion achieved by 24 countries from the continents of

[4] However, before performing such kind of analysis, the data considered duly satisfy the conditions of normality with z-values for both the skewness and kurtosis lying between $\pm$ 1.96σ considering the group of countries from both the continents (Schmider et al., 2010) as well as accepting the null hypotheses of the Shapiro–Wilk test at 5% level of significance (Shapiro & Wilk, 1965). Further, non-significance of the Levene's F-statistics also indicates that application of the independent samples t-test is appropriate.

Europe and Asia for 2013–16 based on a set of 20 variables. It also draws a comparative view of financial inclusion for nations grouped under different continents, income groups and over time.

The need for an accurate weighting scheme that addresses the issue of imperfect substitutability and ensures an appropriate consolidation of variables in to sub-dimensions or dimensions and sub-dimensions in to dimensions forms the background of the present chapter. Applying the exploratory factor analysis and the inverse of Euclidean distance, an index of financial inclusion is constructed, where Japan from the continent of Asia finds a place at the top followed by Italy from the continent of Europe holding the second position throughout the study period. Within the selected sample space, India with an average IFI score of 0.732 holds the sixth and twelfth position among the nations from Asia and in terms of the overall ranking, respectively. Similar rankings have been reported by a number of studies except a few variations that took place due to the *time effect* and on the ground of *methodological* differences (Arora, 2010; Park & Mercado, 2015; Sarma, 2012). Further, an unstable movement in mean IFI values is observed while tracking the changes over the study period. The intensity of such instability amplifies especially during the period of 2014–16 for all of the classifications considered. Earlier studies by Rahman (2012) and Amidžić et al. (2014) also extend evidence in favor of such anfractuous movements over time in mean IFI scores. Interestingly, the difference in mean IFI values between the continent of Europe and Asia is not found to be significant.

However, the difference between the two classes (i.e., high- and low-income group of countries) with respect to their mean IFI achievement appears to be significant. Countries from high and upper-middle income groups tend to show better achievement level in financial inclusion scores over the study period (Amidžić et al., 2014; Park & Mercado, 2015; Jukan & Softic, 2016). Although better achievement levels considering the dimension of efficiency for countries from lower income group is theoretically unexplained (Demurgic-Kunt and Levine, 2008).

Worldwide, the issue of financial inclusion has gained prominence as a policy priority by the majority of the nations (Ghosh & Sahu, 2020a). However, the anfractuous move over time in the index of financial inclusion scores raises the issue of instability on targeting the same. Similarly, findings validate the alliance between income and development established long ago. In this regard, to ensure a more inclusive formal financial system throughout the globe, more initiatives are required.

Appendix

See Table 14.

Table 14 Descriptive statistics across the classifications

	EUROPE				ASIA				HIGH INCOME				LOW INCOME			
	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min
LRI	5.71	2.40	10	2	3.77	2.09	7	1	4.79	2.37	9	1	4.69	2.56	10	1
CII	6.69	0.65	8	5	5.92	2.20	8	0	6.71	0.62	8	6	5.90	2.20	8	0
BZ	10.59	5.57	22.83	4.38	15.73	7.57	32.83	5.25	13.43	7	29.61	4.38	12.89	7.32	32.83	4.50
CRWA	17.97	4.09	28.56	13.28	18.64	7.62	40.48	12.32	17.96	4.17	29.65	13.28	18.65	7.57	40.48	12.32
ROA	0.78	1.22	3.67	-2.75	2.04	1.55	5.60	0.34	0.65	1.04	3.60	-2.89	2.16	1.56	5.60	-0.02
CDR	114.56	20.42	159.64	73.60	90.17	34.21	167.33	46.71	109.65	27.51	159.64	46.71	95.08	32.23	167.33	48.16
OCTA	2.05	0.89	4.32	0.67	2.02	0.74	3.41	0.64	1.56	0.45	2.76	0.64	2.50	0.81	3.95	1.07
NIM	2.77	1.89	8.30	0.84	4.03	2.22	10.48	0.76	1.90	0.75	3.62	0.76	4.90	1.98	10.48	1.80
NPLG	9.68	9.65	36.65	0.72	4.98	4.42	17.57	1.08	7.91	10.09	36.65	0.72	6.75	4.72	17.57	1.60
CR	29.43	13.13	63.96	5.27	21.90	9.99	50.60	6.75	27.25	14.22	63.96	5.27	24.08	9.76	50.60	6.75
LOAN	78.55	37.70	169.13	38.64	52.79	28.69	116.12	15.96	84.29	35.47	169.13	40.02	47.05	24.32	116.12	15.96
PRIVY	83.41	40.46	172.47	36.35	53.03	29.72	120.07	14.77	89.32	37.78	172.47	38.01	47.12	24.99	120.07	14.77
DMBAG	98.26	45.01	185.80	39.10	69.99	40.60	180.15	34.70	109.87	44.84	185.80	46.70	58.38	25.57	134.25	34.70
LLG	84.99	40.77	190.31	27.06	73.33	52.89	217.70	22.99	102.85	49.97	217.70	42.38	55.46	28.50	135.12	22.99
CTA	9.74	3.43	17.40	4.78	11.59	4.42	23.71	5.47	8.58	3.05	14.80	4.78	12.75	3.79	23.71	6.92
DEPO	1860.94	853.68	3763.15	658.59	1494.48	1837.38	5669.09	289.11	2247	1800.53	7269.09	658.59	1108.42	478.50	2231.96	289.11
BDG	73.74	36.05	171.62	26.31	66.85	53.83	218.23	23.31	89.31	52.57	218.23	28.78	51.28	25.89	126.37	23.31
BRAN_A	34.32	29.24	93.93	2.71	35.17	40.25	150.00	0.83	43.53	35.39	103.60	0.83	25.96	32.48	122.89	2.26
ATM_P	75.73	26.23	130.64	44.61	55.30	40.04	133.22	6.51	88.24	30.21	133.22	47.55	42.79	21.90	79.35	6.51
ATM_A	67.15	50.47	215.78	3.23	118.83	87.25	369.54	2.81	104.20	92.63	359.54	3.23	81.77	52.55	236.96	2.81

Source Authors Calculation

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Financial Liberalization, Development and the Economy

Financial Constraints and Export Participation: A Case Study of Indian Textile Industry

Puneet Kumar Arora and Jaydeep Mukherjee

1 Introduction

It is now widely known that exports offer a significant growth opportunity to both firms and nations as a whole. From the firms' perspective, exports provide access to a larger world market, thereby enabling them to leverage the economies of scale advantage. Moreover, exporting also helps firms hedge against any risks arising out of unfavourable economic or political conditions in their domestic markets. Meanwhile, for the countries as a whole, exporting supplements their economic growth process and helps them shore up their foreign exchange reserves.

However, despite the potential benefits that exporting offers, it largely remains a rare activity with only a small number of firms engaged in international trade. Recent studies in the literature have attempted to explain the same. The "new-new" trade theory formulated by Melitz (2003) builds upon the theories of heterogeneity in firm productivity and sunk entry costs associated with foreign market entry to explain the fact that even in a particular industry, not all firms are exporters. The key argument made in this strand of literature is that firms that wish to foray into the foreign markets need to incur substantial upfront costs in acquiring knowledge about target markets, setting up new marketing and distribution channels and customising their products according to foreign demand patterns (Roberts & Tybout, 1997). These costs are mostly sunk in nature, and only those firms that are productive enough to be able to pay for the upfront entry costs can enter the foreign markets.

P. K. Arora · J. Mukherjee (✉)
Department of Economics, Indian Institute of Foreign Trade, New Delhi, India
e-mail: jaydeep@iift.edu

P. K. Arora
e-mail: puneetarora_phd17@iift.edu

P. K. Arora
University School of Management and Entrepreneurship, Delhi Technological University, New Delhi, Delhi, India

P. Mukherjee (ed.), *Revisiting the Indian Financial Sector*, India Studies in Business and Economics, https://doi.org/10.1007/978-981-16-7668-0_4

A recent strand of literature has added a financial dimension to the relationship between firm productivity and export entry decisions, by attempting to analyse the role of financial constraints in determining the firms' ability to finance the sunk entry costs. Chaney (2005, 2016) extend the Melitz (2003) model to show that liquidity constraints faced by firms play a significant role in firms' exporting decisions and only those firms which are able to generate liquidity sufficient to recoup the sunk entry costs are able to export. Manova (2013) extends the framework further by incorporating sector-level heterogeneities besides firm-level heterogeneities to show that export-oriented firms face binding liquidity constraints while financing both fixed and variable costs associated with foreign market entry.

The present chapter aims to empirically examine the impact of the financial and non-financial factors on the exporting decision of firms in the Indian textile industry. The Indian textile industry offers an interesting case study in this context, given the fact that despite being one of the major exporters of textiles in the world, the share of the Indian textile industry in the global textile exports has remained stagnant over the years. This could be possibly due to the fact that only a select number of large firms in the textile industry are exporters and the smaller firms are constrained by the lack of availability of financial capital necessary to foray into the foreign markets.

The rest of this chapter is organised as follows. Section 2 provides a brief review of the studies done in this area. Section 3 gives a snapshot of the export performance of the Indian textile industry in the past two decades. Section 4 explains the empirical methodology and data sources. Section 5 discusses the key findings of the study. The study ends with policy prescriptions in Sect. 6.

2 Financial Constraints and Export Participation: The Present State of Art

A large number of studies have attempted to empirically examine the relationship between firm-level financial parameters and export participation. The evidence of the studies, however, is mixed with some finding a positive linkage between financial health and exporting outcomes while some reporting no linkage between the two. The studies also differ in their observations on the impact of financial constraints on the extensive margin of exports (probability of entering into foreign markets) and the intensive margin of exports (volume of exports).

Amongst the first key studies in this area, Greenaway et al. (2005) use a sample of 9352 manufacturing firms in the UK to show that financial factors (mainly measures of liquidity and leverage) are significant determinants of export market entry decisions. The authors argue that while all firms face huge sunk costs while deciding to enter into the foreign markets, firms which are in a better financial position find it easier to finance these costs. Moreover, the study observes that financial factors become even stronger determinants of the probability of exporting for financially constrained firms. The authors also find past exporting status to be a significant determinant of current period exporting probability, thereby leading to the conclusion that exporting is a highly persistent phenomenon. In contrast, in another study, Greenaway et al. (2007) find no evidence of a direct link between ex-ante financial parameters and probability of exporting but conclude that better financial position is more of an outcome rather than a possible basis for foreign market entry.

Using a cross-country database comprising 5000 firms in nine developing countries, Berman and Hericourt (2010) find that while better financial health has a positive impact on the firms' extensive margin of exports, it has no impact on the intensive margin. Amongst other multi-country studies in this area, Fauceglia (2011) observes that the impact of liquidity on exporting probability is much more pronounced in countries with low levels of financial development. A study by Wang (2010) comprising 28 East European and Central Asian countries also reveals that firms with lower credit constraints tend to export more.

Muûls (2015) in her study of Belgian manufacturing firms for the period 1999–2007 finds both the extensive and intensive margin of exports (in terms of exporting products and destination countries) to be significantly impacted by credit constraints. The studies on Chinese manufacturing firms by Du and Girma (2007) and Egger and Michaela (2010) also emphasise the fact that firms with fewer financial constraints are likely to have a greater foreign market orientation.

In their study on the export participation decision of manufacturing firms in France over the period 1996–2004, Bellone et al. (2008) find that firms with better ex-ante financial position are more likely to start exporting. However, in contrast to Greenaway et al. (2007), the authors find no significant improvement in the financial health of exporters. On the other hand, Stiebale (2011) finds no evidence of the impact of financial constraints on the export participation of French manufacturing firms. Similarly, no association is observed between the financial health of firms and their exporting decisions by Ngo (2008) and Akarim (2013) in their studies on manufacturing firms in Ghana and Turkey, respectively.

Not many studies have been done to investigate the relationship between firms' financial health and export participation in the Indian context. Amongst the key studies, Ito and Terada-Hagiwara (2011) observe that exporting is a highly persistent activity for manufacturing firms in India, thereby pointing towards the fact that Indian firms face high fixed costs while entering foreign markets. The study also finds that firms in India rely more on internal sources of finance rather than external capital to fund their foreign market entry. The authors find a positive correlation between firms' financial status and their extensive margin of exports. Using multiple estimation techniques, Nagaraj (2014) also finds evidence of a strong association between financial constraints and the extensive margin of exports for manufacturing firms in India. Further, the study supports the conclusion drawn by Bellone et al. (2008) that exporting has no impact on firms' ex-post financial health. In a study of service firms in India over the period 1997–2007, Lancheros and Demirel (2012) observe that financial factors are not a significant determinant of firms' exporting activity. Meanwhile, Arora and Mukherjee (2020) show that because of the underlying linkages between financial factors and firms' export performance, the level of financial development has a significant positive impact on the exports of Indian manufactured goods.

The present study addresses a key gap in the existing literature on the interplay between financial factors and export performance. While there are studies that look at the impact of financial factors on export performance across the manufacturing sector, there are a very few firm-level studies that study this aspect for specific Indian industries. The study therefore seeks to add to the growing literature on the relationship between firms' financial status and export performance by taking the example of the Indian textile industry. The study uses a rich data set of around 1900 firms in the Indian textile industry and uses multiple estimation models to derive the relationship between financial factors and export performance. Further, the research focuses on the determinants of both intensive and the extensive margin of exports. By providing insights on how financial factors can stimulate exports, the study makes a case for government intervention in augmenting the supply of credit to industries to help them foray into international markets. The methodology and approach adopted in the study can be used to analyse the role of financial factors in the export performance of other major industries in India.

3 Export Performance of the Indian Textile Industry

The textile industry is one of the major engines of economic growth in India, given its significant share in the country's gross domestic product (GDP), employment and export earnings. During 2018–19, the share of the textile industry in the Indian GDP was around 2%, and it accounted for 7% of industry output in value terms (Textile Industry Annual Report 2018–19). The industry is highly employment-intensive and engages over 45 million people directly and around 60 million in allied sectors, thereby making it the country's second-largest employer after agriculture. The industry comprises a diverse set of firms, ranging from small and medium-scale handlooms and handicrafts units at the one end operating in the unorganised sector to capital-intensive textile mills operating in the organised sector on the other.

Over the past few years, the textile industry has emerged as one of the major export-oriented sectors in India. During 2018–19, the industry contributed to around 15% of the country's total export earnings. India's textile exports predominantly comprise garment exports (around 40%), followed by cotton yarn, fibre and filament.

However, despite being a cost-competitive manufacturing base for all types of products across the textile value chain, the share of the Indian textile industry in the global textile exports has remained abysmally low over the last two decades. In fact, the share of the Indian textile industry in the global textile exports has declined from a high of 5.1% in 2013 to 4.3% in 2019. Over the years, only a few large firms, particularly in the garments segment, and mostly from the north-western and southern regions of the country have engaged in exports. The major part of the industry, being dominated by small- and medium-scale enterprises, has largely remained domestic

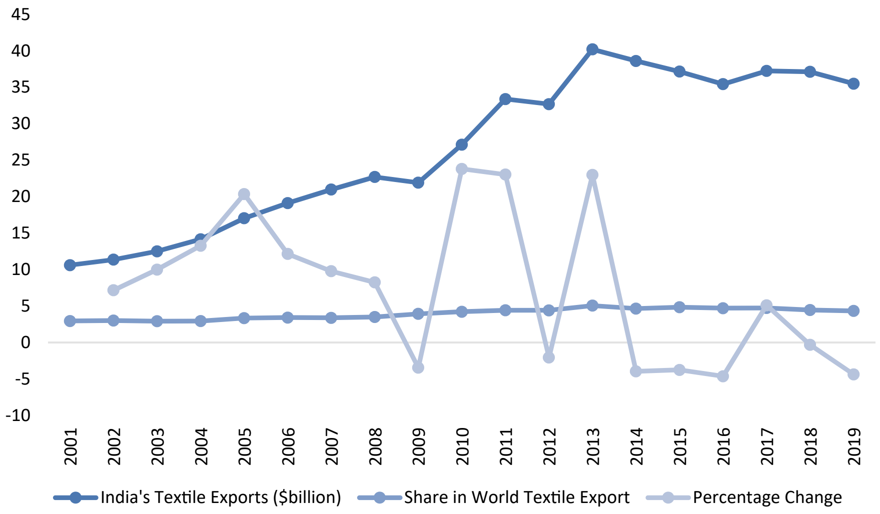

Fig. 1 Growth and share of India's textiles exports, 2001–2019. *Source* Calculated from Trade Map, International Trade Centre (ITC)

oriented. The exports have also been limited to only a few markets, with the USA and EU accounting for around 50% of the total Indian textile exports (Fig. 1).

The reasons for the unimpressive export performance of the Indian textile industry are both global and domestic. On the global front, the Indian textile industry is facing competition from neighbouring countries such as China, Vietnam, Cambodia, Bangladesh and Sri Lanka, which produce garments similar to India. Domestically, the Indian textile firms are constrained by high electricity and production logistic costs and lack of availability of fibre base for round-the-year supply. Moreover, most firms in this industry tend to remain domestically oriented owing to the large size of the domestic market, high export standards and strict delivery schedules (Ray, 2019).

The Indian textile industry, particularly the small and medium enterprises (SMEs), is also constrained by the lack of availability of credit at a reasonable rate. This is a major challenge for an industry which is highly capital intensive in nature and faces long payment cycles. The industry is primarily dependent on banks and other financial institutions for its credit requirements and faces high rates of interest and collateral requirements, thereby making it difficult to enhance domestic production capacities or enter new markets. During the past two years, the industry has witnessed a sharp deceleration in total gross credit offtake from banks (Fig. 2).

In this context, given the importance of the textile exports in India's overall export basket, it becomes imperative to analyse the various financial and non-financial factors that affect the export performance of the Indian textile industry.

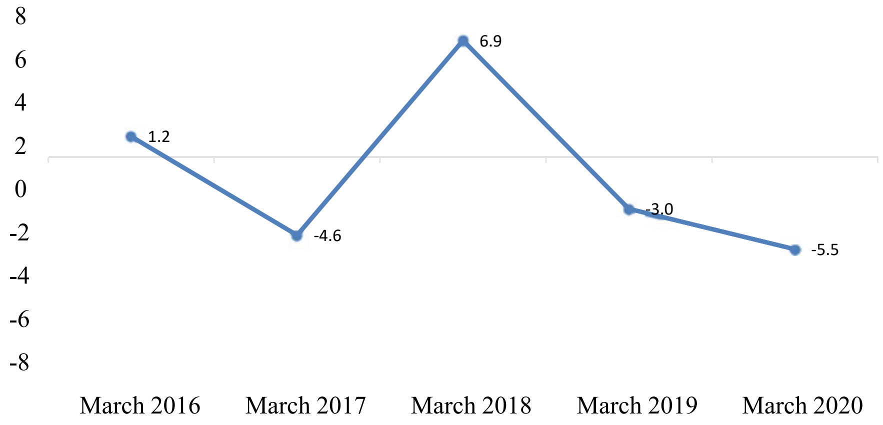

Fig. 2 Growth in gross deployment of credit to the textile sector. *Source* Reserve Bank of India (RBI)

4 Empirical Analysis: Data and Methodology

4.1 Data Source

The study uses an unbalanced panel of 1892 Indian textile firms with data over the period 1993–2019 taken from the Centre of Monitoring Indian Economy (CMIE's) Prowess database. The Prowess database contains information on the financial parameters of Indian companies, sourced from their audited financial reports. The panel includes a total of 51,111 observations. Moreover, owing to the fact that firms oscillate between exporters and non-exporter status in the period under consideration, our empirical analysis focuses on firm years rather than simply firms. All the flow variables are deflated by the annual wholesale price index (base year 2012).

4.2 Financial and Non-financial Variables

Majority of the studies in this area generally use two key measures of firms' financial health, namely liquidity and leverage ratio. We measure liquidity as the ratio of the firm's current assets to current liabilities. A liquidity ratio greater than 1 signifies that the company can repay its current liabilities with its current assets. Leverage is measured as the ratio of a company's short-term bank borrowings (debt) to total assets. A high leverage ratio indicates that the majority of the company's assets are being financed with debt. A company with a high liquidity ratio and low leverage ratio is therefore said to be in a healthy financial position.

There could be several other non-financial factors affecting the exporting decisions of firms as well. We control for two key variables: size and age. Size is measured by real value of total assets of the firms. A priori, it is expected that large firms (in terms of assets) find it easier to export since it is easier for them to gain access to external finance to pay for the upfront entry costs. In the existing literature, the impact of firm age on exports is mixed, with some studies finding a positive association between experience and internationalisation (Majocchi et al., 2005) some finding older firms to be reluctant in adapting to foreign market patterns (Kirplani & McIntosh, 1980) and some finding the impact of age on export performance to be insignificant (D'Angelo et al., 2013).

4.3 Econometric Specification

4.3.1 Model Specification for Extensive Margin of Exports

In order to determine the factors impacting the extensive margin of exports, i.e. the probability of exporting, we estimate the following model:

$$\text{Expstat}_{it} = \beta_1 + \beta_2 \text{financial}_{i(t-1)} + \beta_3 \text{size}_{i(t-1)} + \beta_4 \text{age} + u_i + u_j + u_{ij} \quad (1)$$

where

$$\text{Expstat}_{it} = \begin{cases} 1, & \text{if the firm } i \text{ exported in year } t \\ 0, & \text{otherwise} \end{cases};$$

financial_{it} denotes the financial variables: liquidity ratio and leverage ratio and size_{it} refers to the real value of the total assets of the firm i in year t. The error term has three components: u_i which takes into account time-invariant firm-specific effects not included in the model, u_j taking into account time-specific factors and the idiosyncratic error term u_{ij}. In order to account for possible simultaneity problems, the time-varying explanatory is lagged by one period.

4.3.2 Model Specification for Intensive Margin of Exports

In order to determine the factors impacting the intensive margin of exports, i.e. the volume of exports, we estimate the following regression equation:

$$\text{Exports}_{it} = \beta_1 + \beta_2 \text{financial}_{i(t-1)} + \beta_3 \text{size}_{i(t-1)} + \beta_4 \text{age} + u_i + u_j + u_{ij} \quad (2)$$

where Exports_{it} refers to exports of firm i in period t.

Table 1 Summary statistics of key variables

Parameters		Mean	Median	Standard deviation
Liquidity ratio	Exporting firm years	1.36	1.22	0.68
	Non-exporting firm years	1.25	1.16	0.79
Leverage ratio	Exporting firm years	0.19	0.17	0.14
	Non-exporting firm years	0.51	0.18	7.06
Real sales (Rs. million)	Exporting firm years	3254.01	1317.72	7952.45
	Non-exporting firm years	965.38	326.49	3776.33
Real total assets (Rs. million)	Exporting firm years	4013.32	1246.18	13,187.8
	Non-exporting firm years	1158.51	253.16	9230.81
Age (years)	Exporting firm years	37.37	31	21.83
	Non-exporting firm years	30.53	27	19.22

Source Authors' computation

5 Empirical Methodology and Results

5.1 Summary Statistics

The database comprises a total of 51,111 firm years, with 10,337 exporting firm years (around 20% of the total firm years) and 40,774 non-exporting firm years (around 80% of the total firm years).

Table 1 presents the summary statistics of the key variables for exporting and non-exporting firm years. Exporting firm years, on an average, are characterised by higher average and median liquidity and lower leverage as compared to non-exporting firm years. Meanwhile, exporting firm years are also observed to be larger (in terms of real total assets) and older as compared to non-exporting firm years.

5.2 Extensive Margin of Exports

Since the dependent variable in case of the model estimating the extensive margin of exports is dichotomous, as shown in Eq. 1, we first use a linear probability approach for estimation. The results of the same are presented in Table 2. The results report expected positive and negative statistically significant coefficients for liquidity and leverage, respectively. This, therefore, suggests that in the case of the Indian textile industry, more liquid and leveraged firms are more likely to export. Further, the results also indicate a positive impact of firm size (in terms of total assets) and age on the exporting probability.

Given the limitations of the linear probability model (non-normality of the error term and heteroscedastic errors), we estimate Eq. 2 using a probit approach. We

Table 2 Estimation results for extensive margin of exports

Variables	Linear probability model	Pooled probit model	Random effects probit model
Liquidity ($t-1$)	0.06*	0.14*	0.10
Leverage ($t-1$)	−0.002*	−0.29*	−1.28*
Total assets ($t-1$)	2.82e−06*	7.81e−06*	−2.41e−06
Age	0.0027*	0.0068*	0.016*
Constant	0.29*	−0.42*	−0.93*

Source Authors' computation
Note Asterisk (*) denotes statistically significant at 5% level of significance

first estimate a pooled probit model that allows us to correct for clustering, i.e. it takes into account the fact that since we have repeated observations on firms, the observations within firms may not necessarily be independent. The estimation of the pooled probit model also finds the impact of liquidity, size and age on exporting probability to be positive and statistically significant. Meanwhile, as in the case of the linear probability model, the coefficient of leverage is negative.

We finally estimate the model using a random effects probit approach which takes into account unobserved heterogeneity between the firms included in the sample. In this case, we only find the coefficients of leverage and age to be statistically significant. The coefficient of leverage, again, here has a negative sign suggesting that it is difficult for over-leveraged firms to enter into markets outside their home countries.

5.3 Intensive Margin of Exports

Equation 2 specifying the model for the intensive margin of exports, i.e. the volume of exports is estimated using the ordinary least squares (OLS) approach. In this case, the coefficients of the two financial variables, namely liquidity and leverage, are found to be insignificant while only the size of the firm is observed to have a significant positive impact on the volume of exports. This, therefore, seems to suggest that once a firm has entered a foreign market, its financial health no longer determines its export performance. Only the size of the firm matters, with firms larger in size expected to export more compared to the smaller firms (Table 3).

Table 3 Estimation results for intensive margin of exports

Variables	Exports
Liquidity($t-1$)	−93.93
Leverage($t-1$)	−36.49
Total assets ($t-1$)	0.08*
Age	−1.75
Constant	997.31*

Source Authors' computation
Note: Asterisk (*) denotes statistically significant at 5% level of significance

6 Conclusion and Policy Implications

The empirical findings suggest that financial factors play a significant role in determining the probability of exporting for firms in the Indian textile industry. These factors, however, do not have a significant impact on the firms' intensive margin of exports. The results are robust to using different methods of estimation and are consistent with the findings of similar studies done in the case of developing countries. (Berman & Hericourt, 2010; Nagaraj, 2014).

The critical policy implications that emerge from the study are that Indian textile firms are constrained by the lack of finance while making a foray into the international markets. This seems to be one of the key reasons behind the almost stagnant share of Indian textile exports in the global textile industry. Hence, in order to achieve a spurt in the Indian textile exports, the government should ease financial constraints for textile firms to help them customise their products according to foreign demand patterns and finance the other fixed costs associated with foreign market entry. To this end, there is a need to augment the supply of external capital to the Indian textile industry.

The policy conclusions assume much more significance at a time when China's position as the "factory of the world" has taken a considerable beating because of COVID-related disruptions. Meanwhile, amidst the ongoing trade war, the USA has imposed restrictions on textiles from China, besides other products. These developments have given an opportunity to the Indian textile industry to expand their presence in other countries. To leverage these opportunities, there is an urgent need for policy reforms to fast-track investments in the Indian textile industry.

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Global Monetary Policies and Implications for Financial Flows to India and Other Emerging Markets

Sanket Mohapatra

1 Introduction

The central banks of the G-4 advanced economies (USA, Euro Area, UK, and Japan) embarked on extraordinary monetary easing to counter the effects of the Global Financial Crisis (GFC) in 2008–09, during the post-GFC period, and most recently, during the COVID-19 health crisis in 2020–21. These included large-scale purchases of financial assets and close to zero or negative policy interest rates. Studies suggest that the monetary easing broadly had positive effects in terms of reducing the cost of capital and improved economic activity in the advanced economies including in the USA and the Euro Area (Bernanke, 2020, Krishnamurthy et al., 2018).

However, the increase in global liquidity and a search for higher yields resulted in spillovers to emerging market economies in the form of surges and sudden stops in capital flows, accompanied by greater volatility of financial asset prices and exchange rates (Aizenman et al., 2016; Chari et al., 2017; Eichengreen & Gupta, 2015; Lim & Mohapatra, 2016).

This chapter reviews the experience of monetary easing by the G-4 central banks and the spillover effects of such policies on developing countries. The chapter builds on the work of Basu et al. (2014) and Medvedev et al. (2019) on the effect of the specific episode of expectation of tapering of quantitative easing by the US Federal Reserve in 2013 on financial asset prices and exchange rates in India. It considers the implications of QE in the period spanning 2009–19 as well as the impact of the recent COVID-19 monetary easing, for developing countries and particularly for India. The implications of these developments are examined for private capital flows, exchange rates, capital controls and macroprudential measures, and the conduct of monetary policy.

S. Mohapatra (✉)
Indian Institute of Management Ahmedabad, Ahmedabad, India
e-mail: sanketm@iima.ac.in

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The next section discusses the contours of monetary easing during the GFC and COVID-19 crisis. This is followed by a discussion of the spillover effects of such policies on developing countries, and specifically for India, in Sect. 3. Some policy options to deal with spillovers are examined in Sect. 4. Section 5 concludes with directions for the future.

2 Global Monetary Easing During Global Financial Crisis and COVID-19 Crises

The central banks of the major advanced economies undertook unconventional monetary policies involving significant large-scale purchases of financial assets during the Global Financial Crisis in 2008–09 and in the years following the GFC. In the period between August 2008, just prior to the collapse of Lehman Brothers, and the end of 2014, the combined assets of the US Federal Reserve (US Fed), European Central Bank (ECB), and the Bank of Japan rose threefold from \$2.8 trillion to about \$8.7 trillion. As a result of the unconventional monetary policies, the US Fed assets registered the steepest increase from \$906 billion to \$4.5 trillion, a fivefold increase, while the assets of the ECB and the Bank of Japan rose 1.8 and 2.5 times, respectively, in dollar terms in the same period (Fig. 1). In the 2015–19 period prior to the COVID-19 crisis, while the US Fed slowed its pace of asset purchases as US economic growth picked up, the ECB and the Bank of Japan continued to expand their balance sheets to provide support for their economies. The purpose of quantitative easing (QE) or large-scale asset purchases were to provide abundant liquidity to financial markets and the banking sector; reduce bond yields (see Krishnamurthy & Vissing-Jorgensen, 2011, for evidence from the USA, and Krishnamurthy et al., 2018, for

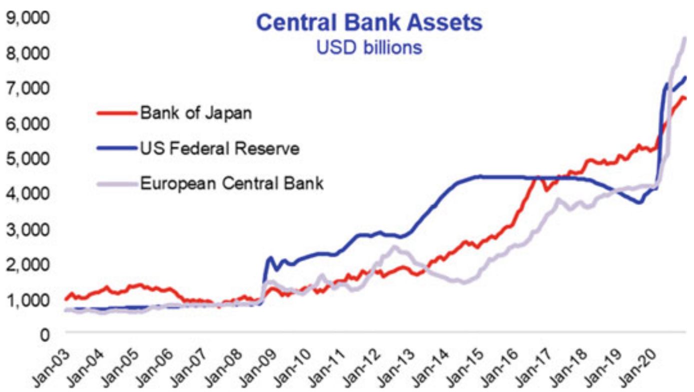

Fig. 1 Quantitative easing by central banks of major advanced economies. *Source* Federal Reserve Bank of St. Louis FRED database

evidence from Europe) and borrowing costs for corporates; restore confidence; and stimulate investment and economic growth.

Similar large-scale central bank purchases of financial assets and liquidity infusions were undertaken during the COVID-19 health crisis in 2020 in order to help the banking system and corporates absorb the unprecedented shock to aggregate demand and incomes. By the end of 2020, the assets of the US Fed, ECB, and BoJ had risen to about \$22.5 trillion, 1.7 times the \$13.5 trillion in December 2019. The assets of the ECB and US Fed rose by 2.0 and 1.8 times, while the Bank of Japan's assets rose by a smaller 1.3 times (Fig. 1). Compared to the ECB's initial reticence to implement quantitative easing in the GFC and post-GFC period, it has been relatively more willing to ease monetary policy during the COVID-19 crisis.

The unconventional monetary policy measures above were implemented after or together with a sharp reduction in the main policy interest rates by the major central banks. With the collapse of the US housing market that preceded the GFC, the US Fed reduced its main short-term interest rate from 5.3% in mid-2007 to nearly 0% by the end of 2008 as the crisis deepened (Fig. 2, left panel). In a unique period for monetary history, the US Fed kept its main policy rate close to zero for an extended period of 7 years even as it continued to implement the quantitative easing operations discussed above. The ECB cut its marginal lending facility rate, its main policy rate, from 5.25% in mid-2008 to 1.75% in May 2009 during the GFC (Fig. 2, right panel). The ECB's newly introduced main refinancing operations rate ("repo rate") was reduced from 3.75% in October 2008 to 1% in May 2009 and then gradually to 0.0% by March 2016 and kept at that level in subsequent years. With the US economic growth gaining steam, the US Fed's policy interest rate was raised 2.4% in January 2019 to counter inflationary pressures but then was reduced to mitigate the impact of the US–China "trade war" in 2019, and subsequently to close to 0% in April 2020 as COVID-19 infections started spreading across the world.

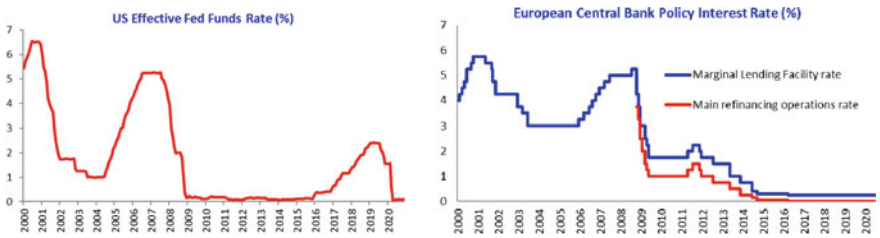

Fig. 2 Policy interest rates of central banks of major advanced economies. *Source* Federal Reserve Bank of St. Louis FRED database

3 Spillover Effects of Global Monetary Policies on India and Other Emerging Markets

Although the unconventional monetary policies in the advanced economies were aimed at supporting their domestic economies, the ultra-low interest rates and quantitative easing in the advanced economies led to significant expansion of global liquidity and spillover effects for emerging market countries such as India via equity and debt flows (Fratzscher et al., 2018; Lim & Mohapatra, 2016). These spillover effects were facilitated by greater openness to foreign capital in emerging markets and increasing integration of financial markets between the emerging economies and the advanced economies.

Monthly foreign equity and debt inflows into India and the average inflows into other large emerging market countries, drawn from the database compiled by Koepke and Paetzold (2020), show considerable volatility (Fig. 3). Equity inflows to India and other emerging markets fell sharply during the Global Financial Crisis in 2008–09. Debt inflows to India were relatively smaller in magnitude compared to other emerging markets but also slowed during this period. Facilitated by an economic recovery and the abundant liquidity in global financial markets due to quantitative easing and ultra-low interest rates in the advanced economies (as discussed in the previous section), both equity and debt inflows to India and other emerging markets rose sharply in the years following the GFC (see Turner, 2014, for evidence on the links between global interest rates and foreign investment in bond markets in emerging market countries).

The testimony by the US Fed Chairman Ben Bernanke in the US Congress in May 2013 about "tapering" or gradual reduction of its quantitative easing program resulted in a sharp slowdown of foreign capital flows to emerging market countries (Chari et al., 2017). The expectation of the fall in the pace of bond purchases by the US Fed was accompanied by a rise in long-term bond yields in the USA, which made emerging market assets relatively less attractive. This was more pronounced in terms of a reversal of foreign debt inflows into India (Fig. 2 right panel), while

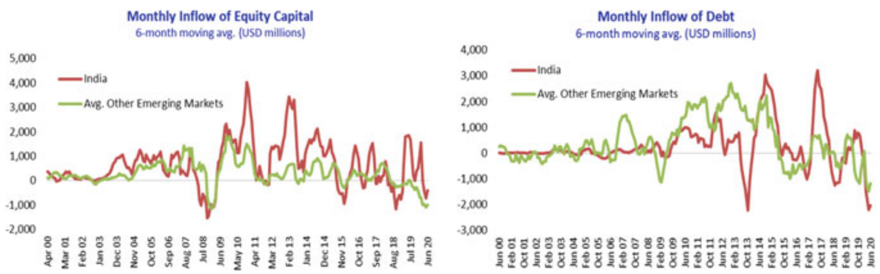

Fig. 3 Foreign equity and debt inflows into India and other emerging markets. *Note* The avg. of other emerging markets is the average monthly equity capital inflows into Brazil, South Africa, Turkey, and Mexico. Data for Mexico is from June 2009 onward. Disaggregated data for China is unavailable. *Source* Koepke and Paetzold (2020)

equity inflows also slowed down (Fig. 2 left panel). An increase in external financing needs due to a rise in India's current account deficit to 5% of GDP in 2012 made it particularly vulnerable to changes in global financial markets, with India being termed as part of the "Fragile Five" countries with fiscal and external imbalances. During the COVID-19 crisis in 2020, while foreign equity inflows to India remained fairly resilient relative to other emerging markets, partly due to domestic monetary policy support, debt inflows to India declined in tandem with other emerging markets.

The supportive global liquidity conditions due to ultra-low interest rates and quantitative easing in the post-GFC period was evident in a relatively quick recovery of equity markets in the large BRICS countries, namely Brazil, Russia, India, China, and South Africa (Fig. 4). The strong monetary policy response during the COVID-19 crisis by the advanced economy central banks such as the US Fed, ECB, and Bank of Japan (as discussed earlier) as well as the implementation of large-scale liquidity operations by emerging market central banks such as the Reserve Bank of India gave support to emerging equity markets during the global health crisis (Fig. 4).

The two-year rolling correlation of equity markets in advanced economies and India, usually driven by foreign capital inflows and outflows, rose steadily between 2000 and 2007, illustrating the increasing openness of Indian equity markets and its integration with international financial markets. In the post-GFC period, the correlation fell somewhat, although still remaining in the 40–60% range, mostly stemming from domestic factors. The linkage between advanced economies' and India's equity markets has usually strengthened during crisis, with rolling correlation between the two rising to more than 80% both during the GFC in 2008–09 and during the COVID-19 crisis in 2020 (Fig. 5).

The rising inflows of capital into emerging market countries in the post-GFC period due to quantitative easing and ultra-low interest rates in the advanced economies have influenced the exchange rates of the emerging markets. While exchange rates of the BRICS countries depreciated relative to the US dollar in late

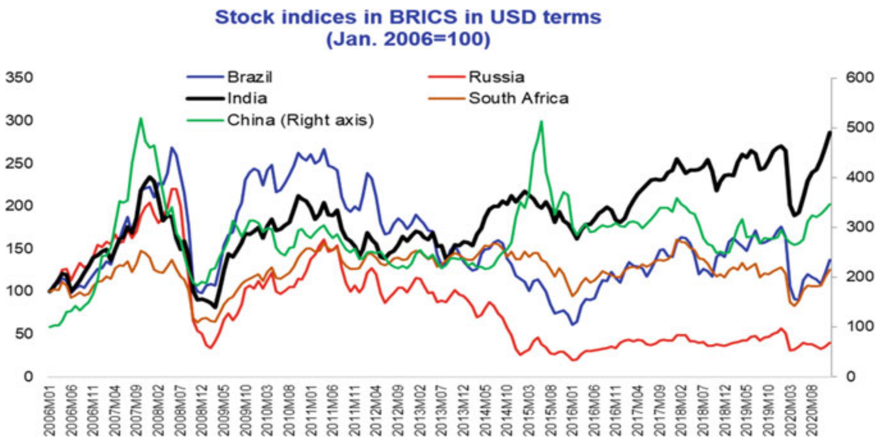

Fig. 4 Equity indices of India and other emerging markets. *Source* World Bank

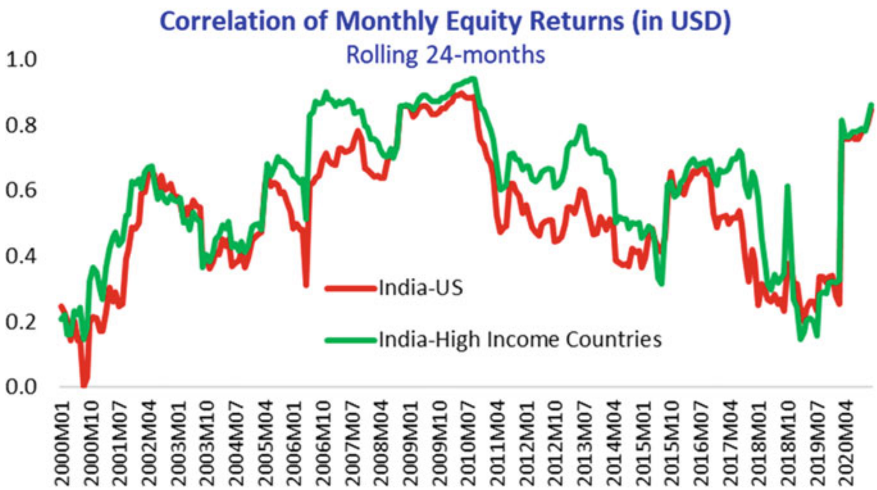

Fig. 5 Correlation of monthly equity returns of India and advanced economies. *Source* Author's calculations based on World Bank data

2008 when capital flowed out of these countries, the unconventional monetary policies and resumption of capital inflows in the post-GFC period (as discussed earlier) resulted in appreciation of nominal exchange rates in most of the BRICS countries and to some extent in India, but with the exception of the managed Chinese renminbi (Fig. 6, left panel—higher values of the nominal exchange rate indicate depreciation). The post-GFC appreciation of BRICS's currencies in 2009–11 was even more evident in the behavior of real effective exchange rates or REER which account for differences in inflation rates across countries (Fig. 6, right panel—note that higher values of the REER indicate appreciation). This led to concerns about a possible erosion of external competitiveness of the emerging market countries.

The "taper tantrum," denoting the sharp reversal of foreign capital flows in 2013 due to concerns over tapering of the US Fed's QE, resulted in a depreciation across the BRICS, excepting for China (see also Eichengreen & Gupta, 2015; Medvedev

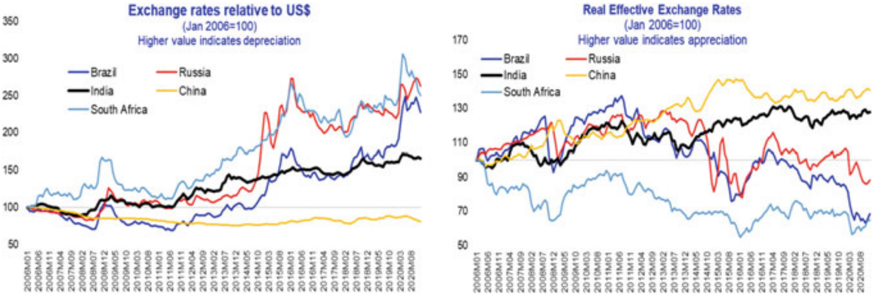

Fig. 6 Real and nominal exchange rates of India and other emerging markets. *Source* World Bank

et al., 2019). However, in the subsequent years the exchange rates of the BRICS followed divergent paths reflecting heterogeneity in the domestic growth performance across these emerging market countries. Notably, while India's nominal exchange rate depreciated, its REER strengthened in the years following the taper tantrum. During the COVID-19 crisis in 2020, India's nominal exchange rate did not depreciate significantly, as equity inflows and durable foreign direct investment (FDI) inflows offset the slowdown in debt inflows, as the nominal and real exchange rates did not experience a steep depreciation unlike the GFC period.

4 Dealing with Advanced Economies' Policy Spillovers to India and Other Emerging Markets

The spillovers of advanced economies' extraordinary monetary policies to emerging markets, as discussed in the previous section, have occasioned both proactive and reactive policy measures. During the period of quantitative easing and ultra-low interest rates, emerging market countries such as India have faced challenges in responding to the spillovers in the form of volatile capital flows that can lead to an impact on domestic equity markets and exchange rates.

The vulnerability of emerging markets such as India is linked to the need for external financing, usually due to a current account deficit and reliance on foreign portfolio flows (sometimes termed as "hot money") to bridge the gap. When capital flows are strong and exports are booming, as happened in India during the pre-GFC period, the concerns usually revolve around the consequences of an appreciating real exchange rate. India's current balance was in surplus of 1.2–1.4% of GDP in 2003–04; however, it deteriorated moderately to −1.0% by 2006 (see Fig. 7) as strong

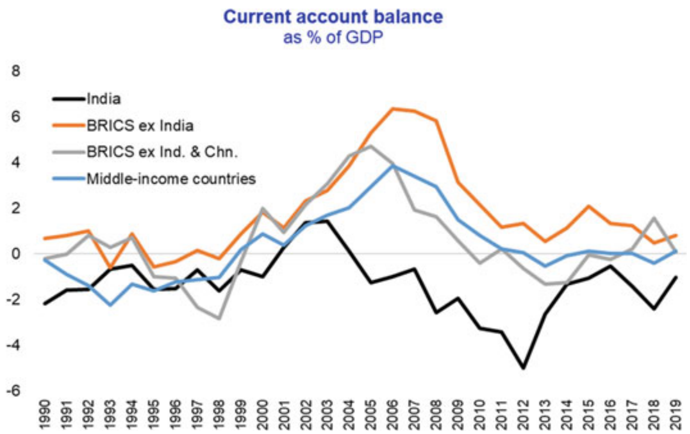

Fig. 7 Current account balance of India and other emerging markets. *Source* Author's calculations based on IMF World Economic Outlook data

domestic GDP growth resulted in increasing demand for imports. In the post-GFC period, India's current account deficit almost doubled from −2.6% of GDP in 2008 to about −5% in 2012, as a swift recovery of the Indian economy combined with an appreciating real effective exchange rate and high international crude oil prices (in addition to a rise gold imports) which resulted in India's overall imports outpacing exports. While the strong foreign debt and equity inflows to India in the post-GFC period were facilitated by the ultra-low interest rates and quantitative easing in the advanced economies (as discussed earlier), this reliance on hot money inflows also exposed emerging markets such as India, particularly those with fiscal and current account imbalances, to sudden reversal of capital flows during the taper tantrum in 2013 (see also Basu et al., 2014).

This experience suggests that two of policy options to reduce the impact of spillovers on the domestic economy include (a) a reduction in current account imbalances and (b) lower reliance on "hot money" portfolio flows. Fortunately, India's current account deficit has narrowed substantially in the years following the "taper tantrum" in 2013, to −1% of GDP in 2019 prior to COVID-19 crisis (Fig. 7), albeit resulting from both lower international oil prices and a weakening of overall economic growth and consequent slowing of import demand. By contrast, the large current account surplus position of the BRICS countries excluding India has become smaller and turned into deficit for countries excluding India and China, in the same period. In parallel, net foreign direct investment inflows have risen strongly, from $24 billion in 2012 to $50.6 billion in 2019, according to World Bank data. FDI inflows tend to be relatively longer term compared to foreign portfolio (equity and debt) inflows and less prone to sudden reversals when global financial conditions change. The decline in India's current account deficit and the robust FDI inflows suggest that India's external position in the pre-COVID-19 period was stronger compared to the situation in 2013.

The Reserve Bank of India, India's central bank, has been proactively purchasing foreign currency assets during surges in foreign capital inflows in the years prior to COVID-19 period in order to stem a further appreciation of the real effective exchange rate. This has resulted in a substantial increase in India's foreign exchange reserves. While India's international reserves measured in months of imports are smaller than the other BRICS countries, it has risen by 41% in 2013–19, from the equivalent of 6.4 months of imports in 2013 to 9 months of imports in 2019 (Fig. 8). In US dollar terms, India's reserves rose by a larger 55% during this period, with a further increase in 2020 as inflows remained strong due to global liquidity conditions while domestic demand collapsed during a nationwide lockdown for a substantial part of the April–June quarter of 2020. The RBI's interventions in foreign currency markets have prevented an even larger appreciation of India's real effective exchange rate, as seen earlier. Moreover, an improved international reserve position is usually seen as a sign of strength by international investors and rating agencies and can discourage speculation against the currency.

Other policy options to deal with volatile portfolio capital flows include capital controls and macroprudential measures. According to Forbes et al. (2015), capital controls are any type of restrictions on cross-border financial activity that discriminate

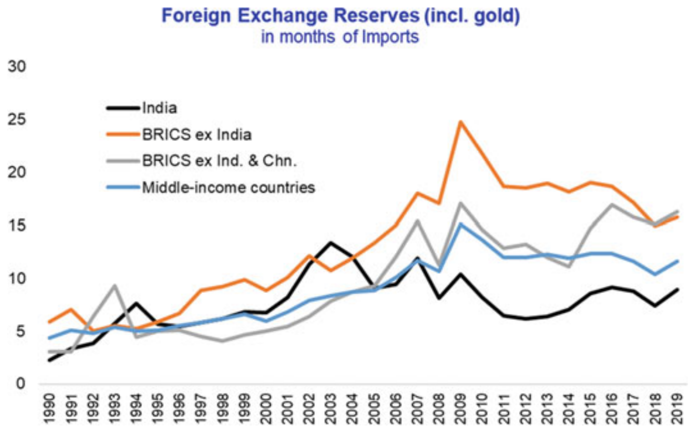

Fig. 8 International reserves in India and other emerging markets. *Source* Author's calculations based on IMF World Economic Outlook data

based on residency, whereas macroprudential measures do not discriminate based on residency but relate to cross-border or foreign currency exposure or lending. The authors discuss a variety of capital control measures: quantitative limits on foreign ownership of domestic companies' assets; quantitative limits on borrowing from abroad; limits on ability to borrow from offshore entities; restrictions on purchase of foreign assets, including foreign deposits; special licensing on FDI and other financial transactions; minimum stay requirement for new capital inflows; taxes on capital inflows; and reserve requirements on inflow of capital.

Forbes et al. (2015) also discuss a variety of macroprudential measures that do not discriminate based on an investor's residency and are primarily designed to reduce systemic risk arising from cross-border transactions. These include reporting requirements and limitations on maturity structure of liabilities and assets; restrictions on off balance sheet activities and derivative contracts; limits on asset acquisition; limits on bank's foreign currency positions; limits on bank's new lending in foreign currency; asset classification and provisioning rules; taxes on foreign currency transactions; capital requirements on foreign currency assets; and differential reserve requirements on liabilities in local and foreign currencies. Controls, taxes, and other special requirements on capital inflows or outflows should be temporary and implemented with care, as sustained controls can create severe disincentives for foreign investors.

5 Conclusion

The increasing financial integration of advanced and emerging market economies such as India brings with it both opportunities as well as challenges. The discussion in the chapter and the extant literature highlights how global monetary policies implemented by the advanced economies' central banks can create spillover effects for emerging market economies. These include conventional policy interest rate changes and unconventional measures such as quantitative easing involving large-scale financial asset purchases. Such spillover effects can take the form of greater volatility in foreign portfolio capital inflows, changes in equity valuations, and exchange rate movements. These may be more relevant particularly during episodes such as the Global Financial Crisis and the taper tantrum in the past, and the COVID-19 health crisis in 2020–21.

Policy makers in emerging market economies such as India need to be cognizant of the developments in global financial markets and attempt to reduce their external vulnerabilities, in particular, current account imbalances and reliance on "hot money" inflows. While the monetary policies of the advanced economies are aimed at their domestic goals of reducing unemployment and fostering economic growth, the spillovers to emerging market economies documented in this chapter underscore the importance of greater international coordination in monetary policy.

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Financial Liberalization and Convergence of Financial Development Among BRICS Economies

Paramita Mukherjee, Poulomi Bhattacharya, and Sahana Roy Chowdhury

1 Introduction

Globally, most of the economies today are in a dire need of financial liberalization and financial development. The reasons are multi-pronged: Firstly, opening up obligations under the auspices of several regulatory and advisory multilateral organizations such as GATS-WTO and IMF with the underlying theoretical justification that financial liberalization leads to market efficiency. The GATS talks about individual countries' specific commitments on market access, transparency in measures relating to trade services including that in the financial sector and general obligations such as providing most favored nation (MFN) status to other member countries have longer-term implication of gradual removal of restrictions in trade services in general. Secondly, there are perceived causal relationship between financial development and economic prosperity which further stimulates financial development.

Financial development in developed economies has been perceptibly progressive, since these economies typically have had stronger financial policies and sophisticated financial market structures. Among the developing and emerging economies, the BRICS are considered as the 'innovative building blocks' and 'among the leading emerging economies.' As the acronym emerged recognizing their remarkable role in the global economy, in 2001 Brazil, Russia, India and China formed the group with South Africa joining later on in 2010 (Stiglingh & Vijloen, 2018). In one of the projections using demographic factors, capital accumulation processes and mapped out GDP and productivity growth paths until 2050, Goldman and Sachs forecasted that the BRICS countries together could be larger than G6 in USD terms by early

P. Mukherjee (✉)
School of Commerce, Narsee Monjee Institute of Management Studies, Hyderabad, India

S. Roy Chowdhury
Department of Economics, International Management Institute, Kolkata, India

P. Bhattacharya
Department of Economics, Jadavpur University, Kolkata, India

P. Mukherjee (ed.), *Revisiting the Indian Financial Sector*, India Studies in Business and Economics, https://doi.org/10.1007/978-981-16-7668-0_6

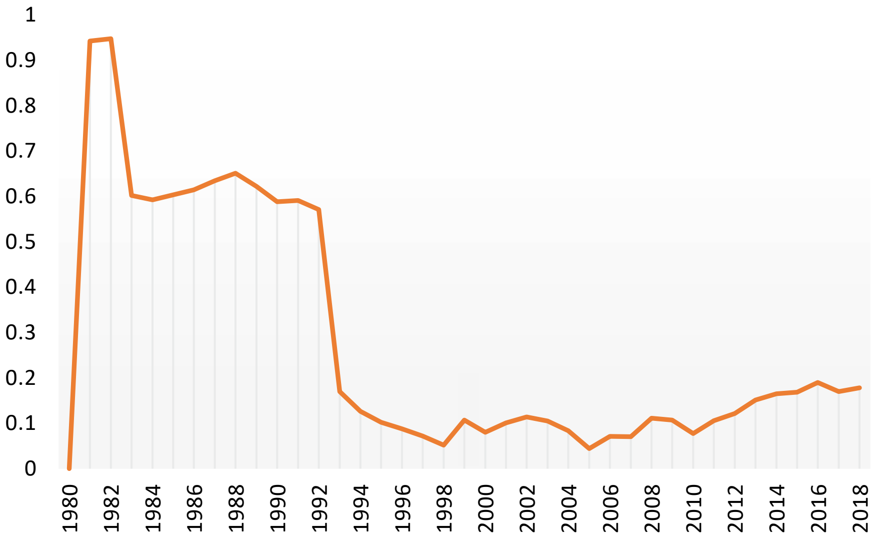

Fig. 1 Coefficient of variation for FD in BRICS countries, 1980–2018. *Source* Authors' computation

2030s (Kupchan, 2012).[1] However, the caveat mentioned was that the predicted growth depends on a set of identified factors such as quality of financial, regulatory and related institutions, openness to trade, among others.

While the increasing importance of the BRICS nations in their global contribution is well recognized, crucial questions that emerge are as follows: As and when they open up, what are the identifiable differences or similarities in the financial development pattern of these economies? Who among this group of nations while liberalizing have gained the most in terms of the depth and width of financial development, and who are among the laggards? Or, is it the case that in the medium to longer run these economies have shown 'convergence' in their financial development performances? Empirically, it is quite challenging to find out such predictive commonalities of these economies given their diverse set of structural differences; nonetheless, casual empiricism suggests that they have undergone quite varied performance patterns in their earlier and later phases of financial liberalization. If we look at the data on financial development, viz. overall financial development index for BRICS for a period from 1980 to 2018, provided by financial development database of International Monetary Fund (IMF), an interesting observation is worth mentioning here. Figure 1 depicts that the within group variation in financial development was quite high among the BRICS nations in the 1980s, followed by a precipitous fall in the same in 2000s which is their post-liberalization era in general. This is indicative of

[1] https://www.theatlantic.com/business/archive/2012/02/the-world-in-2050-when-the-5-largest-economies-are-the-brics-and-us/253160/.

the narrowing up of gap in the levels of financial development in these economies in the later stages of their financial liberalization process.

Taking cue from this, the chapter tries to find out whether, post opening up, these countries have gained in terms of increasing levels of financial development. Other pertinent questions are as follows: (a) whether the pace of growth in financial development was even across the BRICS economies before and after their financial liberalization and (b) whether it is the less or more financially developed economy that contributes more to the financial development process of the economy, i.e., whether it is the more financially developed economy or the less financially developed economy that experience higher financial development. In other terms, was there an observable 'convergence' in the overall financial development process? By addressing these questions for BRICS, this chapter also tries to understand how India, categorized by the World Bank as the only lower middle income country among BRICS, performs vis-à-vis the remaining BRICS economies, i.e., Brazil, China, Russia and South Africa, categorized as upper middle income countries.

A brief account of the financial liberalization process in the BRICS countries is documented in the chapter. Financial development is broadly categorized as development of financial markets and financial institutions. An interesting discussion on within country financial development and a comparison between the countries' financial development in terms of financial institutions and financial markets is also carried out. In order to find out whether convergence in the development process has taken place, measures like absolute sigma convergence, beta convergence and conditional convergence are considered. Based on estimation of panel regression, the analysis leads to some interesting findings. Evidence of both unconditional and conditional beta convergence for overall financial development and its components is there. Convergence is the faster in case of development of financial markets than that of financial institutions. India is catching up quite fast with the rest of BRICS in terms of financial development. Quite expectedly, the findings suggest that the effect of financial liberalization on financial development is negative when it is measured in terms of capital account openness.

The sections are arranged as follows: Sect. 2 provides a brief background of the process of financial liberalization in each of the BRICS economies. Section 3 provides a summary on the extensive literature of financial convergence and the methodologies used for analyzing convergence. Section 4 discusses the data used for the analysis and presents an in-depth comparative analysis to understand the financial development experience of each of the BRICS economies. The section also describes the regression analysis of convergence. Section 5 provides the results and interpretations. Section 6 concludes the chapter.

2 Financial Liberalization in BRICS

Though the emerging economies across the world have gone for liberalization of the economy and the financial sector mostly toward the end of the twentieth century, it is interesting to study the timeline, pace and pattern of financial liberalization processes among the BRICS countries. Looking at some key financial liberalization measures of these countries will enable us to keep in mind the similarities and differences in the liberalization process and its possible impact on financial development in the respective countries. Appendix and Boxes 1 to 5 provide an overview of some significant financial liberalization interventions in the BRICS economies during the last few decades. As evident from the table and the boxes, BRICS economies differ not only in terms of the pace of liberalization in financial sector, but also in the timing and sequencing of the key reforms like deregulation of interest rates in the banking sector, allowing foreign direct investment (FDI) or portfolio investment, opening up of stock markets, etc. But interestingly, in all these economies, financial liberalization took place during the 1980s and 1990s and by 2000, barring China, most of the benchmark measures have been undertaken by them implying the liberalization process was in full swing by 2000 (see Appendix).

Box 1 Select financial liberalization measures in Brazil

1980—Domestic loan rates were freed
1983—Resolution 802 and Resolution 841 supported the elimination of dollar-indexed internal financial assets
1987—The authorities allowed the establishment of foreign investment companies and investment funds and thus freed making portfolio investments in Brazil
1988—Interest rates of loans were liberalized
1988—Resolution 1524 was issued and embodied a fundamental shift in approach away from a financial system composed of specialized institutions restricted by regulations to narrowly defined operating modalities to a different type of configuration closer to the model of the so-called universal banks
1988—The endeavor to develop the Sao Paulo Stock Exchange (BOVESPA), which was established in the late nineteenth century, intensified from the 1980s on
1989—Deposit interest rates were fully liberalized
1990–92—Liberalization of capital inflows
1991—Corporate foreign investors were allowed to enter the Brazilian securities market. In the early 1990s, the sectoral bans on the foreign direct investments in Brazil were abolished, and the bureaucratic obstacles were reduced
1992—Regulations for the liberalization of capital outflows gained momentum, and the scope of the so-called CC-5 foreign exchange mechanism, which is implemented by the BCB, was expanded, making it easier for foreign financial institutions to transfer capital abroad
1992—In addition, residents in Brazil were permitted to undertake FDI using the CC-5 and to transfer foreign currency to real persons' accounts abroad
1994—The CMN adopted the risk-weighted minimum capital adequacy ratio in accordance with the standards of the Bank for International Settlements
1994—Real stabilization plan reduction of public sector participation in the financial system
1995—PROER (the Program of Incentives for the Restructuring and Strengthening of the National Financial System)
1996—Foreign companies were allowed to issue Brazilian Depositary Receipts in Brazilian capital markets

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1997—Encouraging entry of new foreign banks/institutions
1999—Companies established in Brazil were allowed to issue the American Depositary Receipts in the US capital markets. Consequently, many restrictions on capital inflows to Brazil were reduced or eliminated
2005—The Central Bank replaced CC-5 by allowing transfer of resources abroad through bank accounts, with permission to obtain foreign exchange through contracts with authorized dealers, with no quantitative limits. The merging of the foreign exchange markets was also done, which until then were split into the free rate market and the floating rate segment
2005—The reform of the Bankruptcy and Judicial Recovery Law (Law 11101) was an important step in the evolution of the Brazilian credit market, since it established the priority of bank liabilities over the tax liability
2006—Residents have been allowed to send resources abroad through the foreign exchange market in order to acquire stocks, derivatives and other investments in the international capital markets
2010—Third BASEL ACCORD
2012—Financial Stability Assessment Program (FSAP)
2015—BCB launched the National Partnership for Financial Inclusion
2016—Investment Partnership Law
2017—Law targeting alignment lending rates with market rates by almost 2022 (This reform will level the playing field and facilitate the development of private long-term financial markets through a new, market-based long-term interest rate called TLP (OECD Economic Survey 2018))

Source IBRD (1984)

Box 2 Select financial liberalization measures in Russia

1991—At the end of 1991, announcement to proceed from planned economy to market economy was made
1992—Joined IMF and World Bank
1994—The Russian Federation adopted a new constitution which explicitly protected the property and other economic rights of foreign investors
1994—Limited non-resident portfolio started which liberalized completely in 1998
1996—Stock market was established
1996—The capital markets regulatory framework is based on the Federal Law on the securities market (Securities Market Act) first enacted in 1996 and later amended more than 40 times with the recent changes in 2016
2000—A law governing fixed capital investment passed in 1998 and amended in 2000, included an article underlining, but not adding to, the rights of foreign investors already laid out in the Civil Code and other business legislation
2002–03—A law specifically governing foreign investment in Russia was passed in 1999 and amended in 2002 and 2003. This law stipulates national treatment for foreign investors and gives them the right to engage in investment activity in any form authorized by law, e.g., compensation for expropriation, authorized repatriation of profits and capital, etc.
2003—Deposit insurance scheme (DIS) for bank deposits was introduced

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2004—Russian banks required to draw up financial statements in accordance with IAS/IFRS; also, radical revision of Central Bank of Russia's (CBR) Instruction no. 1 On Banks' Mandatory Norms
2006—A new foreign exchange law, passed at the end of 2003, has brought Russia's foreign exchange regulation in line with international practice; under this law, currency controls will be brought more into line with modern international practice by end 2006
2009—Improve the structure of the banking sector by outlining a long-term privatization strategy for state-owned banks
2012—Linking domestic capital market with the international financial system by joining the Clearstream and Euroclear payment and settlement systems. Foreign investors were encouraged to invest in Russia
2013 onwards—Transition to a new bank resolution framework took place, after massive banking sector cleanup following the 2014–2015 recession, enhanced regulation and supervision, recapitalization of some larger banks

OECD (2004), Balling (2009)

Box 3
Select financial liberalization measures in India

1991—New Industrial Policy 1991 where the government allowed 51% FDI in 47 industries
1992—Partial deregulation of rupee denominated term deposit rates, SLR, CRR all cut down, banks were given freedom to set the credit requirements for their borrowers. Multilateral Investment Guarantee Agency Protocol is signed to protect foreign investment
1993—Liberalization of the provisions FERA
1993—Rules for establishing private banks were introduced
1993—Entry of private sector mutual funds. Prior to that in 1987, public sector mutual funds entered the market. During 1964 to 1987, only one mutual fund operated which was set up by RBI
1994—Liberalizing prime lending rates regulations
1994—India's commitment to the World Trade Organization (WTO) to allow greater foreign bank entry
1998—Minimum lock-in period for term deposits reduced, interest rates loan of against domestic and NRE term deposits liberalized
1999—Different PLRs for loans with different maturities
2000—Further lending rate liberalization
2000—Elimination of restrictions on interest rates against third-party deposits
2000—Trading in derivatives in Indian bourses started
2002—SARFAESI Act in banking which empowered banks to resolve the problem of non-performing loans more easily
2010—Indian Depository Receipts (IDR) came up to enable foreign companies to raise funds from the Indian securities markets
2016—Insolvency and Bankruptcy Code came up with an objective of providing a time-bound process to resolve insolvency, applicable to companies, partnerships and individuals

Source Panagriya (2004), Koeva (2003)

Box 4 Select financial liberalization measures in China

1978—In late 1978, 'Open door' policy initiated; beginning of foreign trade and investment reforms
1983—Peoples' Bank of China (PBC) granted the right to adjust the benchmark lending rate
1983—The government also introduced laws and regulations to encourage FDI inflows the Regulations for the Implementation of the Law on Chinese-Foreign Equity Joint Ventures in 1983
1986—The Law on Enterprises Operated exclusively with Foreign Capital and the Provisions of the State Council on the Encouragement of Foreign Investment in 1986 to facilitate FDI inflows
1990—Stock exchanges open in Shenzhen and Shanghai
1993—State Council drew its first plan for interest rate liberalization. This plan proposed to first liberalize money market rates and bond yields and then free deposit and lending rates
1994—Renminbi convertible for current account transactions announced
1994—Open market operation first started in foreign exchange market
1994—Policy banks established; commercialization of banking system announced
1996—China in compliance with International Monetary Fund Article VIII (current account convertibility)
1996—People's bank of China (PBOC) began to transact in bond market
1996—CHIBOR was established as an important step of introducing market-based interest rate
1999—Interest rate liberalized in deposit wholesale market
2000—Foreign currency lending rates liberalized
2002—Launch of the Qualified Foreign Institutional Investor (QFII) program that allows certain licensed international investors the opportunity to invest in China's stock exchanges, in yuan-denominated 'A' shares of Chinese companies
2004—Ceiling on lending rates and floor on removed
2005—Strategic foreign investment introduced and partial privatization started in SOEs
2006—The five years' transition period ended in December 2006 when foreign banks could enter Chinese financial market in an all-round way
2011—Renminbi Qualified Foreign Institutional Investor (RQFII) program, similar to the QFII program, was introduced to allow foreign investors the opportunity to invest in China's stock exchanges with less restrictions
2014—Publication of 'deposit insurance regulation (draft),' committed to secure deposits of less than RMB500,000
2018—China Securities Regulatory Commission (CSRC) has allowed foreign companies to issue Chinese Depositary Receipts (CDRs) which can be traded in the Shanghai and Shenzhen stock exchanges

Source Huang et al. (2010), He (2012), Law (2018), Garnaut et al. (2018)

Box 5 Select financial liberalization measures in South Africa

1980—Interest rate control removed, credit ceiling removed, both lending and deposit rates were liberalized
1983 and 1985—Liquidity ratio of banks was liberalized, i.e., liquidity and reserve requirement lowered
1990—The Banks Act where foreigners were allowed to establish a representative office or local branch of that foreign bank in South Africa
1992—Lifted most of the economic sanctions of South Africa, lifted international sanctions leading to liberalization of stock market controls
1994—Dismantled apartheid and the South African economy was reintegrated into the world economy which improved liquidity
1995—Exchange controls on non-residents removed
1997 and 1998—South African corporations to repatriate more funds for investment, domestic firms were allowed to borrow from abroad
2003—Pension funds, insurers and mutual funds permitted to invest abroad subject to the aggregate limit of 15% of total assets
2004—Pension funds, insurers and mutual funds permitted to invest abroad subject to the aggregate limit of 15% of total assets
2014—Financial Sector Development and Reform Program phase 1 completed in 2018. Objective of this World Bank executed program was to implementing its reform agenda of the financial sector by strengthening financial stability and improving financial inclusion
2014—Financial Sector Development and Reform Program phase 2 is ongoing. It aims at making the financial sector reform effective
2015—By terminating its Bilateral Investment Treaties with many European countries since 2012, South Africa came up with the Protection of Investment Act in 2015 which came into effect on July 13, 2018
2017—Insurance Act; International Arbitration Act, incorporating the UNCITRAL Model Law on International Commercial Arbitrations (2006 version) into South African law

Source Gottschalk and Sodre (2008), Precious et al (2014), Nowak and Ricci (2006)

From the Boxes 1 to 5, it should be noted that apart from the key liberalization measures, certain important measures unique to the respective countries are also documented to present a chronological perspective on the liberalization process. For example, Brazil put a lot of emphasis on banking sector reforms as well as attracting foreign investments in the early years of liberalization. India also started nationalization of banks right from 1965. Though the liberalization of trade imports and exports started since 1980s, it initiated liberalization of trade in services since 1991. India followed a gradual process of liberalization. The recommendations of the Narasimham Committee I and II focused on all aspects of financial development in both banking sector and capital markets. The long-term capital gain tax was significantly reduced in capital markets in 2003–04 that boosted foreign institutional investments. It opened up the financial sector more in 2005 under WTO and Basel agreements with a motive of increasing efficiency and competition of banks. The 2007–08 global recession reduced credit delivery compared to 2003–04 but could not stall the financial sector development. In 2011, the Financial Sector Legislative Reforms Commission was asked to review and address the gaps in its regulatory structure, and they came up in 2013 with Draft Indian Financial Code. The Insolvency and Bankruptcy Code, 2016, is a significant step in resolving insolvency.

Russia too started its journey of financial liberalization after the fall of Soviet Union in 1990s. It undertook economic reforms in 1985 when Mikhail Gorbachev restructured the economy, took initiatives for greater openness and also brought an end to the Cold War. Although the initial years of transition from Soviet Union's centrally planned economy were tough with low growth, high inflation and low savings, the 1998 crisis of rise in oil prices changed its pattern of growth. Russia is an economy of crisis. Recently, it experienced financial crisis in 2014 due to fall in investors' confidence in Ruble. The situation started improving in 2017, and important cleanup in the banking sector took place from 2014.

South Africa had controlled financial services sector where the government in 1970 decided to reduce interest rates and reduce upper limit on certain deposit rates. However, it imposed controls again in 1972 and later on started liberalization with reduction of both lending and deposit rates in 1980. Due to the second oil price shock in 1979, world interest rates rose and Brazil had a huge foreign debt. The austerity program in Brazil by IMF that initiated in late 1979 continued till 1984 and was targeted toward reducing the foreign debt but achieved trade surplus only from 1983. Hence, the economy faced huge financial burden in early 1980s. It encountered economic crisis in 2014. On the other hand, in China, financial reforms began in 1978 when China decided to transform into market economy. China, with a strong place in the bond market, financial assets and big financial institutions, follows strict restrictions on credit allocation and cross-border capital flows, interest rates. Exchange rates are also not market determined. This earned China the name 'a country with repressive financial liberalization policies.' However, it accelerated its pace of reforms in cross-border capital flows and market—determined interest rates around 2014. China's financial liberalization strategy was biased toward the banking system (Huang et al., 2010).

While South Africa (SA) prioritized on outflows by all institutional investors, others, Brazil (BR) and India (IND) in particular, liberalized corporations and individuals (Arestis & de Paula, 2008), despite the differences in the process of liberalization, BRICS economies undertook substantial financial liberalization reforms before 2000 and are continuing to improve it further. The 1997 Asian Financial Crisis and the 2007–08 Global Financial Crisis also could not stop these economies from growing and maintaining their positions in the world economy. BRICS formed a financial institution called the 'New Development Bank' in 2014 as a means of providing funds and aid to projects and institutions like IMF in BRICS economies. Gottschalk and Sodre (2008) analyzed that Brazil was the first in liberalizing capital account for resident corporations and individuals to invest abroad (i.e., capital outflows) in 1990s followed by South Africa, India and China. During 1990s, Russia's capital account transactions were controlled by the Central Bank. South Africa focused on liberalization of financial outflows by institutional investor. India opened its capital market gradually. It liberalized capital investment by residents abroad in 1997 and has taken a gradual approach toward capital account convertibility. China though liberalized in capital inflows, liberalized capital outflows very late in 2004.

3 Literature Review: Convergence of Financial Development

The literature on convergence is quite rich, and we apply those measures in the context of the BRICS economies in this chapter. When countries with poor financial development grow faster than the ones already financially developed, it is called absolute beta convergence (Cappelen, 2004). In that case, one can observe countries converge in the long-run irrespective of their initial level of financial development. After controlling for factors that explain the steady-state growth path of financial development, if the growth rate is still negatively related to the initial level of financial development, then it is called conditional beta convergence. If there is conditional convergence, each country would converge to their own steady states which vary from one another. If there is presence of beta convergence, the dispersion/coefficient of variation of country-level financial development should be declining which is known as sigma convergence. Absolute or conditional convergence holds independent of the initial level of financial development. Club convergence occurs when there is no absolute or conditional convergence, i.e., it should converge only when the initial level of financial development of economies is same.

Bahadir and Valev (2015) with all the countries and for all years from 1965–2009 in the financial structure database, focusing on the convergence in the credit variables of financially underdeveloped, developing and advanced economies, conclude that countries converge until they reach a higher level of financial development. Evidence suggests that no country-level institutional factor or efficiency in the knowledge and innovation of the financial sector could explain the convergence of the financial development in the countries. Rather, it is the expansion of financial sector services, i.e., access to the customers in underdeveloped economies that explains its convergence. With a sample of industrial and developing economies, Antzoulatos et al. (2011) show no convergence of financial development indicators. Absence of convergence is more prominent for stock market and private credit by banks and less for bond market and bank deposits. It studies 13 financial development indicators for 38 industrial and developing economies. Veysov and Stolbov (2011) with 102 countries from 1980 to 2009 using World Bank financial structure database show that countries converge though the speed of convergence of developing countries catching up with the developing world is very low. It also shows while higher transparency or lesser corruption prevails only in insurance sector and facilitates its convergence, higher transparency in financial systems acts as an impediment in the convergence of banking sector indicators. It concludes that financial openness measured by KAOPEN facilitates financial development and its convergence. Also, the study reports the presence of conditional beta convergence without sigma convergence which implies that the economies have their unique steady state and the gap between developing and developed economies prevail.

Bruno and De Bonis (2009) with OECD data show that while beta convergence exists for share and insurance products, i.e., capital markets, mixed results are obtained for debt securities and deposits. Kılınç et al. (2017) find that convergence of banking and stock market variables across European Union countries improves over time when controlled for country-specific institutional and macroeconomic indicators. It shows the presence of both conditional and unconditional convergence. Moreover, trade openness, inflation rate and real GDP per capita explain banking sector development and stock market development in EU countries. Khatun and Bist (2019) observe that in BRICS economies openness in financial services leads to more financial development through stock market, bond market and insurance sector, and this in turn increases economic growth. Fung (2009) studies 57 countries from 1967 to 2001 and finds that middle and high income countries converge in terms of financial development, but such convergence in the low income group depends on the level of development of financial sector.

Aghion et al. (2005) shows with 71 countries for the period of 1960–1995 that after reaching a critical level of financial development, a country would converge to the average growth rate of GDP of the USA. Lin et al. (2020) theoretically explain that while economies that do not reach a critical level of financial development get into poverty trap. There is an optimal combination of monetary and fiscal policy that can lead to initially a faster growth rate in these economies and then a consistent growth toward the world technology frontier. Dekle and Pundit (2015) show out of 23 Asian countries, the financially poor ones are catching up with the advanced benchmark groups like Hong Kong, China, Japan, the republic of Korea and Singapore. It shows while GDP per capita has significant impact on growth rate of financial development, it is insignificant for the institutional variables like legal rights and dominance of government banks. It further finds that overall financial development and financial access converge faster than the convergence in financial efficiency.

Thus, a detailed study on the convergence of financial development in BRICS economies is absent in the literature. The present chapter fills this gap by comparing the experiences of BRICS economies, i.e., Brazil (BR), Russia (RS), India (IND), China (CN) and South Africa (SA).

The literature on methodology for understanding convergence and divergence talks about a number of ways to measure the same and also discusses their limitations in some cases. While the literature on methodology of convergence is extensive, here we present a brief summary. Cappelen (2004) studies income convergence and divergence of European economies over a long period 1820–1992 through income distributions and gives a vivid description of the possible reasons from the history for its convergence and divergence. Apergis et al. (2012) estimate convergence with Phillips and Sui (2007) method for endogenously identifying convergence clubs. Bukenya et al. (2002) talk about different methodologies of estimating sigma convergence, beta convergence with parametric and nonparametric testing of convergence.

For panel data, while pooled OLS and fixed effects are all popular measures of unconditional and conditional convergence, respectively, as posed in the literature, it also raises question of reliance on its estimation. For example, Barro (2012) raised question on the overestimation of fixed effects estimates since removing country-specific characteristics could inflate the rate of convergence of the initial level. On the other hand, pooled OLS by omitting time-invariant variables is considered to undermine the estimates. While pooled OLS is accused of under estimation and considered a lower bound in the literature, fixed effects are accused of over estimation and considered an upper bound where the true convergence rate would fall between these two estimates. Literature on convergence also consists of works that analyze financial development convergence with system GMM in order to deal with serial correlation and endogeneity when a no. of cross sections are greater than the number of time points ($N > T$). It is also popularly known that in the presence of first-order autocorrelation within countries and heterogeneity across countries, feasible GLS (FGLS) provides consistent and efficient estimates than GLS in panel data.

4 Data and Methodology

4.1 Data

The concept of financial development is very wide, and in this chapter, we perform our analysis based on the financial development database of International Monetary Fund (IMF). We take the data on overall financial development index (FD) for the BRICS countries. This measures the extent of development of financial institutions and financial markets in terms of depth, access and efficiency. While depth refers to size and liquidity and access refers to the access of individuals and business organizations to financial services, efficiency refers to the ability to provide financial services with low cost.[2] So, the overall index consists of the index of financial institutions (FI) and financial markets (FM). The methodology of constructing the index is described thoroughly in Sviryzdenka (2016). Each of these components, viz. FI and FM, is composed of depth, access and efficiency in institutions and markets, respectively. The individual indices for each of these components in both financial institutions and markets are denoted as FID, FIA and FIE for depth, access and efficiency of financial institutions, respectively, and FMD, FMA and FME for depth, access and efficiency of financial markets, respectively. These components are aggregated by application of principal component analysis (PCA) in order to derive each of FI and FM. The overall financial development index (FD) is then constructed by aggregating the FI and FM by using PCA. The financial variables considered for the construction of the index are summarized in Table 1.

[2] See IMF Staff Discussion Note (2015) for further details.

Table 1 Financial development variables for construction of index as in Svirydzenka (2016)

Financial development indicators	Financial institutions (FI)		Financial markets (FM)
Depth (FID)	Private sector credit to GDP	Depth (FMD)	Stock market capitalization to GDP
	Pension fund assets to GDP		Stocks traded to GDP
	Mutual fund assets to GDP		International debt securities of government to GDP
	Insurance premiums life and non-life to GDP		Total debt securities of financial corporations to GDP
			Total debt securities of non-financial corporations to GDP
Access (FIA)	Bank branches per 100,000 adults	Access (FMA)	Percent of market capitalization outside of top ten largest companies
	ATMs per 100,000 adults		Total number of issuers of debt (domestic and external financial and non-financial corporations)
Efficiency (FIE)	Net interest margin	Efficiency (FME)	Stock market turnover ratio (stocks traded to capitalization)
	Lending deposit spread		
	Non-interest income to total income		
	Overhead costs to total assets		
	Return on assets		
	Return on equity		

Source IMF

Since the analysis is done in two stages, viz. an event study to find out whether the indices differ significantly after some important liberalization measures are in place and whether financial development in these countries converges or not, we also incorporate some control variables which may have significant effect on financial development. For example, in a study with 65 countries (both developing and developed), Demirguc-Kunt and Detragiache (1998) show that in order to deter banking crisis, strong macroeconomic environment is crucial. Also, weak law enforcement, high inflation and low growth create banking sector problems with high real interest rate. Similarly, the role of country institutional framework is also important for financial sector performance (Demetriades & Law, 2006; Stallings & Studart, 2006). In another study, Rajan and Zingales (2003) observe that higher trade openness leads to higher competition resulting in financial development.

So, in line with the literature, the macroeconomic variables we consider are real GDP per capita (GDP), inflation (INF), trade openness (TO) and government spending (GS). They are collected from World Bank Open Data (https://data.worldbank.org/). INF is measured by the consumer price index, which reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services. TO is trade as a percentage of GDP, where trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. GS is general government final consumption expenditure (formerly general government consumption) that includes all government current expenditures for purchase of goods and services (including compensation of employees). All the variables are taken in logarithmic form, except inflation and are denoted with a prefix 'L' before the name of the variable. GDP per capita is in constant 2010 US dollars, and an economy with higher real growth per capita contributes more to the growth of financial sector. A higher inflation would lead to disinvestment, lower credit and increase inefficiency and frauds, and so it should reduce the growth of financial development. While higher trade openness implies lesser restrictions on foreign transactions which leads to higher growth of financial development, higher government spending would lead to decrease in borrowing leading to lower credit creation and lesser growth in financial development.

For institutional quality, we take Worldwide Governance Indicators (WGI) data from World Bank (https://info.worldbank.org/governance/wgi/). We take the index on government effectiveness (GE). The indices range from −2.5 signifying weak governance performance to +2.5 signifying strong governance performance. We convert them to a range between 0 and 5. It describes the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government's commitment to such policies. Higher value of GE implies financial development would be higher as it acts as an enabler of reforms. In addition to this, financial development may depend on the extent of opening up of different sectors, and in order to incorporate the effect of this, we take freedom indices too, as control variables. The business freedom (BF) index, which is part of economic freedom index is obtained from the Heritage Foundation database (https://www.heritage.org/index/). Higher value of BF represents an efficient government regulation in starting, doing and closing a business ranging from 0 to 100, 100 implying the most free business environment. Therefore, BF is expected to be positively related to financial development. Another widely used measure of capital account openness of a county is also included, viz. KAOPEN, that is based on IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).[3] KAOPEN tabulates the cross-border restrictions on financial transactions and is taken as the normalized value of Chinn-Ito index ranging between zero and one (Ito & Chinn, 2020), with higher values implying more openness. This may

[3] Regarding measure of financial openness, see Chinn and Ito (2006), Chinn and Ito (2008).

have a positive or a negative impact on financial development as there are evidences that capital market openness potentially may destabilize capital markets; however, owing to more openness to transactions, a positive impact on financial development is also possible. All these variables are also taken after log transformation, except GE and KAOPEN and prefixed with 'L'.

The annual data for all the variables is collected for Brazil, Russia, India, China and South Africa for the period of 1980 to 2018. The sample period covers the period when these countries initiated financial liberalization and also the period when financial liberalization process has taken place to a considerable extent as mentioned in the previous section. Before 1980, data on a number of variables for more than a country was not available. This leads to 195 observations in the panel. Descriptive statistics for all the variables are presented in Table 2.

From Table 2, it is evident that the countries under consideration have low to medium level of financial development in terms of FD and its components, viz. FI and FM, since the means of the indices are around 0.4.[4] If the sub-components are taken into account, in case of both FI and FM, average efficiency is higher than average access and depth, on an average. Between the financial institutions and markets, it is the institution that has an overall higher average level of financial development. Among the financial components of institutions and markets, i.e., depth, access and efficiency, it is efficiency in both the institutions and markets that have the highest average level of financial development, and it is almost same for institutions and markets (0.5). Access to financial system both in institutions and markets has the lowest average score, though the average is slightly higher in financial institutions (0.28) than markets (0.25). Interestingly, the within cross-section variation and between cross-section variation have mixed patterns of one exceeding or falling short of the other implying that in some parameters of financial development countries made a lot of progress, and in some cases, there is little variation in the level of financial development across countries. The average level of real GDP per capita (5494) is almost half the maximum GDP per capita (11,993) where the minimum average income is as low as 317.

4.2 Financial Development in BRICS: A Comparative Analysis

In order to find out whether there is a significant change in financial development after some important liberalization measures have been undertaken in BRICS countries, we first look at the financial development indices country-wise by using box plots and graphical analysis. It is observed from the Sect. 2 that by the year 2000, all the five countries have undertaken majority of the key liberalization measures, e.g., lifting the restrictions on the banking sector or opening the capital market for financial investment. So, by box plots and graphical analysis of the components of financial

[4] The indices lie between 0 and 1.

Table 2 Summary statistics

Variable		Mean	Standard deviation	Min	Max	Observation
FD	Overall	0.39	0.16	0	0.65	$N = 195$
	Between		0.05	0.32	0.45	$n = 5$
	Within		0.15	−0.01	0.64	$T = 39$
FI	Overall	0.4	0.18	0	0.74	$N = 195$
	Between		0.13	0.27	0.58	$n = 5$
	Within		0.14	0.02	0.73	$T = 39$
FM	Overall	0.37	0.18	0	0.68	$N = 195$
	Between		0.06	0.31	0.46	$n = 5$
	Within		0.17	−0.03	0.69	$T = 39$
FID	Overall	0.33	0.24	0	0.88	$N = 195$
	Between		0.25	0.08	0.73	$n = 5$
	Within		0.1	0.04	0.58	$T = 39$
FIA	Overall	0.28	0.25	0	0.94	$N = 195$
	Between		0.18	0.12	0.54	$n = 5$
	Within		0.19	−0.09	0.84	$T = 39$
FIE	Overall	0.54	0.23	0	0.85	$N = 195$
	Between		0.19	0.31	0.76	$n = 5$
	Within		0.15	−0.22	0.97	$T = 39$
FMD	Overall	0.32	0.2	0	0.83	$N = 195$
	Between		0.1	0.22	0.48	$n = 5$
	Within		0.18	0.02	0.74	$T = 39$
FMA	Overall	0.25	0.16	0	0.69	$N = 195$
	Between		0.09	0.15	0.36	$n = 5$
	Within		0.14	−0.12	0.57	$T = 39$
FME	Overall	0.55	0.34	0	1	$N = 195$
	Between		0.25	0.21	0.8	$n = 5$
	Within		0.25	−0.24	1.08	$T = 39$
Control variables						
Log real GDP per capita (LGDP)	Overall	8.19	1.1	5.85	9.39	$N = 186$
	Between		1.08	6.74	9.12	$n = 5$
	Within		0.51	6.61	9.72	T-bar = 37.2
Inflation (INF)	Overall	84.65	346.449	−1.4	2947.733	$N = 169$
	Between		134.3904	5.21	317.3772	$n = 5$
	Within		322.9233	−229.53	2715.009	T-bar = 33.8
Log of trade openness (LTO)	Overall	3.53	0.49	2.5	4.7	$N = 186$

(continued)

Table 2 (continued)

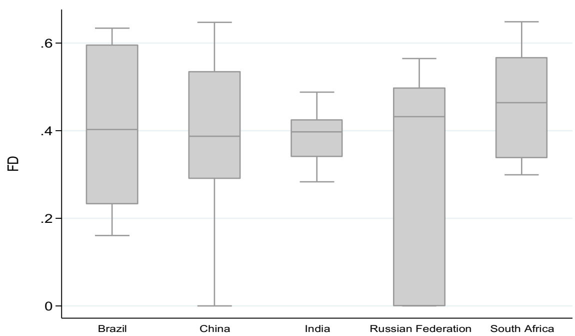
Variable		Mean	Standard deviation	Min	Max	Observation
	Between		0.4	3.05	3.96	$n = 5$
	Within		0.34	2.52	4.29	T-bar = 37.2
Log of government spending (LGS)	Overall	2.73	0.24	2.11	3.06	$N = 187$
	Between		0.22	2.38	2.92	$n = 5$
	Within		0.15	2.04	2.97	T-bar = 37.4
Government effectiveness (GE)	Overall	2.51	0.34	1.77	3.52	$N = 100$
	Between		0.32	2.12	3	$n = 5$
	Within		0.17	2.08	3.03	$T = 20$
Log business freedom (LBF)	Overall	4.07	0.19	3.57	4.44	$N = 120$
	Between		0.16	3.9	4.31	$n = 5$
	Within		0.12	3.75	4.4	$T = 24$
KAOPEN	Overall	0.2	0.17	0	0.72	$N = 170$
	Between		0.13	0.14	0.45	$n = 5$
	Within		0.13	-0.26	0.54	$T = 34$

Source World Bank, Heritage database, IMF

development, we compare the performance of the countries in terms of financial development indices, during the pre- and post-2000 and also try to find out where the countries stand with respect to the average financial development indices of these BRICS countries.

Figure 2 provides the level of overall FD for the five countries. Though the average FD (median) is very similar across countries, they significantly differ in terms of variance. While first quartile of FD in India is at a much higher level than that of others, the maximum FD is way below all other countries. Also, inter-quartile range is the lowest for India, while it is the highest for Russia. However, there has been a distinct improvement in average level of FD if we compare the pre- and post-2000 periods for each of the five countries (Fig. 3). Interestingly, variance in the post-2000

Fig. 2 Overall financial development. *Source* Authors' computation



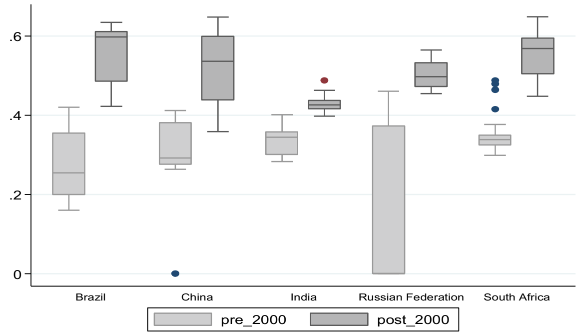


Fig. 3 Overall financial development: pre- and post-2000. *Source* Authors' computation

period has increased for CHN and SA, remained the same for BR and decreased significantly for RUS and IND. For India, variance in post-2000 period is very small, unlike other countries. In terms of the components of FD, countries like IND, RUS and CHN have higher average development in terms of FI compared to FM, while the opposite has happened for BR and SA (Fig. 4). SA and BR have the highest median value of FI (0.5) while RUS and IND have the lowest median value (<0.3). On the other hand, IND and RUS have the highest median value for FM, and BR has the lowest median of FM.

If we further look at the sub-components, median efficiency in financial markets is significantly less compared to financial institutions in SA; it is similar in BR, while it is way higher in IND, CHN and RUS. When the comparison is made across the countries, average efficiency in financial institutions is the highest in CHN (0.8), followed by SA and IND. CHN has the highest average efficiency in financial markets (>0.9), too, followed by IND and RUS, and it is the lowest in SA (Fig. 5). Figure 6 presents the comparison in terms of another sub-component, viz. access. Average access to financial markets is less than financial institutions in BR and SA, but is considerably higher in the other countries. The cross-country comparison reveals that BR has the highest median of access to financial institutions (around 0.6), and CHN and IND have the lowest median (around 0.1). However, in terms of access to financial markets, RUS scores the highest median while CHN scores the lowest. The

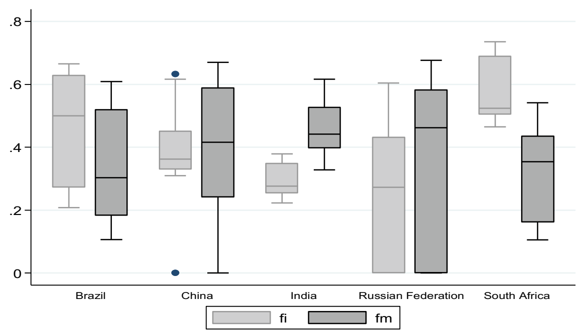


Fig. 4 Development of financial institutions and financial markets. *Source* Authors' computation

Fig. 5 Efficiency of financial institutions and financial markets. *Source* Authors' computation

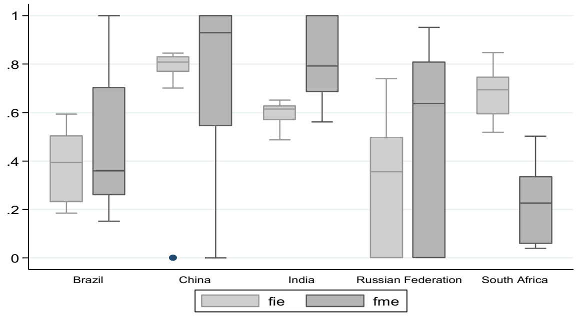
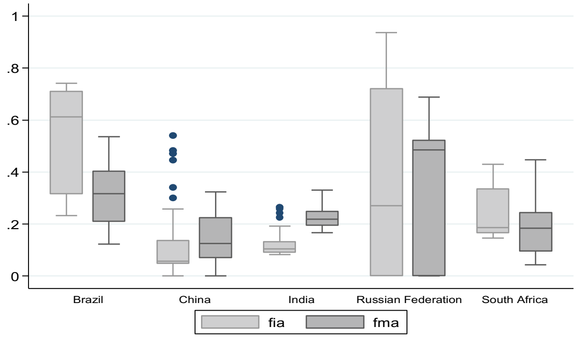
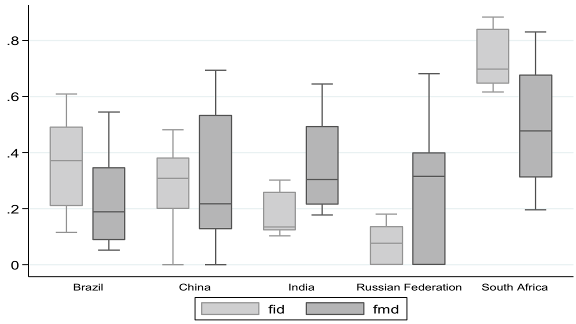


Fig. 6 Access to financial institutions and financial markets. *Source* Authors' computation



comparison in terms of the third sub-component, viz. depth is presented in Fig. 7. In BR and SA, average levels of depth of financial institutions are higher than that of financial markets, while in IND and RUS, it is much lower. The depth of financial institutions is way above others in SA with the minimum value being greater than 0.6, whereas the highest level among the rest is around 0.5. However, depth in financial markets in these countries is not much different from each other, with median depth at around 0.5 in SA and between 0.2 and 0.3 in other countries. Notably, in terms of most of the measures, the variance is the lowest for India.

Fig. 7 Depth of financial institutions and financial markets. *Source* Authors' computation



The scenario of financial development in the BRICS countries with respect to the BRICS average is depicted in Figs. 8, 9, 10, 11, 12, 13 and 14. In each of these figures, the year 2000 is presented as 0 and the shift in financial development in pre- and post-2000 is clearly visible. FD in IND and RUS is below the BRICS average in post-2000 period. In terms of sub-components of FD, India is more or less at par with the BRICS average when it comes to efficiency of financial institutions and financial markets. CHN is above average in terms of both FIE and FME, but, surprisingly SA scores above average in FIE, but below average in FME. In terms of access, while BR and RUS score much higher than the average, IND scores lower than average in both financial institutions and financial markets. SA has a much higher level of

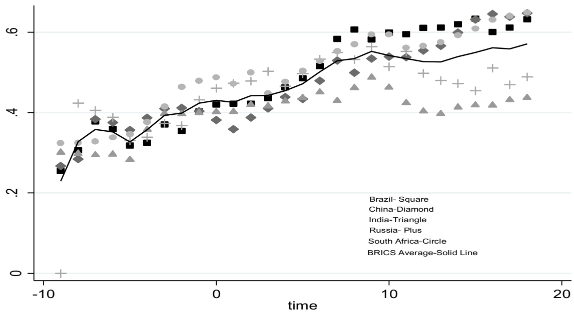


Fig. 8 Overall financial development pre- and post-2000. *Source* Authors' computation

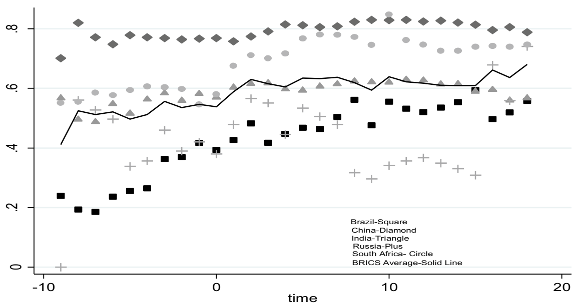


Fig. 9 Efficiency in financial institutions, pre- and post-2000. *Source* Authors' computation

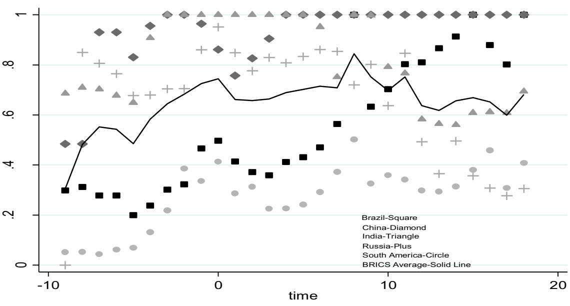


Fig. 10 Efficiency in financial markets, pre- and post-2000. *Source* Authors' computation

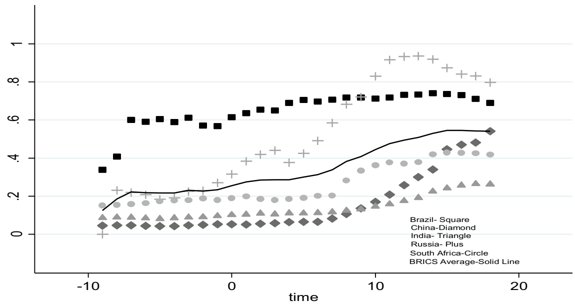


Fig. 11 Access to financial institutions, pre- and post-2000. *Source* Authors' computation

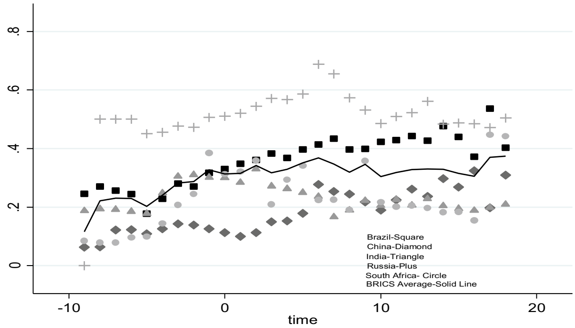


Fig. 12 Access to financial markets, pre- and post-2000. *Source* Authors' computation

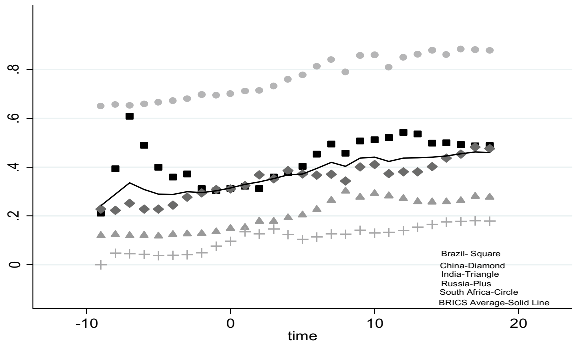


Fig. 13 Depth of financial institutions, pre- and post-2000. *Source* Authors' computation

depth in financial institutions and markets in post-2000 period. Interestingly, India has a lower than average depth especially after 2000 in financial institutions, but it is at par with the BRICS average in terms of FMD.

From the comparative analysis, it is evident that though in terms of financial development, countries do not differ much from each other (average FD varies between 0.32 and 0.45), they differ widely in terms of variance of FD. This clearly points to the possibility of beta convergence, and also, there is scope for conditional convergence among the countries. It will be pertinent to see whether the lower middle

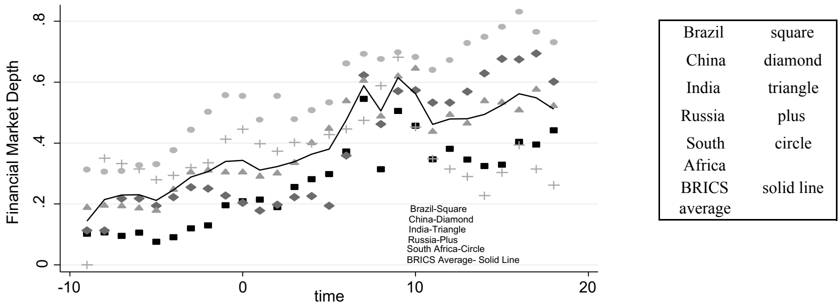


Fig. 14 Depth of financial markets, pre- and post-2000. *Source* Authors' computation

income country like India (upper middle income countries like other four) is moving toward (away from) the BRICS average level of financial development. Also, it is interesting to note that there is significant difference across countries in terms of the components and sub-components of FD. So, it will be really interesting to find out whether the countries are converging in terms of financial development and what are the contributions of the components in that process. The estimations for convergence are discussed in the next section.

4.3 Convergence Analysis

The objective of convergence analysis is to understand whether it is the less financially developed economy or the economy that has high financial development that contributes more rapidly to the growth of the financial development (and its components, viz. FID and FMD) of the economy. Also, it is important to figure out which of these, institutions or markets, is contributing more to the growth of the financial development in BRICS economies. Moreover, comparing the rate of convergence of the sub-components of financial development, viz. depth, access and efficiency would also provide better insights for these economies.

The simple empirical formulation for unconditional β convergence is

$$G_{it} = \alpha + \beta FD_{it-1} + \varepsilon_{it} \tag{1}$$

where G_{it} is the growth of financial development index in ith economy at t—the period and FD_{it-1} is the ith economy's position of financial development in the previous period, i.e., $(t - 1)$th period. If $\beta < 0$, there is convergence of financial development. This implies that financial development grows more rapidly in countries or periods with a lower initial level of financial development. $\beta = 0$ implies that the differences in financial development across countries persist over time while $\beta > 0$ indicates divergence, i.e., financial development takes place more rapidly in countries that are already more financially developed. We have considered only one lag as it is annual data and financial development being a gradual process, increasing the lags might not have added more insights, but it would have reduced the number of observations.

We add a vector of control variables in Eq. (1) to find out conditional β convergence and the regression specification is

$$G_{it} = \alpha + \beta FD_{it-1} + \theta Z_{it-1} + \varepsilon_{it} \quad (2)$$

where G_{it} represents the growth of a financial development index, FD_{it-1} represents the financial development index with a lag, and Z_{it-1} represents the vector of control variables at $(t-1)$th period. Control variables are included to account for the effect of country characteristics.

Both the equations are estimated separately for each of the financial indices, viz. FD, FI, FM, FID, FIA, FIE, FMD, FMA and FME. The dependent variable in each equation is the growth rate of the corresponding financial index, and they are denoted by GD, GI, GM, GID, GIA, GIE, GMD, GMA and GME, respectively (e.g., GD = $(\mathrm{FD}_{it} - \mathrm{FD}_{it-1})/\mathrm{FD}_{it-1}$). For Eq. (2), the control variables considered are real GDP per capita (GDP), inflation (INF), trade openness (TO), government spending (GS), government effectiveness (GE), capital account openness (KAOPEN) and business freedom (BF). Control variables include country-specific macroeconomic variables as well as institutional quality that influence the development indices. The correlation between the variables is presented in Table 3. From the table, it is evident that the depth and efficiency of FI have moderate to high correlation with GE, whereas KAOPEN has moderate and positive correlation with FD and access to FM. Also, efficiency of FM is negatively correlated with BF moderately, and depth of FM is positively correlated with TO. Quite expectedly, FI is also positively correlated with GDP and GS. Among the control variables, GS has moderate and positive correlation with BF as well as GDP. Regressions are specified taking these correlations into account in order to avoid the problem of multicollinearity. For example, since GDP and GS have high correlation, they are incorporated in separate set of regressions.

The Woolridge test for autocorrelation in panel data and modified Wald test for group-wise heteroskedasticity in fixed effects model confirm the presence of the first-order autocorrelation (serial correlation) within countries and presence of heteroskedasticity across countries, respectively, in our data. Hence, feasible generalized least squares (FGLS) is used in order to estimate the regression model.

5 Results

Table 4 presents the results of estimating Eq. 1 for various measures for financial development. There is evidence for convergence for all financial development indices except FID and FIA. For the rest of the variables, for each of them, the β coefficient is negative with a level of statistical significance mostly at 1% (a couple of them at 5 percent). This implies that in terms of overall FD, FI and FM, countries with lower

Table 3 Correlation coefficients

	FD	FI	FM	FID	FIA	FIE	FMD	FMA	FME	LGDP	INF	LTO	LGS	GE	LBF	KAOPEN
FD	1															
FI	0.84	1														
FM	0.85	0.43	1													
FID	0.54	0.83	0.09	1												
FIA	0.56	0.62	0.34	0.2	1											
FIE	0.63	0.55	0.52	0.46	−0.14	1										
FMD	0.83	0.67	0.73	0.58	0.28	0.54	1									
FMA	0.65	0.38	0.72	−0.04	**0.71**	0.02	0.42	1								
FME	0.56	0.09	0.85	−0.23	0.05	0.5	0.35	0.45	1							
LGDP	0.37	**0.56**	0.04	0.42	**0.69**	−0.34	0.27	0.46	−0.34	1						
INF	−0.25	−0.11	−0.25	−0.04	0.08	−0.41	−0.28	−0.02	−0.19	0.16	1					
LTO	0.49	0.39	0.39	0.39	0.05	0.34	**0.66**	0.26	0.06	0.40	−0.26	1				
LGS	0.38	**0.59**	0.04	0.5	0.51	-0.05	0.26	0.33	−0.28	**0.70**	0.07	0.38	1			
GE	0.21	0.48	−0.32	**0.79**	−0.32	**0.58**	0.48	−0.55	−0.44	0.01	−0.4	0.21	0.16	1		
LBF	0.03	0.41	−0.48	0.46	0.21	−0.14	−0.001	0.1	**−0.66**	0.45	0.15	0.04	**0.63**	0.42	1	
KAOPEN	**0.51**	0.31	0.45	−0.13	0.64	−0.11	0.25	**0.68**	0.21	0.3	−0.24	0.22	0.35	−0.48	0.14	1

Source Authors' computation

Table 4 Unconditional β convergence for financial development

	1	2	3	4	5	6	7	8	9
	Dependent variable								
	GD	GI	GM	GID	GIA	GIE	GMD	GMA	GME
FD_{t-1}	**−0.06***** (0.02)								
FI_{t-1}		**−0.04**** (0.02)							
FM_{t-1}			**−0.07***** (0.02)						
FID_{t-1}				**−0.01** (0.01)					
FIA_{t-1}					**0.01** (0.01)				
FIE_{t-1}						**−0.11***** (0.03)			
FMD_{t-1}							**−0.05**** (0.02)		
FMA_{t-1}								**−0.07***** (0.03)	
FME_{t-1}									**−0.07***** (0.02)
Constant	**0.03*****	**0.02*****	**0.04*****	**0.01*****	**0.01*****	**0.07*****	**0.03*****	**0.02*****	**0.05*****

(continued)

Table 4 (continued)

	1	2	3	4	5	6	7	8	9
	Dependent variable								
	GD	GI	GM	GID	GIA	GIE	GMD	GMA	GME
	(0.01)	(0.01)	(0.01)	(0.004)	(0.004)	(0.02)	(0.01)	(0.01)	(0.02)
Chi squared	7.86	5.09	8.73	1.15	0.31	15.62	4.8	7.76	7.75
Prob > Chi^2	0	0.02	0	0.28	0.58	0	0.03	0	0
No. of observations	**190**	**190**	**190**	**190**	**190**	**190**	**190**	**190**	**190**
No. of countries	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**

'*', '**' and '***' denote significance at 10%, 5% and 1%, respectively. Figures in parenthesis are the robust standard errors. All the regressions are estimated with FGLS

Source Authors' computation

financial development have grown faster and vice versa. In terms of FIE too, evidence of convergence is there. The value of significant coefficient ranges between −0.04 and −0.11. If we consider the lowest value, it implies that one point increase in the initial level of development reduces the growth rate of financial development by 0.04 points. When we look at the maximum value, this implies that a 10-point increase in financial development index is likely to reduce the growth rate of that index by 1.1. Among the components, convergence occurs rapidly in financial markets. Among the sub-components of FI, convergence occurs only in terms of efficiency, and the rate of convergence is the highest. On the contrary, in FM, convergence occurs most rapidly in access and efficiency (both −0.07), followed by depth (−0.05).

The results of conditional convergence are presented in Table 5.[5] It is observed that even after incorporating some control variables, there is evidence of convergence for all the indices of financial development barring FIA and FID, as the β coefficient is negative and significant at 1% level of significance (except for FIE, it is negative and significant at 10% level of significance). Interestingly, β coefficient in each of the regressions has increased compared to that of Table 4, implying that the rate of convergence is higher when we control for the effects of other relevant variables. For instance, the coefficient is −0.14 for GD, whereas it is −0.09 for GI and −0.15 for GM. Among the sub-components of financial institutions, evidence of convergence is there only in efficiency (−0.12). However, in all the components of financial market, the rate of convergence is very high, ranging between 0.17 for efficiency and 0.37 for access. If we look at the set of control variables, GDP has a positively significant influence on growth of FD, growth of its component FI and the sub-component access of both FI and FM. Among other variables, inflation has a positively significant impact (at 10% level of significance) on the growth of access of FM.[6] Trade openness has a positive and significant effect on depth of financial markets, but it reduces efficiency in financial market. On the other hand, KAOPEN has a significant negative impact on growth of overall FD, FM and depth of FM among the sub-components. However, the negative impact of business freedom on growth of FIA may possibly be explained by more efficient regulations leading to developments of other financial institutions other than banks. Government effectiveness reduces the growth of FM and growth of its sub-components access and efficiency. One of the factor might be that with more GE, investors may shift to many other asset markets from stock market, and thus, it leads to the negative effect.

From the set of regressions where the two correlated variables GDP and BF are dropped, but rest of the variables are taken as independent variables including GS, it is observed that GS has a positive and significant impact on growth of FD and FMA. The effect of rest of the variables remains qualitatively the same as in Table 5, and hence, the results are not presented here.

[5] Since data on control variables for some years for certain countries were not available, the number of observations is less.

[6] As per the definition of FMA, the positive impact possibly implies that investors and corporations seek new avenues as there is erosion in their wealth.

Table 5 Conditional β convergence for financial development

FD_{t-1}	1	2	3	4	5	6	7	8	9
	Dependent variable								
	GD	GI	GM	GID	GIA	GIE	GMD	GMA	GME
	−0.14*** (0.04)								
FI_{t-1}		**−0.09***** (0.03)							
FM_{t-1}			**−0.15***** (0.05)						
FID_{t-1}				**−0.02** (0.02)					
FIA_{t-1}					**−0.04***** (0.03)				
FIE_{t-1}						**−0.12*** (0.07)			
FMD_{t-1}							**−0.26***** (0.06)		
FMA_{t-1}								**−0.37***** (0.08)	
FME_{t-1}									**−0.17***** (0.05)
$LGDP_{t-1}$	**0.01****	**0.01*****	**0.01**	**0.0003**	**0.02*****	**−0.01**	**0.01**	**0.03*****	**0.01**

(continued)

Table 5 (continued)

FD_{t-1}	1	2	3	4	5	6	7	8	9
	Dependent variable								
	GD	GI	GM	GID	GIA	GIE	GMD	GMA	GME
	−0.14***								
	(0.04)								
	(0.01)	−0.01	(0.01)	(0.004)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
INF_{t-1}	**−0.01**	**0.04**	**−0.04**	**0.01**	**0.05**	**0.1**	**−0.04**	**0.19***	**−0.23**
	(0.05)	(0.04)	(0.08)	(0.04)	(0.05)	(0.12)	(0.14)	(0.11)	(0.20)
LTO_{t-1}	**−0.004**	**0.0001**	**−0.01**	**−0.002**	**0.01**	**−0.001**	**0.06****	**−0.0002**	**−0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
GE_{t-1}	**−0.01**	**0.01**	**−0.04***	**0.01**	**−0.01**	**0.03**	**0.02**	**−0.05***	**−0.09***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)	(0.05)
LBF_{t-1}	**0.004**	**−0.003**	**0.01**	**0.02**	**−0.05*****	**0.03**	**0.005**	**0.03**	**−0.05**
	(0.02)	(0.01)	(0.03)	(0.02)	(0.02)	0.04	0.06	(0.04)	(0.08)
$KAOPEN_{t-1}$	**−0.05****	**−0.01**	**−0.09****	**−0.004**	**−0.03**	**0.01**	**−0.13***	**0.06**	**−0.15**
	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)	(0.06)	(0.07)	(0.06)	(0.10)
Constant	**−0.01**	**−0.09**	**0.12**	**−0.09**	**0.04**	**−0.04**	**−0.21**	**−0.13**	**0.80****
	(0.06)	(0.06)	(0.12)	(0.06)	(0.06)	(0.14)	(0.18)	(0.14)	(0.34)

(continued)

Table 5 (continued)

FD_{t-1}	1	2	3	4	5	6	7	8	9
	Dependent variable								
	GD	GI	GM	GID	GIA	GIE	GMD	GMA	GME
	−0.14* **								
	(0.04)								
Chi squared	18.1	17.25	17.69	4.45	34.21	12.71	21.28	26.29	15.08
Prob > Chi^2	0.01	0.02	0.01	0.73	0	0.08	0	0	0.04
Observations	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**
No. of countries	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**

‘*’, ‘**’ and ‘***’ denote significance at 10%, 5% and 1%, respectively. Figures in parenthesis are the robust standard errors. All the regressions are estimated with FGLS

Source Authors’ computation

6 Conclusion

The present chapter makes an attempt to figure out whether in emerging economies like the BRICS economies the pace of growth in financial development was similar across the BRICS economies before and after their financial liberalization and whether more financially developed economies grow more or less compared to less financially developed economies. The chapter is based on a panel dataset on financial development indexes on the access, depth and efficiency of financial institutions and markets for the period of 1980 to 2018 for the BRICS countries. Since the patterns of development in these countries over time indicate the possibility of convergence in financial development, unconditional and conditional beta convergence are tested.

The study yields some interesting insights. *First*, evidence suggests that there is both unconditional and conditional beta convergence for overall financial development and its components, viz. financial institutions and markets. *Second*, the convergence is the fastest in case of financial markets, more specifically, access to financial markets followed by depth and efficiency of financial markets. Convergence is the slowest in case of access to financial institutions. This implies that in BRICS economies, convergence is more prominent in development of financial markets compared to financial institutions. *Third*, after controlling the effects of macroeconomic variables and variables related to financial liberalization, if a country has one point higher level of initial financial development, its growth of financial development, on an average, reduces to around 0.14 points, which is no way, meager. Similarly, growth of financial institutions declines by 0.09, and financial markets decline by 0.15 points with a single point in initial level of financial development. *Fourth*, the effect of financial liberalization on financial development, more specifically on depth of financial markets, is negative when it is measured in terms of capital account openness. However, trade openness leads to higher growth in depth and efficiency of financial markets. *Fifth*, among the macroeconomic variables, higher GDP also contributes positively to growth of financial development. Higher government spending, too, contributes to higher growth of financial development. *Sixth*, given the fact that India is a lower middle income country among BRICS whereas others are upper middle income countries, the evidence of convergence implies that India is catching up quite fast with the rest of them in terms of financial development, especially the development of financial markets.

The study is conducted on the BRICS economies in this chapter. It can be extended by incorporating a number of other emerging markets in Asia and Latin America to find out whether the convergence observed here holds.

Appendix

See Table 6.

Table 6 Key reforms in financial sectors in BRICS

	Brazil	Russia	India	China	South Africa
Deregulation of interest rates in banks	1988	–	1994–2000	1999–2004	1980
Allowing Foreign Portfolio Investment	1987–1991	1999	1993	2002	–
Relaxing FDI restrictions	1991	1994	1991	1983	–
Implementation of prudential norms in Banking	1994	2003–2004	1992	2010	–
Opening up of stock markets (depository receipts, etc.)	1996–1999	–	2010	2018	2004
Allowing entry of foreign/new foreign banks	1997	–	1994	2006	–
Foreign exchange reforms	2005	2006	1993–1997	1994	1995

Note: Blank cells indicate either the exact years are not available or the information on that measure is not available; it does not mean that those have not taken place. For further details, refer to Boxes 1 to 5

Source Authors' compilation

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Financial Intermediation: Banks and NBFCs

Sectoral Growth and Sectoral Credit: Panel Evidence from Indian States

Samaresh Bardhan and Rajesh Sharma

1 Introduction

Existing literature on finance–growth nexus considers aggregate credit a prominent indicator of financial intermediary development, which has a large, positive, and robust impact on economic growth (Beck & Levine, 2004; Beck et al., 2000; King & Levine, 1993; Levine et al., 2000). Theoretical models with endogenous financial intermediation mainly focus on firm financing having implications for investment, specifically for firms facing financial constraints connected to investment opportunities or temporary liquidity needs (Gertler & Gilchrist, 1994; Gilchrist & Himmelberg, 1995; Hubbard, 1998; Whited, 1992). Essentially, financial intermediaries become instrumental in mitigating asymmetric information through better structure and efficiency of lending contracts. This, in turn, promotes better allocation of resources and growth, thereby increasing financial intermediation efficiency. Existing empirical literature based on cross-country growth regressions mainly considers aggregate credit comprising mostly firm credit and household credit as measures of financial

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S. Bardhan (✉)
Department of Humanities and Social Sciences, Indian Institute of Technology, Ropar, Punjab, India
e-mail: samaresh@iitrpr.ac.in

R. Sharma
University School of Management and Entrepreneurship, Delhi Technological University, Vivek Vihar-Phase II, Delhi, India
e-mail: rajesh.sharma@dtu.ac.in

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development (Rajan & Zingales, 1998). Pagano (1993), however, mentions explicitly that empirical studies on finance–growth relationship overlook the fact that effects of finance on growth can vary depending upon markets in which it acts.

However, focus on firm credit as an instrument of financial intermediation in growth is thought to shift to other forms of credit such as household credit or credit to service sector as it happens in many countries since the 1990s (Beck et al., 2012). Oikarinen (2009) finds that deregulation in Finland's banking system since the late 1980s led to household credit growth and increased demand in the housing market. In cross-country context, Beck et al. (2012) observe that household credit has increased over time, and banks lend more to households than firms in several countries. The literature, however, provides mixed evidence of the effect of this growth of household credit on aggregate or sectoral growth. Galor and Zeira (1993) and Banerjee and Newman (1993) show that household credit, in the form of microcredit, fosters economic development as it leads to an increase in human capital accumulation through greater access to credit to the poor. Beck et al. (2008), on the other hand, have shown that while firm credit enhances economic growth, the effect of household credit, however, is not statistically significant.

In developing countries (e.g., India), scheduled commercial banks (SCBs) play a significant role in the financial intermediation and constitute the primary source of saving mobilization and financing investments. A shift in credit distribution in favor of a vast range of informal sector activities and underdeveloped regions and states helped widen the economy's demand base and contributed to a more dispersed sectoral and regional growth during the 1980s. However, during the 1990s, even with financial sector reforms, banks were reluctant to extend credit to different sectors such as agriculture, small-scale industries, and individual borrowers. In India, SCBs were faced with weaknesses in operations following enormous growth of banking activities until the 1990s and subsequent reform measures, which continued until 2002–2003. One significant development in the process of financial intermediation during last two decades is that credit to household and service sector significantly increased, following a notable increase in demand for housing, other retail loans, and also a significant growth of service sector (RBI, 2006). During first half of the 2000s, long-term loans increased only for household credit, and half of the household credit was meant for housing, and rest to meet the demand of consumer durables (excluding education loans) (EPWRF, 2008). Agricultural credit significantly increased during the 1980s, followed by a sharp deceleration in the 1990s, and gained momentum again during first half of 2000, following a series of policy initiatives taken by India's central bank (EPWRF, 2008). Share of agriculture in total bank credit had increased due to bank nationalization, reached 18% toward the end of the 1980s, and declined to less than 10% by the late 1990s. Consequently, the number of farm loan accounts with SCBs reduced from 27.74 million in March 1992 to 20.84 million in March 2003 (Shetty, EPW, 2004); however, bank credit to the industrial sector slowed down during mid-1990 following demand slowdown due to recession in industrial sector.

The distribution of growth across sectors also appeared to be uneven. The growth rates of agricultural and industrial sectors declined from 3.54% and 7.10% to 2.69% and 5.68%, respectively, during the 1980s and 1990s (Bhattacharya & Kar, 2004). In contrast, the service sector registered a sharp increase from 6.76% to 7.69% during the 1980s and 1990s, respectively (Bhattacharya & Kar, 2004). These different growth episodes across sectors also led to noticeable changes in sectoral composition of output, with agriculture share declining from 40% in 1980 to 24% in 2000, and share of industry going up from 24 to 28% (Bhattacharya & Kar, 2004). In contrast, share of service sector rose remarkably from 31 to 47%. These shifts in financial intermediation and sectoral composition in aggregate GDP over recent decades are supposed to have significant implications for changing role of financial intermediation in sectoral growth. Against this background, this chapter is motivated by following observations.

First, since most empirical studies use highly aggregated financial development variables such as the ratio of private sector credit to GDP (King & Levine, 1993; Rioja & Valev, 2004), it becomes difficult to disentangle different growth effects of various credit components on specific markets (Pagano, 1993). For instance, in many countries, the importance of household credit has increased over time, and banks lend more to households than businesses. Büyükkarabacak and Valev (2010) found that household credit growth raises debt levels without affecting long-term income that can potentially lead to a banking crisis. Authors also contend that expansion in firm credit also precipitates the banking crisis, but to a lesser extent. Literature also reveals that some forms of financial development may not be conducive to faster growth. Jappelli and Pagano (1994), for instance, contend that availability of household credit smooths out consumption over time and may well reduce growth rate via reduced savings. In contrast, bank lending to firms is more likely to promote growth, thereby enhancing firms' capital accumulation and productivity. In support of this observation, Levine (2005) also explains that through firm financing, financial system enhances physical capital accumulation, productivity, and economic growth by reducing transaction costs and information costs.[1]

Second, the sectoral credit implications in financial intermediation and growth in the corresponding sector and aggregate growth are less scrutinized in India, which can have important theoretical implications. Beck et al. (2012) point out that while a particular component of credit such as household credit exerts an independent effect on growth, this observation provides a particular direction about how theory should model finance–growth relationship. In Indian economy, bank credit to household and service sector substantially increased during last few decades following the boost in demand in these sectors. These shifts in credit composition are expected to cause massive changes in production–demand linkages among different sectors and, in turn, could have enormous ramifications for long-term development of Indian economy.

Third, while there is vast existing literature on growth and financial intermediation in cross-country context, empirical studies on financial intermediation's role at sub-national level, particularly in a developing economy (e.g., India), seem to be quite inadequate. Although Indian states have long shared common institutions and national economic policies, states are different in terms of stages of economic and financial development apart from geographic and demographic diversities. Since

[1] See also Islam and Mozumdar (2007) that also explain important role of firm financing on private investment.

independence, regional disparities in economic development drew a great deal of attention, and emphasis was placed on regional convergence/divergence of income per capita. Subsequently, greater emphasis was placed on changes in sectoral composition. However, there are fewer attempts to scrutinize the issues related to sectoral growth and financial intermediation across sectors at the sub-national level. Moreover, disaggregating total bank lending into its various components such as agriculture, industry, and service can explain the role of financial intermediation in growth process. It is also expected to provide valuable insights into channels through which financial development fosters economic growth.

Finally, in Indian economy, there have been significant changes in financial intermediation over last few decades, thanks to several reform measures introduced in Indian banking in the early 1990s; these reforms were expected to improve the allocative efficiency of resources through improved financial viability, operational flexibility, and strengthening of institutions (Mohan, 2007). Consequently, these were expected to change the composition of credit across different sectors in the economy and hence sectoral growth, given that bank credit is the dominant source of finance across different sectors in the Indian economy.

Against this backdrop, we aim to address the following questions in this chapter: Has the growth been evenly percolated across sectors at sub-national levels over pre-reform and post-reform periods? What explains the uneven pattern of growth across Indian states? How is sectoral allocation of credit related to sectoral growth in Indian economy at sub-national level? We attempt to critically appraise the issues mentioned above across Indian states during 1981–2019, encompassing both pre-liberalization and post-liberalization periods.

This chapter aims to contribute to finance–growth literature in regional context in India in following ways. **First**, this chapter is the most comprehensive attempt to analyze role of various bank lending components in financial intermediation process across Indian states. Unlike previous studies at the sub-national level, it explores the interrelationship between sectoral growth and sectoral composition of credit during last four decades across Indian states. It closely resembles Beck et al. (2012) in a cross-country context, which categorizes total credit for each country as aggregate of industrial credit and personal credit; our study, however, uses disaggregated data across Indian states by taking into account the role of service sector credit, industrial credit, and agriculture credit.[2] **Second**, unlike previous studies in cross-country context, which suffers from heterogeneity in definitions of various credit components such as firm credit and household credit across countries, this chapter considers sectoral composition of bank credit within a homogenous country, by definition. This observation seems to be an improvement over similar studies in cross-country context. **Third**, we employ panel data structure corresponding to a sufficiently long period (1981–2019), which might help us capture credit growth relationship

[2] However, we could not consider the sources of state-level growth such as physical capital accumulation and total factor productivity in this study, as state level is not available. For an excellent review on the sources of India's economic growth and also growth in different sectors, see Bosworth et al. (2007).

dynamics across different sectors of state economies in different periods. **Finally**, we employ panel generalized method of moments (GMM) methods that incorporate lagged growth in growth regression and also control for potential endogeneity of regressors and heterogeneity in states.

This chapter is presented in the following sections. Section 2 provides a brief snapshot of relevant literature. Section 3 provides certain facts about the movement of sectoral growth and sectoral credit across Indian states during last four decades. Section 4 describes data and methodology. Section 5 presents the findings, ensuing discussions, and Sect. 6 provides conclusions.

2 Background Literature

Beck et al. (2012) analyzed effects of sectoral credit, particularly household credit and enterprise credit, on economic growth and inequality across a sample of 45 countries. They find that firm credit affects per capita income, while household credit does not. Financial deepening may cause inefficient capital allocation across incumbent and new firms, fostering structural change, higher growth, and lower-income inequality, and these effects are more likely to be captured by enterprise credit (Beck et al., 2010; Gine & Townsend, 2004). In contrast, Galor and Zeira (1993) and Banerjee and Newman (1993) postulate that microcredit to households fosters economic development as it increases human capital accumulation through greater access to credit by the poor. Literature on microfinance also focuses on the role of small consumption loans and loans for investment to microenterprises (Karlan and Morduch, 2010; Mahjabeen, 2008).

Demetriades and Luintel (1997) examined finance–growth nexus at an aggregate level and observed that restrictive policies adversely affect financial deepening and negatively affect growth. Misra (2003) analyzed bank credit–output relationship in 25 Indian states during 1981–2000 and observed a long-term relationship between credit and output in 19 states, and output granger causes credit for most Indian states, indicating the importance of credit absorptive capacity in credit flow across different states of India. Sehrawat and Giri (2015) examined finance–growth nexus in 28 Indian states during 1993–2012 and found a granger causal relation from per capita credit and per capita deposit to economic growth. Nain and Kamaiah (2014), using aggregate data, find no evidence of causality between India's financial development and economic growth. Sharma and Bardhan (2017) looked into finance–growth nexus across Indian states during 1981–2012 and observed bidirectional causality between financial development and economic growth in the absence of cross-sectional dependence (CSD). In the presence of CSD, however, evidence in support of demand following hypothesis was observed. Bardhan and Sharma (2019) examined the finance–growth nexus in Indian districts and found critical role of financial development in growth of Indian districts.

Few studies exclusively focused on regional divergence of credit distribution across Indian states. Das and Maiti (1998) found no evidence of credit migration.

Chatterjee et al. (1997) found that major states' credit migration had become more uniform from 1974 to 1994, whereas Dhal (2012) found evidence of asymmetry in credit and bank lending channels of monetary policy transmission across different states. Herwadkar and Ghosh (2013) examined credit inequality across Indian states over 2004–2012 and considered various state-specific factors such as financial deepening and physical infrastructure development. The study observed that those states with higher deposits, improved infrastructure, and banking networks tend to attract more credit than other states.

3 Movement of Sectoral Growth and Sectoral Credit

3.1 Sectoral Growth: Few Observations

Prior to the 1980s, Indian economy went through a phase of dismal growth due to several restrictions on the establishment and expansion of industry, barriers to entry, high tariffs, and import controls. However, trade and industrial reforms initiated in the 1980s resulted in a fundamental shift in Indian economy's thrust, which used to be dominated by agriculture and gradually turned into a service-led economy during the 1990s. Gordon and Gupta (2005) showed that high growth in service sector in the 1990s was mainly due to rapid expansion of banking, business, communication, and community services. From demand side, high-income elasticity of demand for services, increasing input usage of services by other sectors, and rising exports became instrumental in a surge in services growth in the 1990s; from supply side, reforms and technological advances played critical roles. With these sectoral changes, the resulting shift in GDP composition is also likely to cause notable changes in production and demand linkages among various sectors, which have significant ramifications for growth and development (Rakshit, 2007; Sastry et al., 2003). Disruption in credit delivery system and severe infrastructural bottlenecks is thought to undermine agriculture and industry performance. Therefore, efficient disbursement of credit and adequate infrastructure provision were thought to play the most crucial role in enhancing agriculture and industrial sectors' productivity during the post-1990s reforms (Rakshit, 2007).

As far as growth across states is concerned, we observe a remarkable turnaround in average economic growth across states in the 1990s and decade of 2000 and thereafter (Table 6 in appendix). Figure 1 plots average growth of sectoral GDP for sample states in the study period. We observe that while service sector growth has been entirely stable, agriculture growth has been quite volatile. On the other hand, industrial sector growth also exhibits an increasing trend during entire study period, albeit with a few fluctuations. The service sector is considered to be the driver of economic growth in Indian economy (Bosworth et al., 2007), and its growth is expected to continue, whereas agriculture sector requires substantial reforms.

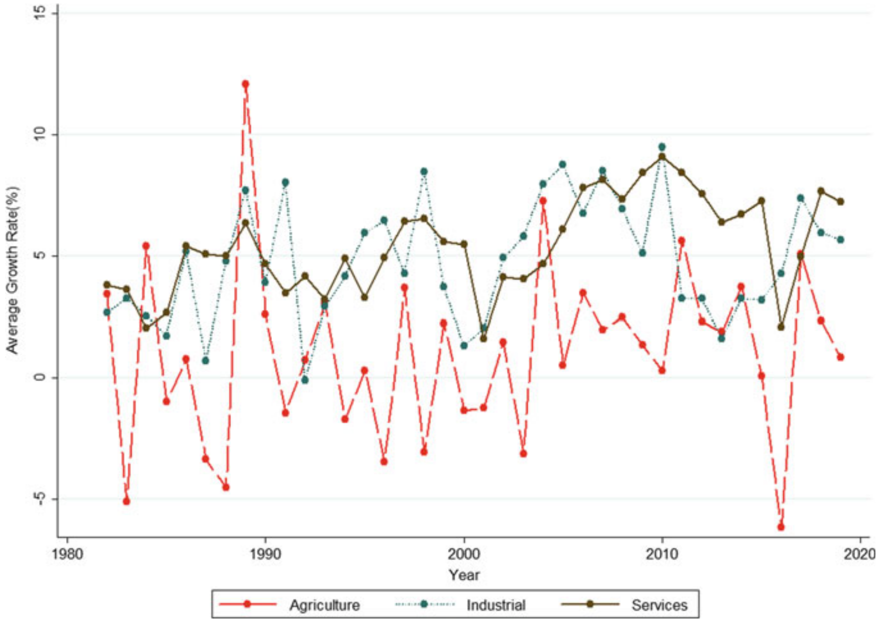

Fig. 1 Temporal patterns of average sectoral annual growth, 1981–2019. *Data Source* CMIE, States of India

3.2 Sectoral Credit: Few Observations

We observe a surge in industrial credit up to the beginning of the 1990s, and credit to industrial sector slowed since the mid-1990s than that in the 1980s. The slowing in bank lending to industry was mainly attributed to banks' reluctance to extend loans and increased reliance of businesses on internal funds (e.g., retained earnings) (RBI, 2006). High level of nonperforming assets (NPAs), in particular, might have encouraged banks to focus more on retail portfolio, which resulted in rapid credit expansion to personal credit in housing, and other retail loans during the 1990s and 2000s (RBI, 2008). Until the early 1990s, there were many restrictions on disbursal of personal loans, which were relaxed under the financial reforms of the 1990s and SCBs were given autonomy to decide loans-related conditions such as quantum of loan, interest rate, margin requirement, and repayment period. The credit growth of agricultural sector during the 1990s slowed down to almost half of the 1980s, and this trend reversed during the 2000s due to RBI's concerted efforts to increase credit flow to agriculture.

Agricultural credit is recorded to be the lowest at 0.96% of GSDP in northeastern state of Arunachal Pradesh; however, it is recorded to be 8.26% of GSDP in Punjab, which is considered to be agriculturally developed state (Table 1). Table 1 also reveals that except a few northeastern states, industrial credit as %age of GSDP is the highest

Table 1 Constituents of credit as percent of GSDP

State	Agriculture credit	Industrial credit	Service credit
Andhra Pradesh	7.29	12.2	6.12
Arunachal Pradesh	0.96	2.9	2.75
Assam	1.58	4.41	3.18
Bihar	3.78	3.85	4.62
Goa	1.3	12.08	11.16
Gujarat	3.16	14.89	4.3
Haryana	5.6	10.28	4.91
Himachal Pradesh	2.8	5.82	4.54
Jammu & Kashmir	1.96	5.54	10.5
Karnataka	6.93	15.17	8.41
Kerala	5.16	6.61	9.3
Madhya Pradesh	5.46	7.35	5.33
Maharashtra	2.91	28.93	20.07
Manipur	1.26	1.37	1.9
Meghalaya	1.75	4.29	2.72
NCT of Delhi	4.04	59.59	36.41
Nagaland	1.03	1.71	1.69
Odisha	3.27	5.84	7.1
Puducherry	4.08	7.24	4.84
Punjab	8.26	12.27	7.4
Rajasthan	5.33	7	3.85
Sikkim	1.13	4.25	4.73
Tamil Nadu	6.2	17.97	9.47
Tripura	2.32	1.64	3.74
Uttar Pradesh	5.64	6.53	4.28
West Bengal	2.04	14.8	6.25

Notes Average values of credit and various constituents as proportion of GSDP over 1981–2019 are reported

Source Data are compiled from center of monitoring Indian economy (CMIE), and percentages are authors' calculations from raw data among all components, and agricultural credit as %age of GSDP has been the lowest except for few states predominantly based on agriculture.

4 Data and Methodology

4.1 Data Source and Variables

Based on consistent data availability, we use an unbalanced panel data set comprising 26 states including union territories for 1980–1981 to 2018–2019. We considered three major bank credit components: agriculture, industrial, and service sector.[3] To analyze the effects of these different credit components, we consider sectoral output separately such as agriculture, service, and industrial GSDP per capita (at 2004–2005 prices).[4] We also use a set of control variables[5]: inflation proxied by GSDP deflator, infrastructure (INFRA) proxied by length of roads and railways/100,000, and ratio of government expenditure to GSDP (GOV) (Table 7 of appendix). Although INFRA is not a perfect measure of infrastructure facilities in a state, it does provide information about relative stages of development of key infrastructure, i.e., roads and railways.[6] Previous studies support the view that states may be diverging because of varying levels of infrastructure facilities (Basu & Maertens, 2007).

Table 2 presents descriptive statistics. It appears that average growth rate of agricultural GSDP per capita has been little more than 1%, whereas growth rate of industrial and service sector output exceeds 5%. Table 2 also reveals that variability in growth rate is highest (11%) in agriculture, whereas it is the lowest (4.63%) in service sector.

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[3] Various sub-components of credit for which data are available are: agriculture credit, industrial credit, transport services, professional services, trade, finance, personal services, and miscellaneous. To arrive at aggregate figure of service credit, we add up data pertaining to transport services, professional services, trade, and finance.

[4] We considered natural logarithm of credit to control for potential non-linearity and outlier effect.

[5] Choice of covariates is governed by data availability. State-level data of many of the relevant variables such as investment/GSDP, consumer price inflation, and school enrolment ratio are not consistently available. Even if some data are available for certain period of time during our investigation, data may not be reliable as well. Owing to these, we choose those control variables for which data are mostly available and these variables are expected to exert influence on economic growth consistent with theoretical predictions and also in conformity with previous empirical literature in cross-country and sub-national context.

[6] Roads and railways also constitute the most important vehicle of inter- and intrastate trade. Therefore, states having good network of roads and railways are expected to grow faster.

Table 2 Summary statistics

Variable	No. of observations	Mean	Std. dev.	Min	Max
AGRI_GR	882	1.1173	11.0774	−65.2533	87.2822
INDUS_GR	884	4.9002	9.2794	−71.3507	99.1695
SERVICE_GR	886	5.5548	4.63	−32.5856	29.6364
CR_AGRI	918	1.013	0.8325	−2.2266	2.8064
CR_INDUS	916	1.9088	1.0201	−1.3063	4.8369
CR_SERVICE	904	1.5815	0.8398	−0.9536	4.3713
Inflation	892	6.6699	8.5496	−9.3042	233.9814
GOV	774	26.5112	20.3259	3.3555	181.822
Infra	868	445.2419	342.3428	75.813	2398.166
RAINFALL	852	1463.268	900.1945	6.2	4452

Source Authors' calculations based on data retrieved from Centre for Monitoring Indian Economy (CMIE) database. The variable definitions are provided in Table 7 of appendix. Calculations are done using STATA 14 econometric software

4.2 Econometric Methodologies

Our model of credit growth relationship is structured on Barro-type basic growth regression model as per the following regression:

$$\Delta Y_i = \beta_1 Y_0 + \beta_2 C_i + \gamma X + \varepsilon_i \tag{1}$$

where ΔY_i is per capita economic growth of ith state, C_i represents credit disbursement in ith state, and X is a set of relevant state-specific control variables. Islam (1995) suggests using panel estimation techniques to overcome the restrictive assumption of identical production function in Eq. (1); therefore, we consider growth model in a dynamic panel data framework as follows.

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta' X_{i,t} + \mu_i + \varepsilon_{i,t} \tag{2}$$

where i indexes state and t indexes time, respectively. $Y_{i,t}$ indicates the growth rate of GSDP per capita of ith state. μ_i denotes individual state-specific fixed effects, and $\varepsilon_{i,t}$ denotes the stochastic disturbance term. Since $Y_{i,t-1}$ in Eq. (2) is correlated with error term, ordinary least squares estimation yields biased and inconsistent estimates due to dynamic effects (Nickell, 1981). Therefore, we apply GMM estimators (Arellano & Bond, 1991), which take care of unobserved heterogeneity and endogeneity issues that arise due to lagged dependent variable in the regression. In our empirical analysis, we report system GMM estimation results (Arellano & Bover, 1995), which combines a regression in differences with one in levels, which has lower potential bias in finite samples and also reduces asymptotic inaccuracy (Blundell & Bond, 1998).[7]

First-difference GMM begins with taking difference of Eq. (2) to eliminate unobserved fixed effects as follows:

$$Y_{i,t} - Y_{i,t-1} = \alpha\left(Y_{i,t-1} - Y_{i,t-2}\right) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (3)$$

First-differencing eliminates unobserved state-specific effects; it, however, introduces a new bias because error term $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ now is correlated with $Y_{i,t-1}$. However, this issue can be dealt by using additional instruments $Y_{i,t-s}$, where $s \geq 2$ assuming that $\varepsilon_{i,t}$ is serially uncorrelated. This is because $Y_{i,t-2}$ is correlated with $\left(Y_{i,t-1} - Y_{i,t-2}\right)$ but uncorrelated with $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ for $t = 3 \ldots T$. Using $Y_{i,t-s}$ as additional instruments provides the following moment conditions.

$$E\left[Y_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \text{ for } s \geq 2, \quad t = 3, 4 \ldots T \quad (4)$$

Other potential sources of bias are endogeneity of regressors and their correlation with error term, which may result in biased coefficient estimates. For instance, higher economic growth may lead to better financial service. Other variables such as inflation and government expenditure may also be influenced by economic growth. In GMM estimation framework, the variables can be treated as endogenous, predetermined (weakly exogenous), and strictly exogenous. In case of strictly exogenous regressors, the following moment conditions can be employed.

$$E\left[X_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \text{ for all s}, \quad t = 3, 4 \ldots T. \quad (5)$$

The weakly exogenous explanatory variables are instrumented using the following moment conditions.

$$E\left[X_{i,t-s}\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\right] = 0 \text{ for } s \geq 2, \quad t = 3, 4, \ldots T. \quad (6)$$

If X is allowed to be endogenous, these variables are correlated with past and contemporaneous error terms such that $\left(X_{i,t}\varepsilon_{i,s}\right) \neq 0$ for $s \leq t and (X_{i,t}\varepsilon_{i,s}) = 0$ for $s > t$. Since $\left(X_{i,t}\varepsilon_{i,s}\right) \neq 0$, $X_{i,t-1}$ is no longer a valid instrument in first-difference model, and valid instruments in this model would be $X_{i,t-2}X_{i,t-3}, \ldots$ and so on.

However, original Arellano and Bond estimator explained above suffers from a problem that the explanatory variables' lagged levels are often poor instruments for first difference. This issue, however, can be resolved using original equations in levels simultaneously along with difference equations, which generate additional moment conditions, leading to an increase in the resulting estimators' efficiency (Arellano &

[7] Estimation results based on difference GMM were also generated and are reported in appendix. The two sets of results are similar in terms of sign and statistical significance of different components of credit. It, however, differs in terms of magnitude of slope coefficient on different components of credit.

Bover, 1995). In these equations, weakly exogenous variables in levels are instrumented using suitable lags of their first difference. The same set of instruments is used for the difference equation in the systems approach; the equation in levels, however, is instrumented by lagged differences of corresponding variables. Additional moment conditions for 2nd part of system estimation (level equation) are as follows.

$$E\left[\left(Y_{i,t-s} - Y_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \; for \; s = 1 \tag{7}$$

$$E\left[\left(X_{i,t-s} - X_{i,t-s-1}\right)\left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \; for \; s = 1 \tag{8}$$

The consistency of the GMM estimators depends on the validity of instruments and the assumption that error terms are not serially correlated. The validity of instruments is verified using Hansen's test of over-identifying restrictions rather than Sargan test (1958), as Sargan test is claimed to be not robust to heteroscedasticity or autocorrelation. Following Roodman (2009), we report Hansen J statistic for one-step, robust estimation, which is the minimized value of two-step GMM criterion function and is robust. We also restrict the number of instruments using only four lags as instruments. The absence of serial correlation in error term is confirmed using Arellano and Bond test (1991).

5 Estimation Results and Discussion

Correlation matrix (Table 8) shows that different constituents of credit and control variables are moderately correlated that rules out misspecifications due to perfect multicollinearity. The system GMM results are presented in Tables 3, 4, and 5. Table 3 shows that industrial credit exerts a significant effect on industrial sector growth only in sub-periods 1 and 3. However, in the decade of the 1990s, industrial credit did not exert significant effect on industrial growth. These observations are consistent with general trend in credit market and growth performance during the period under investigation. Panagariya (2004) argued that growth in the 1980s was higher than preceding years but was fragile and culminated in a crisis in the early 1990s.

One significant development of Indian credit market is that during post-liberalization period from 1991 onward, there has been a sharp deceleration in credit flowing to industrial sector (see Fig. 2). One possible reason for this is slow growth rate of credit to small and medium enterprises (SMEs), an essential component of the priority sector lending program. Lack of credit information, broadening of definition of priority sector, and relatively higher interest rates charged to SMEs than large corporations are few plausible reasons behind slow pace of expansion of credit to SMEs.[8] Moreover, until the mid-1990s, Indian banking sector was plagued

[8] Emphasizing importance of micro, small and medium enterprises (MSME) sector in Indian economy, Salwan (2012) notes that MSME sector accounts for 45% of manufacturing output in

Table 3 System GMM result of industrial growth and industrial credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth($t-1$)	−0.0112	−0.3161***	−0.0643	0.0934
	(0.0908)	(0.0488)	(0.1267)	(0.1313)
INFLATION	0.0165	−0.5352***	−0.3056*	0.0589***
	(0.0477)	(0.2062)	(0.1590)	(0.0109)
CR_INDUS	0.9873	5.0354**	−1.9626	2.7903**
	(1.6633)	(2.2087)	(3.7343)	(1.4385)
GOV	−0.0483	–	0.0848	−0.3011***
	(0.0876)	–	(0.1876)	(0.1346)
INFRA	0.0020	0.0041	−0.0077	0.0100***
	(0.0027)	(0.0029)	(0.0049)	(0.0036)
AR(2) test p-value	0.654	0.052	0.349	0.987
Hansen test p-value	0.314	0.484	0.248	0.423
No. of obs	700	174	224	374
No. of instruments	22	17	22	22

Notes */**/*** denote statistical significance at 10/5/1% level, respectively. Full period corresponds to 1980–1981 to 2018–2019. Sub-period 1 corresponds to the period from 1980–1981 to 1990–1991. Sub-period 2 covers the period from 1991–1992 to 2000–2001, and sub-period 3 covers the period from 2001–2002 to 2011–2019. Standard errors are heteroscedasticity corrected robust errors and are presented in parentheses. GOV is not considered as one of the regressors in first sub-period as observations on GOV for each cross section are only available from 1985 to 1986 and including this variable in regression reduces number of observations in first sub-period considerably. Variable definitions are provided in Table 7
Source Authors' computation

with inefficiencies, which got reflected in a higher incidence of NPAs (Bardhan & Mukherjee, 2016). Therefore, credit growth during this period did not exert any significant positive effect on industrial growth.

However, from 2001 to 2019, we observed a positive and significant effect of industrial credit on industrial growth. Comparing coefficient estimates of industrial credit on industrial growth in sub-period 1 and sub-period 3, we find that it is much less in later period (2.79) than in period 1 (5.04). In fact, we observe two different phases of credit growth in sub-period 3. Until global financial crisis (GFC), we observed rising credit growth trends, coupled with fast economic growth. These high growth episodes in pre-crisis period were attributable to integrated effect of reforms initiated during the 1990s and early 2000, leading to growth acceleration across sectors, except agriculture. Due to 2008–2009 GFC, Indian economy slowed down, which manifested in a slowdown of credit, investment, and manufacturing. However, recovery from GFC-induced deceleration has been slower in parts of Indian economy and pace of credit and economic growth remained subpar in all sectors.

2007–08 and 40% of Indian exports. The importance of MSME sector in employment generation is evident from fact that it employs 60 million (approximately) in 26 million units (Salwan 2012).

Table 4 System GMM result of agriculture growth and agriculture credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth($t-1$)	−0.2974***	−0.3840***	−0.2319	−0.3503***
	(0.1050)	(0.0334)	(0.2383)	(0.1026)
INFLATION	−0.0331	−1.1397***	−0.5231**	0.0280**
	(0.0598)	(0.3519)	(0.2551)	(0.0112)
CR_AGRI	0.4664	−2.5521	3.7982	−0.0468
	(1.8091)	(2.2539)	(6.1223)	(2.4403)
GOV	−0.2370**	–	−0.1636	−0.0812
	(0.1019)	–	(0.1131)	(0.0834)
Infra	0.0045	−0.0053	−0.0072	0.0009
	(0.0039)	(0.0050)	(0.0179)	(0.0031)
Rainfall	0.0028**	0.0007	0.0041	0.0020
	(0.0013)	(0.0010)	(0.0026)	(0.0014)
AR(2) test p-value	0.107	0.199	0.156	0.039
Hansen test p-value	0.616	0.208	0.203	0.454
No. of obs	606	174	217	280
No. of instrument	23	18	18	23

Notes As in Table 3. Variable definitions are provided in Table 7
Source Authors' computation

Table 5 System GMM result of services growth and services credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth(t-1)	0.0341	−0.0186	−0.0637	0.0679
	(0.0632)	(0.0903)	(0.0974)	(0.0835)
INFLATION	−0.0321	−0.3434***	−0.5421***	0.0050
	(0.0372)	(0.1191)	(0.1573)	(0.0103)
CR_SERV	1.6351***	2.0017	2.5174	4.0922***
	(0.6284)	(1.4205)	(2.0770)	(1.1063)
GOV	0.0218		0.1498*	−0.1471*
	(0.0275)		(0.0846)	(0.0825)
INFRA	0.0005	0.0016	−0.0023	0.0054***
	(0.0009)	(0.0017)	(0.0024)	(0.0020)
AR(2) test p-value	0.072	0.748	0.163	0.341
Hansen test p-value	0.344	0.328	0.262	0.291
No. of obs	700	174	221	377
No. of instruments	22	17	22	22

Notes As in Table 3. Variable definitions are provided in Table 7
Source Authors' computation

It can be attributed to generous fiscal stimulus and regulatory forbearance on bank credit leading to a worsening of macroeconomic stability and slower recovery pace (Gupta et al., 2018).

Regarding control variables, infrastructure development exerts a positive and statistically significant effect on industrial growth, only in sub-period 3. This observation is consistent with theoretical predictions. In growth model with aggregate production function and empirical growth models, infrastructure development is found to have large growth effects (Agénor, 2008; Barro, 1990). However, evidence of infrastructure's growth effects is stronger in cross section or panel evidence (Ghate et al., 2012). Ghate et al. (2012) analyzed sectoral allocation of public infrastructure on growth of agriculture and manufacturing sectors in a dynamic general equilibrium model and calibrated the model with observations of structural changes in Indian economy. Findings revealed that sectoral public infrastructure's impact on sectoral growth depends on the relative income elasticity of goods produced in these sectors. Higher inflation adversely affected state's industrial growth in both sub-periods 1 and 2. However, in sub-period 3, contrary to expectations, we observe a positive and highly significant effect of inflation on industrial growth. Perhaps, this happened in post-GFC period when growth revived momentarily, which happened at the cost of high inflation, putting questions on India's post-crisis growth experience (Gupta et al., 2018). Higher government expenditure incurred by states is negative and highly significant in sub-period 3 only. In contrast to the general predictions of

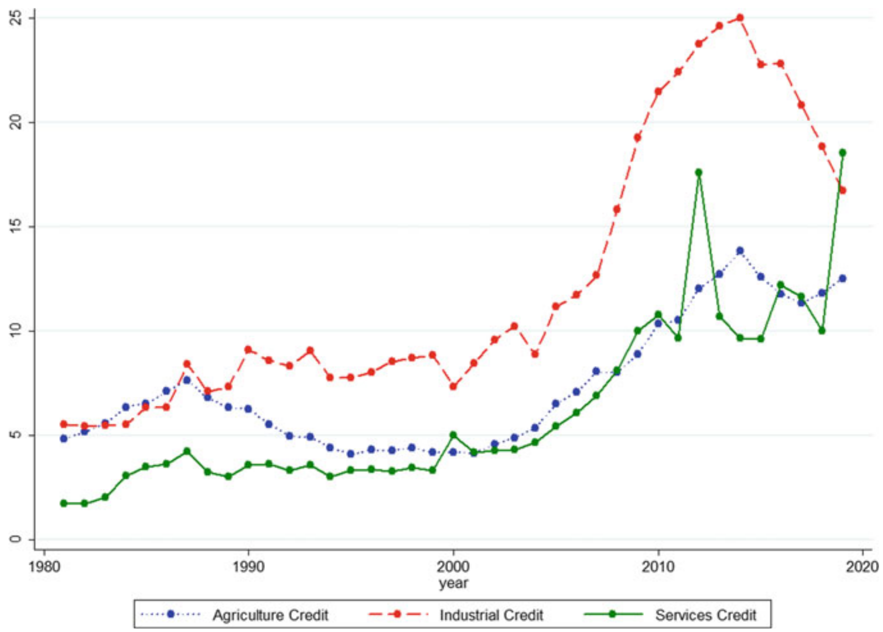

Fig. 2 Temporal movement of average sectoral credit, 1981–2019. *Data Source* CMIE States of India

growth literature, this observation is only exception that it may happen if share of public investment is comparatively much less than government consumption (Barro, 1991).

Table 4 presents system GMM estimation results of growth of agricultural GSDP on agricultural credit. Along with other relevant explanatory variables, we also include total annual rainfall (*Rainfall).* Findings reveal that neither in whole period nor in sub-periods, agricultural credit had statistically significant effect on agricultural growth (Table 4). Until the 1980s, there has been phenomenal growth in the flow of agricultural credit in Indian economy. However, with the introduction of reforms in the 1990s, branch expansion program in the so-called rural unbanked locations, credit delivery, number of loan accounts, and small borrowal accounts received a setback, which significantly affected this sector's growth performance. Moreover, agricultural credit as percent of GSDP has been the lowest compared to that in industrial and service sectors (Table 2). The share of agriculture declined from around 20–16%, share of services sector increased from 54 to 59%, while the industrial sector stagnated (Papola, 2012). In general, several reasons have been identified for steady deceleration in Indian agriculture such as neglect of public investments in irrigation and infrastructure, absence of concerted policies toward agriculture diversification, and failure to promote appropriate technologies for agriculture development. However, most crucial reason has been the weakening of rural credit structure and system's inability to strengthen credit delivery arrangements in agriculture. Estimates reveal that around 51% of rural farm households are kept outside the purview of availability of any credit arrangement (EPWRF, 2008) and farming has become less attractive profession in almost all states because of low profitability.

Among other covariates, states' government expenditure does not seem to have growth effects on agriculture in any sub-periods. However, we find a negative and significant effect of government expenditure on agriculture across states for the entire period. This might happen because of lack of stability of government expenditure that adversely affects agricultural growth across states. Inflation exerts negative and significant influence on agricultural growth in the decade of the 1980s and 1990s. This observation is similar to that in case of industry, explained above. Infrastructure also did not exert any effect on growth of agriculture. Statistical significance of rainfall in full period highlights the critical importance of rainfall in agriculture sector's growth.

Table 5 presents effects of service sector credit on service sector growth. Observe that services credit has a positive and significant effect (at 1% level) on service sector growth only during the post-2000 period and in full sample. However, during the 1980s and 1990s, service sector credit did not significantly affect this sector's growth. Until the mid-1990s, growth of service sector credit across Indian states was negligible (Fig. 1). However, since the mid-1990s, credit channelized to service sector significantly increased and gained momentum in post-2000 period. Faster credit growth to service sector happened during this period because of a sharp rise in credit demand from households, education, communication, medical, and health services. On the supply side, with economic reform measures such as de-licensing, privatization of state-owned enterprises, liberalization of industrial and trade policies, and opening up of banking, insurance, transport, and communication sectors to private sectors, there has also been an enormous expansion of service sector which gained momentum in the decade of 2000 (Jain & Ninan, 2010). In our empirical estimates, we also observe that coefficient estimate of service sector credit on service sector growth in sub-period 3 (4.09) is higher than that in the whole period (1.64). This would imply that in the decade of 2000 and subsequent years, service sector contributed enormously to service sector growth compared to its effect on services during the whole period. Existing research also supports the fact that India's service sector, which accounted for exceptionally high growth and skill bias in service activities, played a significant role in this regard (Eichengreen & Gupta, 2011; Kochhar et al., 2006).

While acceleration in service sector has been steadfast and continued to remain the primary driver of growth during the decade of 2000 and thereafter, sectors such as manufacturing industry and construction were reportedly most affected by demonetization and GST in 2016 and 2017, respectively. However, except for certain temporary disruptions, due to demonetization and GST implementation and some negative impact on demand for services with higher tax rates, service sector activity remained robust and seemed to be primary driver of growth. Indian economy also acquired a significant comparative advantage in the service sector in comparison with other sectors. Over 1996–2005, estimates of revealed comparative advantage (RCA)[9] of the services sector increased from 0.94 to 1.97, whereas RCA of industrial and agriculture sectors declined (Rakshit, 2007). Perhaps, increased flow of sectoral credit to services sector has been instrumental in this regard, because the whole range of activities in this sector related to education, health and financial services are now being traded, contarry to the previous situation.

As far as control variables are concerned, government expenditure exerts a positive effect on services sector growth in sub-period 2. However, it exerts a negative and statistically significant effect on service sector growth in sub-period 3. Infrastructure (INFRA) exerts a statistically significant and positive effect on service sector growth only in sub-period 3. In majority of estimated models, inflation exerts a negative effect on growth. However, we find a highly significant effect of inflation in sub-period 2. As per specification tests, in most estimated models, Arellano–Bond test reveals that error term is not serially correlated of order 2. Hansen's test also reveals that in most cases, there are no over-identifying restrictions ($p < 0.05$).

Overall, the findings reveal that enormous growth of service sector occurred during the 1990s, 2000s, and thereafter. However, the expansion of service sector compared to agriculture and industry in a developing economy like India raises few concerns about the sustainability of these sectors' growth. Several demand-side and supply-side factors contributed to this rapid pace of service sector, given the other two sectors' lackluster performance during post-reform period. Moreover, growth of service sector during last few decades led to an expansion of intermediate consumption with inadequate provision of essential services such as food, shelter, public transport, education, and health care. Since the changing sectoral composition of

[9] RCA of a product is defined as share of that product in country's exports as a proportion of share of global export of that commodity in aggregate world exports.

the Indian economy runs contrary to the tradition of other countries, doubts are often expressed regarding the feasibility of country's growth being driven mainly by service sector. Datta et al. (2015) contend that India's service-oriented development experience in recent decades exhibits a rosy picture rather than reality, given the fact that shares of industry and manufacturing in India show a negative bias in comparison with those of neighboring countries because of differences in accounting concepts.

6 Summary and Conclusions

The chapter investigates relationship between different components of credit and growth across Indian states between 1980–1981 and 2018–2019. In the 1990s, different components of credit hardly had any impact on sectoral growth across states. However, the decade of 2000 and after corresponds to the period in which credit availability exerts a significant effect on sectoral growth. Since the mid-2000s, credit disbursement to various sectors of state economies experienced a sharp upward trend. Service sector credit, in particular, witnessed the biggest spurt in growth during this period. Findings also reveal that growth of service sector during post-reform period has been higher and relatively stable compared to that in agriculture and industrial sectors. Financial intermediation has also been instrumental in this process of change, to a greater extent, compared to other two sectors, particularly agriculture. It is argued that the absence of an effective credit delivery system acts as a hindrance to productive investments in industry, particularly in SMEs and also in large-scale investments such as basic infrastructure (e.g., roads and irrigation facilities) (Banerjee et al., 2005; Rakshit, 2004, 2005). However, it is crucially important to ensure optimal resource allocation across agriculture, industry, and services to ensure balanced economic growth across states and sectors from policy perspectives. In particular, policies should aim to mitigate infrastructural bottlenecks and ensure an uninterrupted credit flow to agriculture and industrial sectors through effective credit delivery systems. We expect that services sector will continue to remain primary driver of Indian economic growth. However, the industrial sector, particularly the manufacturing industry, is also expected to accelerate following certain policy changes such as GST implementation. Agriculture is also likely to contribute to the growth process across states in a self-sustained manner following recent government and central bank policy initiatives.

Appendix

(see Tables 6, 7, 8, 9, 10, and 11)

Table 6 State-wise and sector-wise economic growth in three periods

	1980–1981 to 1990–1991			1991–1992 to 2001–2002			2002–2003 to 2018–2019		
State	Agriculture	Industrial	Service	Agriculture	Industrial	Service	Agriculture	Industrial	Service
Andhra Pradesh	1.01	3.55	3.64	2.24	3.7	4.95	5.44	5.09	7.77
Arunachal Pradesh	4.97	5.33	6.07	1.1	1.74	5.41	−0.84	9.96	5.34
Assam	0.17	3.31	3.01	−1.23	−0.008	2.76	1.08	5.93	6.08
Bihar				2.06	−0.22	3.39	1.21	4.52	5.99
Goa	6.33	9.39	8.97	−0.51	7.37	4.25	1.63	6.59	9.99
Gujarat	−0.64	5.36	4.68	−2.35	4.84	5.39	5.08	7.19	7.83
Haryana	2.04	5.86	5.16	−0.5	2.77	5.36	1.58	6.22	8.65
Himachal Pradesh	0.54	5.25	4.24	−0.033	7.28	4.84	2.05	6.09	7.14
Jammu				1.63	−1.27	3.76	−0.62	2.27	4.4
Karnataka	0.31	4.27	5.15	2.78	5	6.71	0.06	5.88	7.53
Kerala	0.61	1.68	3.81	1.48	5.13	5.79	−0.38	6.49	7.84
Madhya Pradesh				−5.24	4.51	3.68	4.54	4.75	5.11
Maharashtra	1.33	3.65	4.86	0.72	2.18	5.97	1.83	5.65	7.09
Manipur	−0.41	5.09	3.95	0.61	1.6	2.53	3.65	2.26	5.47
Meghalaya	−1.02	4.02	4.88	0.8	3.82	2.8	1.37	1.93	5.28
NCT	0.06	4.39	2.66	−10.94	1.2	3.09	−2.74	3.1	6.63
Nagaland				5.54	−0.65	−1.24	3.84	6.24	6.71
Odisha	−2.45	4.05	3.07	−0.64	2.91	4.87	2.08	6.78	7.11
Puducherry	−2.35	1.98	2.33	−1.86	8.06	8.67	−0.73	2.05	5.75
Punjab	2.8	5.1	2.52	1.12	4.35	3.65	0.64	5.31	5.92

(continued)

Table 6 (continued)

	1980–1981 to 1990–1991			1991–1992 to 2001–2002			2002–2003 to 2018–2019		
State	Agriculture	Industrial	Service	Agriculture	Industrial	Service	Agriculture	Industrial	Service
Rajasthan	3.8	5.24	5.46	−2.19	5.19	3.7	3.54	5.39	5.75
Sikkim				−2.78	8.45	5.86	5.67	15.64	5.25
Tamil Nadu	2.84	4.08	4.66	2.33	4.17	6.76	2.1	5.76	6.89
Tripura	-0.05	1.92	5.46	−0.34	12.43	6.28	5.01	7.38	8.21
Uttar Pradesh				0.65	3	2.56	0.88	6.18	5.81
West Bengal	1.7	1.47	2.74	2.88	4.21	6.03	1.35	4.3	6.44

Source National Accounts Statistics, Government of India and Authors' Calculations

Table 7 Variable definition and data sources

Variables	Definition	Source
AGRI_GR	Per capita agriculture GSDP growth, defined as ln(Agri ($GSDP_{it}$)−ln(Agri ($GSDP_{it-1}$)	States of India, CMIE
INDUS_GR	Per capita industrial GSDP growth, defined as ln(Industrial $GSDP_{it}$)−ln(Industrial $GSDP_{it-1}$)	States of India, CMIE
SERV_GR	Per capita service sector GSDP growth, defined as ln(Service $GSDP_{it}$)−ln(Service $GSDP_{it-1}$)	States of India, CMIE
GOV	Ratio of state government expenditure(at current prices) to GSDP at current prices	States of India, CMIE
Inflation	Defined as growth rate of GSDP deflator (ratio of GSDP at constant prices (at 2004–2005 base) to GSDP at current prices). Calculated as ln($Deflator_{it}$)−ln($Deflator_{it-1}$)	States of India, CMIE
Infra	Road + rail length in km per 100,000 population	States of India, CMIE
CR_AGRI	Natural logarithm of agriculture credit-to-GSDP ratio	Basic statistical returns, RBI
CR_INDUS	Natural logarithm of industrial credit-to-GSDP ratio	Basic statistical returns, RBI
CR_SERV	Natural logarithm of services sector credit-to-GSDP ratio	Basic statistical returns, RBI
Rainfall	Annual rainfall (in mm)	States of India, CMIE

Table 8 Correlation matrix

	AGRI_GR	INDUS_GR	SERVICE_GR	CR_AGRI	CR_INDUS	CR_SERVICE	Inflation	GOV	Infra	RAINFALL
AGRI_GR	1									
INDUS_GR	0.0319	1								
SERVICE_GR	0.1639	0.1881	1							
CR_AGRI	0.0066	−0.0073	0.1576	1						
CR_INDUS	0.0406	−0.0118	0.1185	0.5327	1					
CR_SERVICE	−0.0073	−0.0006	0.159	0.4735	0.7216	1				
Inflation	−0.0458	−0.0077	−0.055	−0.0365	0.0042	−0.0465	1			
GOV	0	0.06	−0.0131	−0.4394	−0.5267	−0.3318	−0.0129	1		
Infra	0.0336	0.0485	0.0169	−0.3953	−0.3342	−0.2484	0.0105	0.3595	1	
RAINFALL	0.0604	0.0396	0.0006	−0.4105	−0.4122	−0.2417	0.008	0.2966	0.4195	1

Notes The numerical values indicate pair-wise correlations of variables. Variable definitions are provided in Table 7
Source Authors' computation

Table 9 First-difference GMM result of industrial growth and industrial credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth($t-1$)	−0.0599	−0.2750***	−0.1446	0.0184
	(0.1052)	(0.0484)	(0.1365)	(0.1718)
INFLATION	0.0240	−0.3686	−0.5634***	0.0799***
	(0.0471)	(0.2247)	(0.1999)	(0.0148)
CR_INDUS	−14.4354	2.6460	14.0051**	−11.1035**
	(9.1368)	(4.0978)	(6.8383)	(5.6592)
GOV	−0.2260***	–	−0.3299**	−0.8557***
	(0.1125)	–	(0.1336)	(0.2204)
INFRA	−0.0156	−0.0216	−0.0378***	−0.0028
	(0.0108)	(0.0089)	(0.0151)	(0.0085)
AR(2) test p-value	0.671	0.104	0.550	0.455
Hansen test p-value	0.109	0.266	0.145	0.188
No. of obs	668	154	217	369
No. of instruments	17	13	17	17

Notes As in Table 3
Source Authors' computation

Table 10 First-difference GMM result of agriculture growth and agriculture credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth($t-1$)	−0.2950***	−0.3671***	−0.2319	−0.3490***
	(0.1077)	(0.0377)	(0.2383)	(0.1065)
INFLATION	−0.0485	−1.6399***	−0.5231**	0.0246
	(0.0770)	(0.5128)	(0.2550)	(0.0230)
CR_AGRI	−1.6194	−3.2517	3.7982	4.0575
	(7.9388)	(5.2086)	(6.1223)	(3.5936)
GOV	−0.2720	–	−0.1636	0.0832
	(0.2010)	–	(0.1132)	(0.1009)
INFRA	0.0028	0.0022	−0.0072	0.0031
	(0.0077)	(0.0118)	(0.0179)	(0.0069)
Rainfall	0.0061***	0.0049**	0.0041	0.0067***
	(0.0018)	(0.0025)	(0.0026)	(0.0017)
AR(2) test p-value	0.137	0.260	0.156	0.034
Hansen test p-value	0.948	0.322	0.203	0.407
No. of obs	577	154	217	278
No. of instrument	18	14	18	18

Notes As in Table 3
Source Authors' computation

Table 11 First-difference GMM result of service growth and service credit

Covariate	Full period	Sub-period 1	Sub-period 2	Sub-period 3
Growth($t-1$)	−0.0304	−0.0080	−0.1120	0.0459
	(0.0599)	(0.0918)	(0.0801)	(0.0963)
INFLATION	−0.0402	−0.3183*	−0.4471***	0.0043
	(0.0418)	(0.1675)	(0.1454)	(0.0102)
CR_SERV	−1.3551	−0.7482	−11.8457	4.5329***
	(1.7218)	(1.5730)	(11.3797)	(1.2352)
GOV	−0.0833	–	0.2854***	−0.2153*
	(0.1028)	–	(0.0808)	(0.1140)
INFRA	−0.0038	−0.0055	0.0030	−0.0020
	(0.0031)	(0.0028)	(0.0089)	(0.0029)
AR(2) test p-value	0.210	0.647	0.236	0.593
Hansen test p-value	0.438	0.557	0.640	0.697
No. of obs	666	154	211	373
No. of instruments	17	13	17	17

Notes As in Table 3
Source Authors' computation

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Are SHG Loans Demand Constrained in Backward Areas?

Bibek Ray Chauhduri and Ranajoy Bhattacharyya

1 Introduction

The data on India's SHG-Bank Linkage Programme (SLBP) has several interesting features. Most important of these is the fact that compared to individual loans, the spread of self-help group (SHG) loans has been extremely tardy. Only an insignificant proportion (between 1 and 3%) of bank loans in India pertains to SHGs. If we look at the regional distribution of SHG to individual loans, another striking feature emerges: the SHG programme has been significantly weaker in backward areas in India compared to relatively advanced areas.[1]

Seeking explanations for each of these observations, one has to look both at the empirical and theoretical literature. Turning to the empirical literature, first let us note that the reasons provided are mostly on the basis of casual empiricism rather than rigorous empirical research. For instance, a major opinion that drives the first observation is the fact that group loans are a comparatively recent phenomenon compared to individual loans. This has both demand and supply side repercussions—banks are not yet attuned to it and borrowers are still dependent on traditional sources of loans like moneylenders. Further from the supply side, banks primarily disburse

[1] For instance, The Report of the Committee on Financial Exclusion (2008) concludes that the SHG movement is weaker in regions with higher levels of exclusion: only 33% of SHG linkages are through Regional Rural Banks (RRBs)—the main vehicle through which SHG credit reaches the backward areas. In fact, group loans as a proportion of total loans in backward rural areas in India are about one-third that of non-backward areas (see below). See also Sriram and Kumar (2005).

B. R. Chauhduri (✉) · R. Bhattacharyya
Indian Institute of Foreign Trade, Kolkata Campus, Kolkata, India
e-mail: brchaudhuri@iift.edu

R. Bhattacharyya
e-mail: ranajoy@iift.edu

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these loans to satisfy Reserve Bank of India norms of priority sector lending (Ray Chaudhuri, 2010). It is thus an instrument forced upon them—given freedom they would not like to do it. A third opinion also emerges. Group loans need the additional support of Non-Governmental Organizations (NGOs) and insider information regarding the social dynamics of rural areas. This translates to high transaction costs (Bansal, 2004). It has also been pointed out that even though the banks charged low interest rate (on an average 12%) to the groups, the SHGs charge high interest rate to the members, thus making the group lending system ineffective (Chavan & Bhaskar, 2009).

Several explanations have been offered in the empirical literature targeting the second observation as well. These arguments indirectly contradict the perception that group loans are for the poorest of poor—those who are incapable of securing individual loans especially from banks because they lack, for instance, collateral support. The first argument is that SLBP is a savings first program; hence, regions having low income (and hence saving) potential witness slow growth of this kind of lending. In support of this argument, it has been pointed out that lending under this programme has a negative correlation with poverty measures across regions (see for instance, Kumar & Golait, 2009). Presence of branches of commercial banks is another major determinant of SLBP loans. Since there are a lesser number of branches in backward areas, loan disbursement suffers (Kumar & Golait, 2009).

There are many important results in the theoretical literature. Related to lending in groups, joint liability whether explicit or implicit has been seen as a solution to adverse selection problems through peer selection and that of moral hazard problems through peer monitoring (Ghatak & Guinnane, 1999). The result also holds in case of unknown peers (Aghion & Gollier, 2000). If borrowers have present biased preferences, joint liability along with frequent repayments can increase the maximum loan size for which the repayment is incentive compatible (Fischer & Ghatak, 2009). A possibility of group lending leading to overcrowding of risky borrowers (Guttman, 2008) and collusion among group members (Laffont, 2000) cannot be ruled out. Possibility of missing insurance markets leading to heterogeneous groups (Sadoulet, 1999) and investment in consistent but low returns projects cannot be ruled out. A number of studies thus concentrated on other forms of lending especially individual liability with innovative incentive mechanisms. The provisions ranged from threat of termination of future lending (Aghion & Morduch, 2000; Stiglitz & Weiss, 1981), regular repayment schedules (Feigenberg et al., 2009; Jain & Mansuri, 2003), monitoring and relationship building (Udell, 2008; Boot, 2000; Petersen, 2004). Another strand of literature tried to uphold the joint liability lending by suggesting combining it with dynamic incentives. Sequential lending (Chowdhury, 2005) is shown to solve the problem of non-monitoring by group members and collusion among them (Aniket, 2007). Dynamic group lending with significant discount factor (Chowdhury, 2007) is shown to increase profits for homogenous matching of safe borrower types. Optimal determination of payments of successful borrower for a defaulting partner and variation of penalty among group members can make expected welfare of borrowers from group lending higher than individual lending when both types of lending are feasible (Bhole & Ogden, 2010). On the other hand, group lending can impose non-monetary costs on group members which may induce them to shift to individual lending above a certain threshold level of wealth (Waelde, 2011). Individual lending is found to be more prevalent in case of lower loan sizes, high competition among MFIs and low re-financing costs (Lehner, 2009). Ahlin and Waters (2011) show that individual lending is better than group lending when both fail to achieve full efficiency, but the former is better if it achieves full efficiency. In a separate work, group size is found to be an important determinant of exploitation of local information to solve adverse selection and local coordination to mitigate moral hazard (Ahlin, 2011).

The empirical literature looking at group vs. individual loans has mainly resorted to randomized control trials using various experimental designs (Fischer & Ghatak, 2011). Karlan and Gine (2009) did not find any conclusive evidence in favour of either individual lending or group lending in terms of repayment rates. Attanasio et al. (2011) find differential impact of both kinds of lending in Mongolia where group lending showed positive impact on consumption and female entrepreneurship, whereas individual lending had higher impact on asset formation and informal transfers. In case of India, Kumar (2012) finds that group lending with dynamic incentives increases loan to borrowers by almost 698% of her initial loan. Evidence against group lending shows that it leads to strategic default (study on Vietnam, Kono (2007)). In case of a study in Georgia, it has been found that individual lending combined with dynamic incentive, non-conventional collateral, screening and threat of loan termination has led to 100% repayments (Vigenina & Kritikos, 2004).

Modelling the demand side of micro-credit has received relatively less importance in the literature. Evidence though shows that demand factors have been important in determining the spread of the credit programmes. Mukherjee (2013) finds that 'working poor' have more access to microfinance than ultra-poor in case of India. In a study on SHGs in Punjab, it was found that lack of training facilities, proper guidance by promoting agencies, too much documentation, etc., were responsible for suboptimal performance of the programme (Singh & Kaur, 2019). Four backward districts in Tamil Nadu were found to have low financial inclusion. Reasons for this to happen were lack of income, low financial literacy and complex documentation which are again mostly demand side factors (Sriram & Sundaram, 2015). Developed southern states have observed the highest linkage of SHGs in India (Rana & Viswanathan, 2019; Sangwan & Nayak, 2019). The preference for better off regions is mainly guided by financial sustainability considerations and may have led to mission drift as well (Sangwan & Nayak, 2019). Another interesting finding in case of India in terms of formal and informal sources of credit is that it does not have any impact on growth of income, capital formation and inequality in income. Only the level of these is impacted, and it was found that people below poverty line are more negatively impacted (Das et al., 2018). This shows that source of credit is unable to significantly impact the welfare of borrowers, hence just by making formal finances available may not be enough. Raising suspicion that group lending mechanisms may fail because of more demand side reasons. Cross-country evidence also shows similar trends. Individual lending has been found to be more profitable but up to a certain level (Kar & Swain, 2014). In Kenya, surprisingly, it has been found that MFIs prefer individual lending even when default rates are higher than in group lending cases (Kodongo & Kendi, 2013).

For our purpose, one study that is especially pertinent is that the formation of groups opens the possibility of easing credit flow by reducing the equilibrium interest rate. The main argument is based on Ghatak (1999). There are both safe and risky borrowers in a borrower pool. However, banks cannot distinguish between them. They thus offer the same interest rate to both types. When the proportion of risky borrowers is high, the bank has to charge a high interest rate. This means that the safe borrowers end up paying a high interest rate as well (thus indirectly cross-subsidizing for the risky projects of the risky borrowers) and leave the market. Group formation with joint liability and positive assortative matching mitigates this problem. With safe borrowers forming groups with other safe borrowers, the question of cross-subsidization does not arise. As a result, safe borrowers return to the market improving the pool of borrowers. The bank can charge a lower interest rate as the risk associated with offering loans is reduced.

In this chapter, we recast this exercise in a demand–supply framework. Our main argument is that due to joint liability, group formation increases the bank's probability to get back loans. The supply curve for loans thus shifts out and to the right. However, positive assortative matching implies that risky borrowers now have to shoulder each other's risk and hence has 'higher expected joint liability payments' (Ghatak, 1999). Thus, the demand for loans on their part reduces. The question that arises therefore is: Under what circumstances will this fall in demand from risky borrowers nullify the bank's willingness to relax the supply constraint so that the aggregate amount of loans disbursed actually fall? We derive conditions for such a thing to happen.

The genesis of the demand and supply curves of loans in our model is as follows. We assume that the bank is a profit maximizing unit. This activity by the bank yields the supply schedule for loans. On the other hand, we assume that the borrowers undertake a production activity with the loan that is offered by the bank. The profit maximizing condition for this production activity yields the demand function for loans. With demand and supply schedules available, the equilibrium interest rate and loans disbursed are determined.

Given this framework and two distinct types of borrowers (safe and risky), there are three curves to contend with: the supply curve of the bank and two separate demand curves—one for the risky and one for the safe. If the bank is able to distinguish between the two sets of borrowers (there is no adverse selection), the three curves will yield two separate equilibrium outcomes—one for the risky and one for the safe. With probability of success of safe borrowers being assumed to be one, group formation does not affect the equilibrium for them—both before and after group formation the probability for the bank to get back loans and the probability that the safe borrowers will have to pay back remains 1. However, for the risky borrowers both the demand curve and the supply curve shift. Given joint liability group formation increases the probability of banks to get back loans so that its expected return rises inducing an increase in its supply for loans. However, risky borrowers now have to shoulder the risk of their group members provided they succeed and group members fail. Thus, their demand for loans reduces. The net outcome depends on the extent of the rise in supply and the fall in demand. In particular, given the relative return of the production activity that they undertake, if the probability of success of projects for the risky borrowers is very low, then their incentive for forming groups becomes very low and their demand for group loans declines sharply and the equilibrium level of loans declines. We then show that even if we relax the assumption of no adverse selection (so that there is a single demand curve), the same result would carry through. Only in this case, the proportion of risky borrowers in the borrower pool too chips in. In particular if this proportion is high, then—given positive assortative matching—the proportion of risky groups will be high, and the lack of demand from these groups may be an additional reason to overwhelm the supply effect.

Since by definition, a backward area is an area with high incidence of poverty, low levels of infrastructural support, such as roads, electricity, water supply an health centres, and low levels of education, a relatively larger number of borrowers are expected to be risky in such areas and the probability of success of projects is also lower in these areas. Both these possibilities would make group lending infeasible in these areas. Thus, the argument can be used to explain the relative failure of group loans in these areas.

To motivate the analysis and substantiate the two claims made above, we provide some empirical evidence in the next section. The rest of the chapter is arranged as follows: Sect. 2 motivates the theoretical work that follows through some empirical observations. The base model is developed in Sect. 3. Section 4 extends the base model to safe versus risky and individual versus group lending. Section 5 looks at the consequences of including adverse selection. Finally, Sect. 6 concludes the chapter.

2 A Glance at the Data

The first observation is clearly made in row six of Table 1 which shows that only 1–3% of total loans disbursed through banks are SHG loans.[2] To substantiate the second observation regarding the relatively weaker spread of SHG loans in backward districts of India, we compare the relative performance of the backward and non-backward

[2] Data for number of SHGs linked for a sample of 299 districts from 24 states in India is available in the Micro Finance Innovation Department (MFID), NABARD. Data for the number of rural bank branches and rural credit at the district level was obtained from Branch Banking Statistics published by RBI. Literacy (both male and female) at the district level have been taken from the Census of India 2001. The Sarma Committee Report (1997) was used to demarcate the 299 district into backward and non-backward districts.

Table 1 Backward versus non-backward: loan and demographic characteristics

Mean[a]	Backward	Non-backward	$t^{b,c}$	df^{d}
SHG loan	170.31	689.13	4.55*	261.94
No. of rural branches	72.15	67.28	−1.06	94.16
No. of rural a/cs	301,250.25	306,511.96	0.16	78.62
Rural deposits	35,726.67	41,553.31	1.43	126.14
Rural credit	11,613.65	18,767.20	6*	247.83
SHG loan/rural credit	0.01	0.03	2.91*	225.6
No. of SHG groups	144.50	331.69	2.96*	258.2
Literates	827,950.17	848,956.65	0.33	97.4
Male literates	536,143.71	512,780.02	0.515	269
Female literates	291,806.46	336,176.62	1.69*	101
Loan per group	1.18	2.08		

Source Authors calculations
[a]Average values for the following variables

[b]Independent sample t test, $t = \overline{X_1} - \overline{X_2} / \sqrt{\frac{S_1^2}{W_1} + \frac{S_2^2}{W_2}}$

[c]*Implies significant at 5% level

[d]$df = 1/(Z_1 + Z_2)$ where $Z_k = \left(S_k^2 / \frac{S_1^2}{W_1} + \frac{S_2^2}{W_2} \right)^2 / (W_k - 1)$

areas in Table 1. The crucial variable in Table 1 is once again the ratio of SHG to total rural credit in row 6. The average proportion of SHG loans in backward areas is about one-third that of non-backward areas. The table also computes the independent sample t-statistic in column 4. It can be observed from the column that the mean values of (a) SHG loan, (b) rural credit, (c) SHG loan to rural credit, (d) number of SHG and (e) the number of female literates are statistically different in backward and non-backward areas. Of all these variables, SHG loans have the maximum difference. However, mean total rural credit for non-backward districts is about 1.5 times that of backward districts, and SHG loans in non-backward districts are about 4 times that of backward districts. Interestingly, the average number of SHG groups is only about 2.3 times higher in the non-backward districts. Thus, clearly the average loan per group is higher in non-backward districts compared to backward districts. This in fact is a corollary of the fact that the relatively well-off people in non-backward districts can save more and hence has a higher probability of being included in SLBP. The female literacy variable is included as 90% of the groups both in backward and non-backward areas are all female. Apart from the interesting observation that female literacy is a better indicator of backwardness/non-backwardness in India than aggregate and male literacy (both of which have statistically insignificant difference in mean in the backward and non-backward areas), the observation implies that female literacy plays a crucial role in determining the extent of SHG penetration. This is clearly brought out by the following regressions (Eqs. 1 and 2) as well (all estimates are corrected for heteroscedasticity):

$$\begin{aligned}\text{SHG loan/Rural Credit} &= \underset{(4.10)}{0.14} + \underset{(3.0)}{0.00000003}\,\text{Female literates} - \underset{(-2.6)}{0.01}\,\text{Backward}\\ R^2 &= 0.03, \quad F = 5.88 \end{aligned} \tag{1}$$

$$\begin{aligned}\text{SHG} &= \underset{(1.1)}{148.5} + \underset{(2.9)}{0.001}\,\text{Female literates} - \underset{(-4.4)}{447.5}\,\text{Backward}\\ R^2 &= 0.07, \quad F = 9.93 \end{aligned} \tag{2}$$

3 Characterizing the Equilibrium of the Safe Borrowers

Consider a bank with a branch in a rural area possibly remote.[3] The branch lends small amounts of money ('micro-credit') to single borrowers who use the loan to finance a simple production activity such as, say, poultry farming. The activity is assumed to be internal to the household in the sense that there is no payment to household members for participating in the activity. For the moment, assume further that there is no possibility of default.

Since the branch is in a remote rural area, we assume that there is a general dearth of such branches of this or other banks in the locality and potential borrowers have to be cajoled to borrow money for which they are too poor to provide sufficient collateral. With borrowers thus unmotivated in externally financed production activities, the search cost for disbursing loans is high. In particular, assume the unit search cost (C_S) for disbursing loans is of the following form:

$$C_S = \frac{1}{B} + K$$

Obviously, the possibility of the number of people who have already taken loans increases with the number of branches (B) of similar other banks in the locality. We therefore assume that unit effort for motivating a new potential borrow to take loans falls with the number of such branches. However, that effort has to be increased with the size of the loan (K) as more information has to be collected to ensure the assumed certainty of no default in the absence of collaterals. Assume that the cost of funds (per unit of loan made) for the bank is i. Thus, the branch's total cost function looks

[3] Since we are not interested in any other activity of the bank except those pertaining to this particular branch, in what follows we will de-link the operation of this branch from the rest of the bank's activities and consider it as a separate entity. We however maintain the assumption that the branch keeps on receiving funds from the bank (at the bank's cost of obtaining those funds) for dispersal among these rural borrowers.

like:

$$C_{\mathrm{BA}} = (i + C_S)K$$

The branch maximizes profit (π_{BA}) under complete information. Assuming that the gross interest charged to the borrower is r, the objective function of the branch takes the following form:

$$\pi_{\mathrm{BA}} = rK - C_{\mathrm{BA}} \tag{3}$$

As we have already remarked, the borrower uses the loan to carry out some kind of production activity with unpaid family labour. Production is thus carried out with the loaned money as capital and this freely available household labour. In the absence of this activity, however, the labour is assumed to be capable of being used in an alternative occupation, say, working as agricultural labour. Assume that w is the wage loss per unit of loan obtained by the borrower. This includes meetings with bank officials and completing the formalities for which he may have to take help of other more knowledgeable persons. Note that we do not include formal collateral in our model. However, the forgone wage serves this purpose. In fact, it has important implications in our model. Then the borrower's profit function is

$$\pi_{\mathrm{BO}} = PY - rK - wK \tag{4}$$

where P is the price received for the goods sold and Y is the output. The output is produced with the following standard production function: $Y = f(L, K)$ where L is the amount of household labour used in the production activity. Since household labour is free and hence is not an argument in the optimizing exercise of the borrower, we ignore it for the rest of the analysis. We make the following assumptions about the production function:

Assumption 1 (a) $f' > 0$, (b) $f'' < 0$, (c) $f'(0) > 0$ and (d) $Pf'(0) > w$.

Assumptions (a)–(c) are standard. (d) implies that the borrower will take a loan if he is convinced that the production activity that he undertakes should be sufficiently productive to compensate for the loss in wage per unit of the loan. Thus, the borrower might have to be convinced by the branch officials that such an opportunity is there—another element in search costs.

In this setting maximization of (3) and (4) and assuming complete markets[4], we can account for the supply of loans from the branch and demand of loans from the borrower:

$$r - i = \frac{1}{B} + 2K \tag{5}$$

[4] See Bardhan and Udry (1999), Chap. 1.

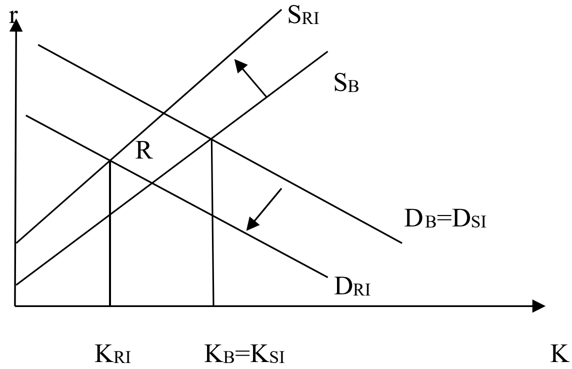


Fig. 1 Equilibrium with risky borrowers. *Source* Authors

$$r + w = Pf'(K) \tag{6}$$

Note that (5) is (linear and) positively sloping in the (r, K) plane and if assumption 1 is satisfied (6) is negatively sloping and an equilibrium with a positive amount of loan exists.

Note that in this case, since there is no default, the probability for repayment is 1 for all borrowers. In the rest of the chapter, a safe borrower is defined as someone whose probability of success in the project she undertakes as 1. Thus, for the rest of the chapter, this case is benchmarked as the case for the 'safe' borrowers. Since this is the case for safe borrowers in Fig. 1, we have drawn the supply and demand curves by S_B[5] and D_B. $K_{\text{BI}} = K_{\text{SI}}$ is the equilibrium outcome.

Our next step is to characterize the equilibrium of the risky borrowers and to compare it with the safe borrowers.

4 Safe Versus Risky

To bring out the difference in the nature of equilibrium for the safe and the risky borrowers, we begin by considering a situation where the safe and the risky borrows are, say, geographically separated so that the bank knows who is who. We begin with individual lending and then move on to groups.

[5] Note that the linearity of the supply curve is a corollary of the linear response of search costs to loans. If search costs rise at an increasing (decreasing) rate with loans, the supply curve assumes a concave (convex) shape.

4.1 Individual Lending

A risky borrower is defined as a person whose project has a probability of success $p < 1$. The bank's optimization in this case turns out to be:

$$\pi_{\text{br}} = prK - iK - \left(\frac{1}{B} + K\right)K$$

The risky borrower's profit function can be represented as follows:

$$\pi_r = p[PY - rK - wK] + (1 - p)(-wK)$$

Thus, the demand and supply curve for loans to risky borrower's obtained from banks' and borrower's optimization exercises is as follows:

$$pr_r = i + \frac{1}{B} + 2K$$
$$r_r = Pf' - \frac{w}{p}$$

Equilibrium r and K can be solved from the above two equations. The solution yields the following proposition.

Proposition 1 Equilibrium loans for risky borrowers are lower.

Proof See Appendix 2.1.

The demand and the supply curves in this case are shaded D_{RI} and S_{RI}, and the equilibrium is represented by point R in Fig. 1. Note that since default increases, the bank's risk of providing the loan the supply curve shifts to the left. On the other hand, in case of an unsuccessful project, the borrower loses his implicit collateral—the wage income that he sacrifices in order to get the loan—thus the demand curve for the risky borrowers also shifts in. The net result is a fall in loans disbursed and taken. The effect on interest rate depends on the extent of shift of demand and supply. If the supply curve shifts more than the demand curve (as in Fig. 1), rate of interest rises in equilibrium.

4.2 Group Lending

Groups are assumed to have 'n' members out of whom 'm' members are given loans at a time. The profit functions for the safe and the risky groups are as follows:

$$\pi_{\text{ss}} = n[PY_i - rK_i - wK_i]$$

$$\pi_{\text{rr}} = n\left[p\left\{PY - \left(\sum_{k=0}^{n}\binom{n}{k}p^k(1-p)^{n-k}k\left(1+\frac{n-k}{k}\right)rK\right\} - wK\right]$$

where k is the number of borrowers whose projects are successful. The term $\left(\frac{n-k}{k}\right)rK$ is the burden of repayment borne by the successful borrower. We assume that the burden is equally shared by all the group members:

Turning to bank's optimization, for safe groups there is no change except for the fact that bank will now decide on how much to lend to the group as a whole rather than an individual. The exercise for risky groups, however, turns out to be different. Profit function for banks in this case is as follows:

$$\pi_{B_{\text{RR}}} = \sum_{k=0}^{n}\binom{n}{k}p^k(1-p)^{n-k}k\left(1+\frac{n-k}{k}\right)rK - n\left[iK - \left(\frac{1}{B}+K\right)K\right].$$

The probability $[1-(1-p)^n]$ that the risky borrowers will be successful is derived from the different combinations of successful and unsuccessful borrowers (Appendix 1.1).

From risky group's optimization, we have

$$r_{\text{rg}} = \frac{pPf' - w}{[1-(1-p)^n]}$$

Bank's optimization for the risky group yields the following:

$$r_{\text{rg}} = \frac{i + \frac{1}{B} + 2K}{[1-(1-p)^n]}$$

From the solutions for r and K from the above two equations, we see that the equilibrium K does not change in case of group formation.

Proposition 2 Group formation does not change the equilibrium amount of loans.

Proof Appendix 2.2.

Demand and supply curves and the equilibrium outcome are represented by S_{RG} and D_{RG}, respectively, in Fig. 2. With joint liability, the probability that the bank gets back the loan rises with the formation of groups and the supply curve shifts to the right. The demand curve shifts to the left as failure to implement a project by one risky borrower now has to be compensated by others in the group. In this case, the shifts keep the equilibrium loan unchanged.

This then is the core of the loan market that we are operating with here. To the question: Does group formation increase the possibility of loans? The answer is in our case 'no'. Though the bank is willing to give more loans, the borrowers will not be willing to take it if they expect low returns from the loan relative to their effort and if they or their group members have a low probability of paying back loans. Given

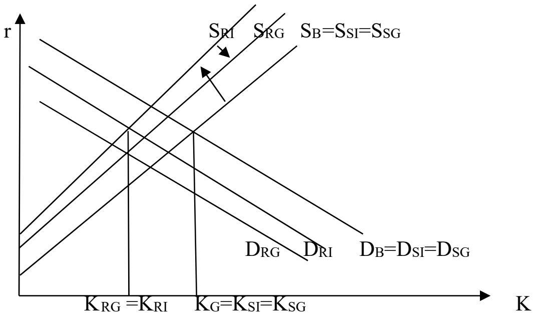


Fig. 2 Unchanged equilibrium with group lending. *Source* Authors

returns, the upshot of the above discussion can be summarized as follows: if I know my group consists of people with low probability of success, I will never join the group. In the rest of the chapter, we will show this result carries through when there is adverse selection in the sense that the bank cannot distinguish between the risky and the safe borrowers.

5 Asymmetric Information

5.1 Consequences of Adverse Selection in the Individual Lending Case

In this case, the banks are unaware of the borrower type, whereas the borrowers know each other's types. With q as the proportion of safe borrowers in the population (known to the banks) and $q' = q + (1 - q)p$, the profit functions of the bank and the borrowers are as follows:

$$\pi_{B_{\mathrm{AS}}} = n\left[q' r K - iK - \left(\frac{1}{B} + K\right)K\right]$$
$$\pi_{\mathrm{AS}} = n\Big[q\{PY_i - rK_i - wK_i\} + (1-q)\left\{p\left(PY - \left(\sum_{k=0}^{n}\binom{n}{k}p^k(1-p)^{n-k}k\left(1+\frac{n-k}{k}\right)rK\right) - wK\right\}\right]$$

First-order conditions of optimality yield the following supply and demand relations.

$$q' r_{\mathrm{AS}} = i + \frac{1}{B} + 2K$$
$$r_{\mathrm{AS}} = Pf' - \frac{w}{q'}$$

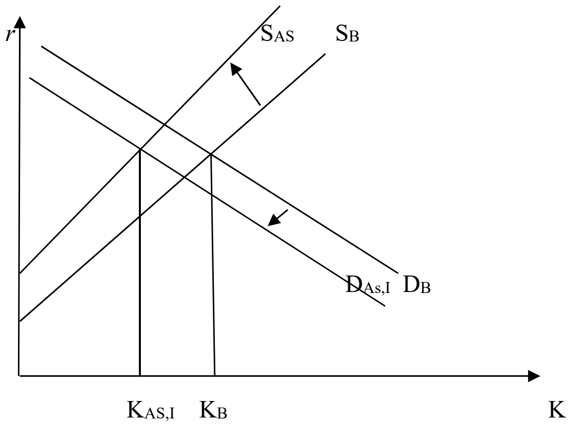


Fig. 3 Individual loans adverse selection versus no adverse selection. *Source* Authors

Proposition 3 Individual loans under adverse selection are lower than without adverse selection in the individual case (the base case).

Proof See Appendix 2.3.

In fact, equilibrium level of loans will fall under individual lending if

$$q' P f' - w < P f' - w$$

This condition is satisfied for all values of q and p. The demand and supply curves for this case are drawn in Fig. 3.

5.2 *Group Lending*

For the group lending case, the profit function for the bank and the group can be represented as follows[6]:

$$\pi_{B_{\text{ASG}}} = q_{2S} r K - iK - \left(\frac{1}{B} + K\right) K$$

$$\pi_{\text{AS}} = m\left[q + (1-q)\left\{p^m (PY_i - rK_i - wK_i) + \sum_{k=1}^{m-1} p^k (1-p)^{m-k} (PY_i - rK_K - wK_i) + \sum_{k=1}^{m-1} (1-p)^k p^{m-k} (-wK_i) + (1-p)^m (-wK_i)\right\}\right]$$

[6] $q_{2S} = q + (1-q)\left\{p^m + \frac{2p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p}\right.$. Detailed calculations given in Appendix 2.

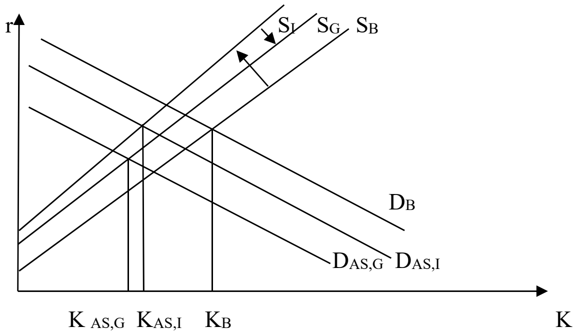


Fig. 4 Reduction in loans under group lending. *Source* Authors

The supply and demand relations obtained from the optimization exercise by banks and groups are as follows[7]:

$$q_{2S} r_{AS} = i + \frac{1}{B} + 2K$$
$$q_{S0} r_{AS} = q_S P f' - w$$

Proposition 4 Group lending contracts will reduce lending compared to individual lending if $\frac{Pf'}{w} < \frac{\frac{q_{2S}}{q_{S0}} - 1}{\frac{q_{2S}}{q_{S0}} q_S - q'}$.

Proof Appendix 2.4.

This situation is represented by S_G and D_G in Fig. 4. Comparing Proposition 2 with Proposition 4, it can be seen that in addition to what is required for loans to diminish under individual lending in the complete information case, under adverse selection the possibility is reinforced by a low q (Appendix 2.4) (Fig. 4).

6 Conclusion

The main conclusion of this chapter is that since group lending is unequivocally beneficial only to the supplier of loans and not to the demanders, an effective demand shortage may restrict its spread especially in underdeveloped areas of the world where borrowers are inherently risk prone. Forming groups may be undesirable to risk prone borrowers as it imposes more burdens on them when they succeed. Since this is not true for safe borrowers, whether loans will be demand constrained or not depend on the proportion of risky borrowers in the pool. If this proportion is high, as it would be in backward areas where making a project successful is a challenge, loans disbursed

[7] $q_{S0} = q + (1-q)\left\{p^m + \frac{p^m(1-p)\{n-p+2\} - p(1-p)^m\{n+m+p-1\}}{2p-1}\right\}\Big]$, $q_S = q + (1-q)\left\{p^m + \frac{p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p}\right]$. Detailed calculations are provided in the Appendix 2.

through groups might be lower than those disbursed at the individual level. Group lending under these circumstances will never be successful. We have shown through data that this is precisely the case in backward areas of India. Hence, this chapter has argued that group lending in backward areas fails as there are no takers for it.

Acknowledgements The authors are indebted to Prof. Ashis Bannerjee and Prof. Sukanta Bhattacharyya for their helpful comments on the earlier drafts of the chapter. The usual disclaimer applies.

Appendix 1

Derivation of the first-order condition under group contracts.

Group Lending Under Complete Information

Note that this derivation is only for risky groups as the safe group has $p = 1$. Totally differentiating the profit function with respect to K of risky group, we have

$$\frac{\partial \pi_{\mathrm{RR}}}{\partial K_i} = n\left[p^m(Pf' - r - w) + \sum_{k=1}^{m-1} p^k(1-p)^{m-k}\left(Pf' - r\frac{\partial K_K}{\partial K_i} - w\right)\right.$$
$$\left. + \sum_{k=1}^{m=1}(1-p)^k p^{m-k}(-w) + (1-p)^m(-w)\right] = 0$$
$$\Rightarrow p^m(Pf' - r - w) + \sum_{k=1}^{m-1} p^k(1-p)^{m-k}\left(Pf' - r\frac{\partial K_K}{\partial K_i} - w\right)$$
$$+ \sum_{k=1}^{m=1}(1-p)^k p^{m-k}(-w) + (1-p)^m(-w) = 0 \quad (\because n \neq 0)$$

$$\text{Now } K_K = \left(\frac{n+m-k}{n}\right)K_i$$
$$\Rightarrow \frac{\partial K_K}{\partial K_i} = \left(\frac{n+m-k}{n}\right)$$

Continuing we have

$$p^m(Pf' - r - w) + \sum_{k=1}^{m-1} p^k(1-p)^{m-k}Pf' - \sum_{k=1}^{m-1} p^k(1-p)^{m-k} r\left(\frac{n+m-k}{n}\right)$$

$$
\begin{aligned}
&-\sum_{k=1}^{m-1} p^k (1-p)^{m-k} w \\
&+\sum_{k=1}^{m=1} (1-p)^k p^{m-k}(-w) + (1-p)^m(-w) = 0
\end{aligned}
$$

Now the expression $\sum_{k=1}^{m-1} p^k(1-p)^{m-k}(n+m-k)$ is an arithmetico–geometric series with the first two terms forming a geometric series with $p/(1-p)$ as the common ratio and the third term forming an arithmetic progression with common difference -1, first term $n+m-1$ with $m-1$ terms. For a finite series, the sum of first n terms of such a series is given as

$$
S_n = \frac{a_n g_{n+1}}{r-1} - \frac{x_1}{r-1} - \frac{d(g_{n+1}-g_2)}{(r-1)^2}
$$

where a_n is the first expression in the nth term of the arithmetic series, g_i is the ith term in the geometric series, r is the common ratio, d is the common difference, and x_1 is the first term in the series.

Thus, we have

$$
\begin{aligned}
p^m(Pf'-r-w) - {} & \frac{p^m(1-p)\{n-p+2\} - p(1-p)^m\{n+m+p-1\}}{2p-1} r \\
& + \frac{p(1-p)\{(1-p)^{m-1}-p^{m-1}\}}{1-2p} Pf' \\
& - \left[\frac{2p(1-p)\{(1-p)^{m-1}-p^{m-1}\}}{1-2p} + (1-p)^m\right] w = 0 \\
& \Rightarrow \left[p^m + \frac{p(1-p)\{(1-p)^{m-1}-p^{m-1}\}}{1-2p}\right] Pf' \\
& - \left[p^m + \frac{p^m(1-p)\{n-p+2\} - p(1-p)^m\{n+m+p-1\}}{2p-1}\right] r \\
& - \left[p^m + \frac{2p(1-p)\{(1-p)^{m-1}-p^{m-1}\}}{1-2p} + (1-p)^m\right] w = 0
\end{aligned}
$$

We can further simplify by noting that the coefficient of w includes all combinations of failures and successes and hence is equal to one. Hence,

$$
p''r = p'Pf' - w
$$

Differentiating the profit function for banks for the risky groups in the complete information case, we have

$$\left[p^m + \frac{2p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p}\right] r = i + \frac{1}{B} + 2K$$

$$\Rightarrow \left[1-(1-p)^m\right] r = i + \frac{1}{B} + 2K$$

$$\left(\because p^m + \frac{2p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p} + (1-p)^m = 1\right)$$

This is the same as in the text.

Group Lending Under Incomplete Information

In case of group lending under asymmetric information, the profit function of banks and the groups can be represented as follows where additionally we have q which is the proportion of good borrowers in the population

$$\pi_{B_{\mathrm{ASG}}} = q_{2S} rK - iK - \left(\frac{1}{B} + K\right)K$$

$$\begin{aligned}\pi_{\mathrm{AS}} = m\Big[q + (1-q)\Big\{&p^m(PY_i - rK_i - wK_i) \\ &+ \sum_{k=1}^{m-1} p^k(1-p)^{m-k}(PY_i - rK_K - wK_i) \\ &+ \sum_{k=1}^{m-1} (1-p)^k p^{m-k}(-wK_i) + (1-p)^m(-wK_i)\Big\}\Big].\end{aligned}$$

Following the procedure outlined in 1.1, we have the following first-order conditions

$$\left[q + (1-q)\left\{p^m + \frac{2p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p}\right\}\right] r = i + \frac{1}{B} + 2K$$

$$\begin{aligned}\Rightarrow &\left[q + (1-q)\left\{p^m + \frac{p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p}\right\}\right] Pf' \\ &- \left[q + (1-q)\left\{p^m + \frac{p^m(1-p)\{n-p+2\} - p(1-p)^m\{n+m+p-1\}}{2p-1}\right\}\right] r \\ &- \left[q + (1-q)\left\{p^m + \frac{2p(1-p)\{(1-p)^{m-1} - p^{m-1}\}}{1-2p} + (1-p)^m\right\}\right]]w = 0\end{aligned}$$

$$\Rightarrow q_{2S} r = i + \frac{1}{B} + 2K$$

$$q_{S0} r = q_S P f' - w$$

In case of individual lending under asymmetric information, we have

$$q'r = i + \frac{1}{B} + 2K$$
$$r = Pf' - \frac{w}{q'}$$

Appendix 2

Proof of Proposition 1

From the base case first-order conditions by eliminating r, we have

$$Pf' - w = i + \frac{1}{B} + 2K$$

Similarly, from the case where risky borrowers are included, we have

$$p(Pf' - w) = i + \frac{1}{B} + 2K$$

Equating the R.H.S. of both these equations lending under risky borrower case would be less than that under base case if the following condition is satisfied

$$pPf' - w < Pf' - w$$

This condition is always true since $p < 1$.

The diagrammatic proof of the proposition is as follows (Fig. 5).

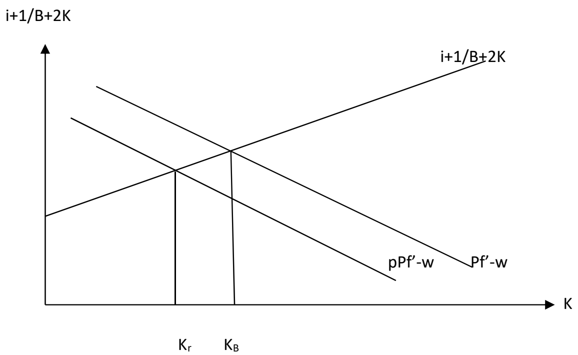


Fig. 5 Lending involving risky borrowers compared to only safe borrowers. *Source* Authors

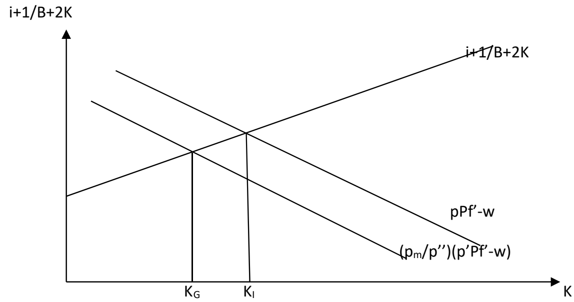


Fig. 6 Lending group contracts versus individual contracts. *Source* Authors

Proof of Proposition 2

From the group contract case under complete information, we have

$$\frac{p_m}{p''}(p'Pf' - w) = i + \frac{1}{B} + 2K$$

As noted earlier from the individual lending case, we have

$$p(Pf' - w) = i + \frac{1}{B} + 2K$$

Thus, if p is sufficiently low, the following condition has to be satisfied for lending under group contracts to be lower than lending under individual contracts

$$\frac{Pf'}{w} < \frac{\frac{p_m}{p''} - 1}{\frac{p_m}{p''}p' - p}$$

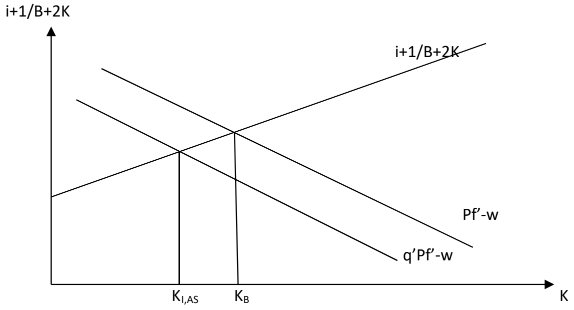
Diagrammatically the proof can be illustrated as follows (Fig. 6).

The L.H.S. of the above expression must be more than one for the project to be viable. Thus, R.H.S must be greater than one also. It can be shown (Appendix 3) that the R.H.S is decreasing in p. For values of $m > 3$, the R.H.S. is greater than one for values of $p \leq 0.6$. This result does not differ across group sizes. But closer is the number of borrowers to the group size, the range of ps for which the R.H.S. is greater than one narrows down significantly.

Proof of Proposition 3

From individual loan contracts under asymmetric information, the first-order conditions of optimum yield

Fig. 7 Lending in the presence of adverse selection. *Source* Authors



$$q'Pf' - w = i + \frac{1}{B} + 2K$$

From the base case as already noted, we have

$$Pf' - w = i + \frac{1}{B} + 2K$$

Hence, for lending in equilibrium to be lower under asymmetric information, we must have

$$q'Pf' - w < Pf' - w$$

Since $q < 1$, this condition is always satisfied.

Diagrammatically (Fig. 7) shows this.

Proof of Proposition 4

Under group contracts in case of asymmetric information, we have

$$\frac{q_{2S}}{q_{So}}(q_S Pf' - w) = i + \frac{1}{B} + 2K$$

From individual contract case under asymmetric information as already noted, we have

$$q'Pf' - w = i + \frac{1}{B} + 2K$$

Hence, for lending in equilibrium under group contracts to be lower than individual contracts, the following condition must be satisfied

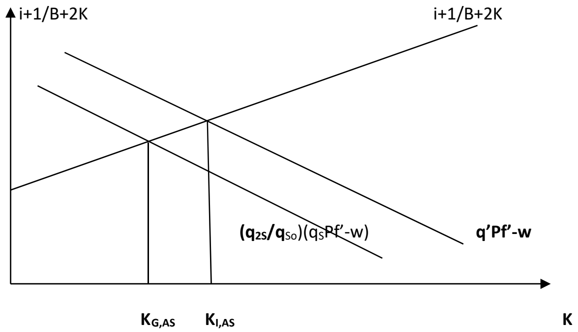


Fig. 8 Lower lending under group contracts than individual contracts. *Source* Authors

$$\frac{Pf'}{w} < \frac{\frac{q_{2S}}{q_{S0}} - 1}{\frac{q_{2S}}{q_{S0}} q_S - q'}$$

Diagrammatically, we have Fig. 8.

For very low values of p and q, we get a negative relationship between R.H.S. and p. But the difference in this case is that we get a small range for very low values of p (< 0.1) for which this relationship turns positive. Secondly, for very high values of q, we get a quadratic relationship between p and R.H.S with positive relationship for a higher range of low values of p; thereafter, the relationship turns negative for most of the range of values of p (Appendix 3). Even in this case we find that if the number of borrowers approaches the group size only for very low values of p (<0.1) will R.H.S be greater than one irrespective of the value of q.

Appendix 3

See Fig. 9.

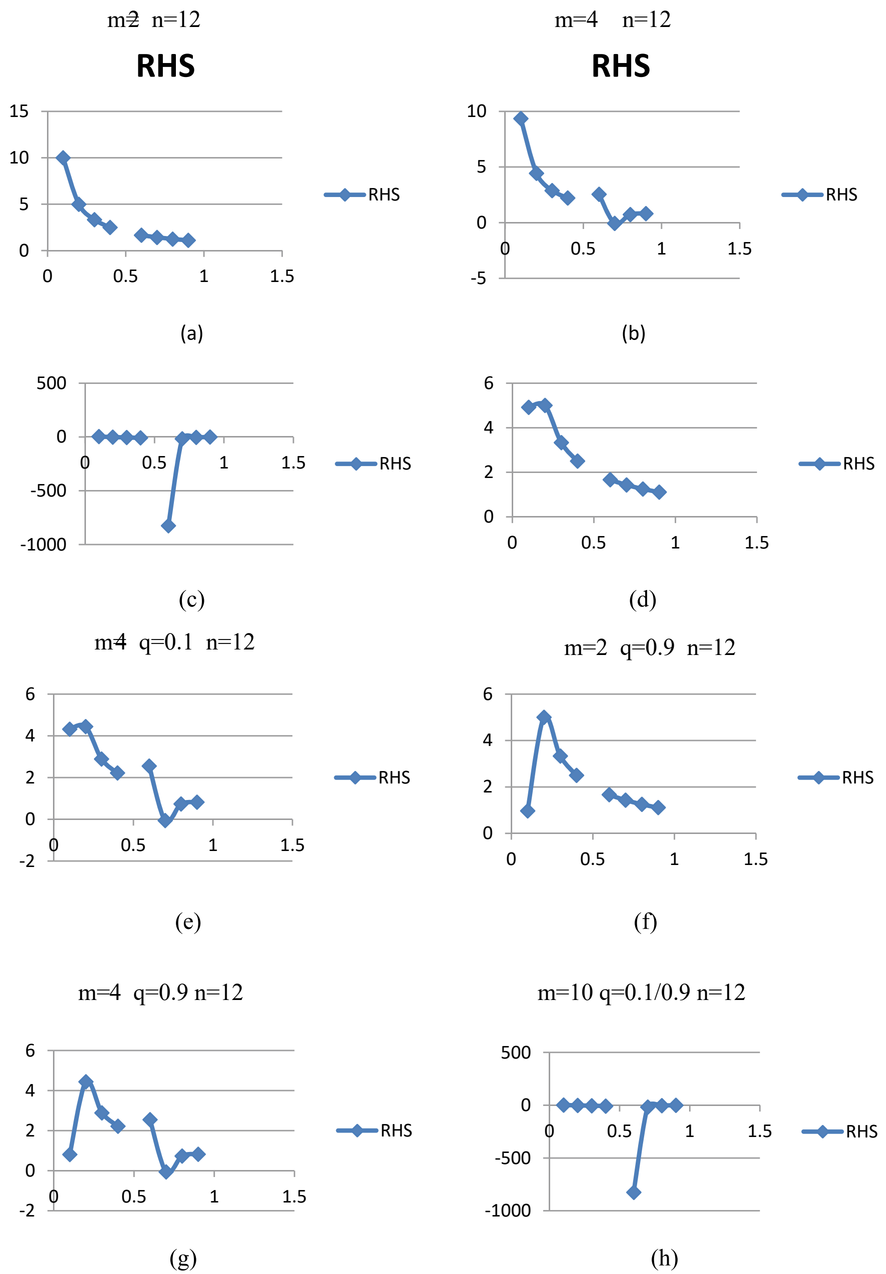


Fig. 9 a–h Value of RHS for various values of the parameters under group and individual lending in the presence of adverse selection. *Source* Authors calculations

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The Effect of Changes in the Policy Rates on Borrowing and Lending of Banks in India

Aditya Banerjee and Samit Paul

1 Introduction

Extensive researches have been carried out to understand how monetary policy transmission affects the banking business across the world. Kashyap and Stein (1994) discuss two different views regarding different channels through which monetary policy transmission takes place, viz. the money view[1] and the lending view. The explanation of Modigliani (1963) presents a picture of the irrelevance of capital structure which means that lending arrangements are not very important. This idea of the irrelevance of capital structure seems to undermine the importance of lending view of monetary policy transmission. Bernanke and Blinder (1988) develop the explanatory model for the lending view which is based on the premise that central banks can influence the volume of lending extended by commercial banks by changing reserve positions using some monetary policy tools. The fact that banks cannot perfectly complement any monetary policy operations by switching between sources of finance is what makes monetary policy effective. However, Bernanke and Gertler (1995) surmise that workings of the credit channel of monetary policy are not well understood and label it as a 'Black-Box.' They point out that though changes in short-term policy rate such as the fed rate should not have any apparent impact on

[1] It is a simplistic model of monetary transmission mechanism which allows for the existence of only two types of assets, viz. money and bonds. This model therefore does not consider 'loans' that are an integral part of the lending view. For further discussion on the money and lending views, refer to Kashyap and Stein (1994, 1995) and Peek and Rosengren (1995).

A. Banerjee
Finance and Accounting, Indian Institute of Management Ranchi, Ranchi, India
e-mail: aditya.banerjee16fpm@iimranchi.ac.in

S. Paul (✉)
Finance and Control, Indian Institute of Management Calcutta, Kolkata, India
e-mail: samit@iimcal.ac.in

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long-term lending and borrowing rates, such changes have been known to affect the purchase of long-lived assets more pronouncedly, which is puzzling.

The impact of monetary policy decisions on the bank's lending has been analyzed by Kashyap and Stein (2000). Their study on a large sample of US banks reveals that central banks can affect credit creation by commercial banks by tightening or loosening monetary policy. They point out the necessity of understanding the impact of monetary policy and the lending channel on aggregate lending and borrowing activities of banks. The effect of monetary policy decisions through the transmission channel has been studied using different variables with vector autoregression (VAR) models (e.g., Aleem, 2009; Bernanke & Blinder, 1988; Pandit et al., 2006). Most of these studies have focussed on either impact of monetary policy on the macroenvironment such as the GDP or the effect of policy decisions of different types of banks, etc. Researchers evince that if central banks start following an accommodative monetary policy after an economic crisis like the 2008 Sub-Prime Crisis, banks tend to respond by increasing leverage and engaging in funding high-risk, illiquid projects (Diamond & Rajan, 2012). However, the impact on various other aspects of a bank's balance sheet such as borrowing, investments, and interbank liabilities has been largely unaddressed in the literature.

Recently, researchers have focussed on the impact of monetary policy decisions on the lending quality of banks. Jimenez et al. (2014) use a VAR model and report that short-term reduction of rates causes banks to go on a lending frenzy, even at the cost of taking additional risk, whereas changes in long-term interest rates are not associated with such behavior. Another study by Dell'Ariccia et al. (2017) provides evidence on the same lines as Jimenez et al. (2014) and points out that well-capitalized banks are more sensitive toward changes in short-term policy rates rather than those who are poorly capitalized. This finding is crucial since it shows another essential aspect of banking—its capital structure, referring to its borrowing vis-à-vis lending. Dell'Ariccia et al. (2017) use individual-level US bank loan data between 1997 and 2011 for their study, and Jimenez et al. (2014) study the same for Spanish banks between 2002 and 2008. Though the focus of these papers was to analyze the impact of monetary policy decisions on risky bank loans at a micro-level, they have ignored the effects of policy changes at an aggregate level.

There are studies which have highlighted how bank's lending channel reacts to the monetary policy interventions such as the multi-nation study by Mishra et al. (2014) of 132 nations for a period of 1978–2013 that demonstrates a relatively weaker monetary policy transmission mechanism in developing nations. A related study in the Indian context by Mishra and Burns (2017) analyzes the impact of monetary policy shocks on bank lending in India using data from 1996 to 2012, revealing a significant impact. The particular aspect which is mostly neglected in the literature is the immediate impact of announcements related to policy changes on the bank's interbank liabilities and aggregate loans and advances.

This study addresses this very issue by using a two-step analysis. First, the analysis of the impact of change in the policy rate (repo rate) by Reserve Bank of India (RBI) on the annual borrowing, deposit, investment, and loans of 43 scheduled Indian banks has been performed using generalized method of moments (GMM) models. Second, the impact of changes in policy rates such as repo rate and cash reserve ratio (CRR) on the aggregate level of fortnightly bank credit and interbank liabilities in the entire banking system of the country is explored with the help of Chow breakpoint test. Results from GMM analysis of annual data suggest that changes in repo rate led to an increase in total borrowings and total loans of the 43 scheduled commercial banks on an average. The result is reflected in the breakpoint analysis with fortnightly data where a change in repo rate or CRR leads to a significant change in the level of fortnightly credit. Interestingly, the change in repo and CRR had a limited impact on the fortnightly aggregate borrowings, and the effect largely disappears after the year 2004. These findings have important implications for banks, regulators, and policymakers of India.

Rest of the chapter is structured as follows: Sect. 2 details the data used and methodology adopted in this study; Sect. 3 reports the findings and discusses the results; finally, Sect. 4 concludes the study.

2 Data and Methodology

Data for analysis are collected entirely from the Reserve Bank of India database. The panel data analysis is carried out using annualized data on 43 scheduled banks that include 25 nationalized banks and 18 private sector banks. The data on aggregate borrowings, deposits, investments, and loans are available on the RBI database[2] and have been obtained for the period starting from 2006 to 2017. The nationalized banks have a much larger scale of operations as they have nearly thrice the average deposits of private sector banks while having nearly 2.5 times the loans and advances in comparison. The private sector banks, however, are more profitable on an average with a return on asset of 1.12 (versus 0.62 for nationalized banks). The banks are included in the sample based on two criteria. Firstly, sample banks should be based in India. Secondly, data should be available for the entire sample period. Further, banks that were merged with other banks during the sample period are not considered. The final sample forms a balanced panel of 43 banks for 12 years resulting in 516 firm-year observations.

The impact of repo rate changes on annual borrowings, deposits, investments, and loans for the sample of 43 banks is carried out with the help of panel data analysis using generalized methods of moments (GMM) models. While investigating with an ordinary least square (OLS) model, the presence of autocorrelation in the dependent variables (annual borrowings, deposits, investments, and loans) has been detected through the Durbin–Watson statistic. Moreover, the presence of heteroscedasticity of errors in OLS results is identified through a Breusch–Pagan LM test. Due to these issues, the OLS method has been considered as inefficient. To address this, a panel data analysis has been performed with the help of n-step GMM proposed by Arellano

[2] The RBI database can be accessed at: https://dbie.rbi.org.in/.

and Bond (1991). The GMM is efficient as it uses the lagged and differenced values of regressors to remove any problem of endogeneity.

Based on the findings of prior researches (e.g., Dell'Ariccia et al., 2017), the study controls the profitability of banks, narrow money supply, bank's capital adequacy ratio, the annual GDP, and average maturities of each component (annual borrowings, deposits, investments, and loans) for removing the possibility of missing variable problems.

The general representation of the GMM equations is given below. Short descriptions of the dependent, independent, and control variables are provided in the following equations.

The regression equations for panel data are as follows:

$$\begin{aligned}\mathrm{BORROWING}_{i,t} = {} & \beta_1\,\mathrm{BORROWING}_{i,t-1} + \beta_2\,\mathrm{REPO}_t \\ & + \beta_3\,\mathrm{ROA}_{i,t} + \beta_4\,\mathrm{M1}_t + \beta_5\,\mathrm{TIER1}_{i,t} \\ & + \beta_6\,\mathrm{GDP}_t + \beta_7\,\mathrm{ABM}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

$$\begin{aligned}\mathrm{DEPOSIT}_{i,t} = {} & \beta_1\,\mathrm{DEPOSIT}_{i,t-1} + \beta_2\,\mathrm{REPO}_t + \beta_3\,\mathrm{ROA}_{i,t} \\ & + \beta_4\,\mathrm{M1}_t + \beta_5\,\mathrm{TIER1}_{i,t} + \beta_6\,\mathrm{GDP}_t \\ & + \beta_7\,\mathrm{ADM}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{2}$$

$$\begin{aligned}\mathrm{INVESTMENT}_{i,t} = {} & \beta_1\,\mathrm{INVESTMENT}_{i,t-1} + \beta_2\,\mathrm{REPO}_t \\ & + \beta_3\,\mathrm{ROA}_{i,t} + \beta_4\,\mathrm{M1}_t + \beta_5\,\mathrm{TIER1}_{i,t} \\ & + \beta_6\,\mathrm{GDP}_t + \beta_7\,\mathrm{AIM}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{3}$$

$$\begin{aligned}\mathrm{LOAN}_{i,t} = {} & \beta_1\,\mathrm{LOAN}_{i,t-1} + \beta_2\,\mathrm{REPO}_t + \beta_3\,\mathrm{ROA}_{i,t} + \beta_4\,\mathrm{M1}_t \\ & + \beta_5\,\mathrm{TIER1}_{i,t} + \beta_6\,\mathrm{GDP}_t + \beta_7\,\mathrm{ALM}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{4}$$

where the subscript i denotes the index of individual banks in the study and t denotes the period in years under investigation. The dependent, independent, and control variables are defined below:
Dependent variables:

BORROWING	Natural log of total borrowings per year by banks. Here, total borrowings refer to the sum of borrowings of all maturities from all sources (RBI and interbank) made by a given bank during a given year, as reported by RBI
DEPOSIT	Natural log of total deposits (aggregate of all deposits) per year by banks. It is the sum of all deposits from all sectors and all maturities during the year. Deposits include interbank deposits
INVESTMENT	Natural log of total investments made per year by banks for all maturities. Including interbank deposits and holdings of securities of various maturities. Investment excludes loans and advances

(continued)

(continued)

LOAN	It is the natural log of total loans and advances (aggregate of all loans, mortgages, including interbank) given per year by banks for all maturities of all types. Loans exclude any investment

Independent variable:

REPO	Repurchase options are the key monetary policy rate of RBI. It is the average repo rate for a given year. Central banks use monetary policy instruments to control the supply of credit with a subsequent impact on the economy (Kashyap & Stein, 1995). Thus, ideally, an increase in REPO is expected to have a negative impact on bank borrowing and lending but should increase deposits and investments

Control variables:

ROA	Return of assets of each bank for each year as reported by RBI. Reported by RBI directly from notes to accounts of annual reports of scheduled commercial banks. The profitability of banks is expected to impact its lending business positively by increasing its accumulated capital (Gambacorta & Shin, 2018). Thus, it is expected to have a positive impact on lending while reducing the need for borrowings and boosting overall banking business
$M1$	Natural log of narrow money supply for the year. It is calculated as *Currency with the public + Demand deposits with the banking system + 'Other' deposits with the RBI*. Though the money supply may itself be affected by the monetary policy intervention exercise which may in turn influence the lending by banks (Mishra et al., 2014), there may be other reasons for changes in the money supply as well (Palley, 1994). The argument here is that narrow money supply is an indicator of economic activity that signals an increased business opportunity for banks. The impact of M1 is, therefore, expected to be positive for all dependent variables
TIER1	TIER 1 capital adequacy ratio of banks. The ratio of Common Equity Tier 1 Capital to risk-weighted assets of the bank. As shown by Dell'Ariccia et al. (2017), the increase in Tier 1 capital has a significant impact on reducing risky lending by banks. Thus, it is important to control capital adequacy ratio. The direction of the impact of TIER1 capital on the dependent variables is also of much interest.
GDP	Natural log of the gross domestic product of India during the year. The GDP is an indicator of economic activity, and it is assumed that an increase in GDP should signal increased activity in the banking sector as well (Dell'Ariccia et al., 2017). Therefore, the impact of GDP is expected to be positive on all dependent variables
ABM	It is the average borrowing maturity in a fraction of years for each bank for the given year. It is calculated as the weighted average of maturities, with weights being the amount outstanding for each maturity. The argument in this study is that banks would prefer to borrow for longer maturity as it allows them more time for repayment. The impact on BORROWING is expected to be positive
ADM	It is the average deposit maturity in a fraction of years for each bank for the given year. It is weighted by amount outstanding for each maturity. Similar to borrowing maturity, banks would benefit by accepting longer maturity time deposits as it provides them with a larger base for lending and longer time before withdrawal. The impact on DEPOSIT is expected to be positive

(continued)

(continued)

AIM	It is the average investment maturity in a fraction of years for each bank. It is weighted by amount outstanding for each maturity. Banks may prefer to keep their investment locked in for a shorter period as they may need the invested money for their business activities. The impact on INVESTMENT is expected to be negative
ALM	It is the average loan maturity in a fraction of years per year for each bank. It is weighted by amount outstanding for each maturity. Banks may prefer loans which are repaid in a relatively shorter period, as this will help in maintaining adequate capital and reduce the probability of the loans becoming unrecoverable in the longer maturities. The impact on LOAN is expected to be negative

Following the panel data analysis, a Chow breakpoint test (Chow, 1960) is conducted. The objective was to test if the level of fortnightly aggregate credit and interbank liabilities (excluding those to RBI) in the banking system (for all banks combined) changed as soon as RBI announced a change in repo rate of CRR levels.

This study uses a very long period time-series data on fortnightly aggregate bank credit and aggregate interbank liabilities (excluding those to the RBI) as reported in the RBI database. The data ranges from June 15, 2001, to December 8, 2017, for a total of 387 fortnights. During these 387 fortnights, RBI revised the repo rate 30 times, the first on April 5, 2002, and last on August 4, 2017. During this period, RBI revised the CRR 28 times, the first on November 16, 2001, and the last on November 16, 2012, and then kept it constant for the rest of the study period.

The Chow breakpoint test examines the stability of regression errors in time-series data. Therefore, the test can only be conducted on a fitted regression equation. In this study, two regression equations are fitted on the time-series data:

The regression equation for credit is:

$$\Delta\text{CREDIT}_t = \beta_0 + \beta_1\Delta\text{AD}_t + \beta_2\Delta\text{AD}_{t-1} + \varepsilon_t \tag{5}$$

where ΔCREDIT_t is the logarithmic change in the bank credit for each fortnightly period t. ΔAD_t is the logarithmic change in fortnightly aggregate bank deposits along with its lagged variable. ε_t is the regression error. AD is the sum of all deposits of all type received by the banks. Since changes in AD significantly affect both bank credit and interbank borrowings, it has been selected as the regressor variable.

The regression equation for interbank liabilities is:

$$\Delta\text{LIAB}_t = \beta_0 + \beta_1\Delta\text{LIAB}_{t-1} + \beta_2\Delta\text{AD}_t + \varepsilon_t \tag{6}$$

where ΔLIAB_t is the logarithmic change in the interbank liabilities for each fortnightly period t. The presence of autocorrelation in LIAB leads to the addition of a lagged regressor variable ΔLIAB_{t-1}.

3 Findings and Discussion

Before discussing the panel data regression results, it is crucial to take a look at the descriptive statistics of the panel data variables in Table 1. The most notable observation in Table 1 is that borrowings, deposits, investments, and loans vary significantly from bank to bank. Most of the variables are positively skewed, and most variables have high kurtosis. The correlation coefficients among the four dependent variables and their correlation with the repo rate are given in Table 2. The significance of the correlations are checked and corresponding *p*- values are reported below the coefficients in italics. It is evident from Table 2 that for the same period, the repo rate is uncorrelated (*p*- values higher than 0.05) with annual borrowings, deposits, investments, and loans. Table 3 shows the correlation between repo rate and the other independent (control) variables. As evident from the table, the correlation between the independent variables is well below 0.5 (except between M1 and GDP) suggesting minimal multicollinearity. Only after adjusting for autocorrelation in the dependent variables, any measurable impact of the repo rate is observed.

The results from GMM regression Eqs. 1–4 are provided in Table 4. As evident from the table, the coefficient of REPO is positive and significant (at 1% level) for annual borrowing and loans. The positive relationship between REPO and annual borrowing is counterintuitive. Still, the answer may lie in a 2017 report published by

Table 1 Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. dev	Skewness	Kurtosis
REPO	7.05	7.45	8.21	5.10	0.98	−0.71	2.26
BORROWING	149,457	35,806	3,233,446	0	337,836	4.95	34.95
DEPOSIT	1,370,896	740,390	20,447,514	8742	2,043,440	4.63	33.33
INVESTMENT	452,787	257,082	7,659,896	2766	668,425	5.08	42.05
LOAN	1,045,131	525,314	15,710,784	4908	1,650,745	4.82	34.69
ROA	0.83	0.88	2.13	−2.80	0.69	−1.40	6.75
M1	15,858	15,864	25,080	7165	5744	0.11	1.80
TIER1	10.15	9.14	55.93	4.88	4.20	5.64	51.25
GDP	54,897	54,577	78,598	35,432	13,257	0.26	1.94
ABM	1.78	1.74	5.00	–	1.09	0.41	2.61
ADM	1.75	1.62	3.69	0.48	0.60	0.63	2.93
AIM	3.26	3.68	4.72	0.16	0.99	−0.94	2.72
ALM	2.10	2.04	3.81	1.00	0.42	0.78	4.35

Source Author's own computations. *Data source* The RBI Database of Indian Economy
Notes BORROWING, DEPOSIT, INVESTMENT, and LOAN are in millions of rupees. M1 and GDP figures are in billions of rupees
This table shows the descriptive statistics of all the variables used in the panel data analysis

Table 2 Correlation matrix among REPO and the dependent variables

	REPO	BORROWING	DEPOSIT	INVESTMENT	LOAN
BORROWING	0.002	1			
	0.964				
DEPOSIT	−0.004	0.844	1		
	0.925	*0.000*			
INVESTMENT	−0.010	0.898	0.976	1	
	0.828	*0.000*	*0.000*		
LOAN	0.008	0.885	0.993	0.977	1
	0.849	*0.000*	*0.000*	*0.000*	

Source Author's own computations. *Data source* The RBI Database of Indian Economy
Notes The values in italics below each correlation value show the significance in *p*-values of the correlation between each pair
This table displays the correlation of REPO with the dependent variables in the panel data analysis. The correlation coefficients among the dependent variables are also provided

Table 3 Correlation matrix among REPO and the other independent variables

	REPO	ROA	M1	TIER1	GDP	ABM	ADM	AIM	ALM
ROA	0.0767	1							
	0.0819								
LNM1	−0.0143	−0.3227	1						
	0.7451	*0.000*							
TIER1	−0.0294	0.3207	0.0584	1					
	0.5056	*0.000*	*0.1855*						
LNGDP	−0.0067	−0.3554	0.9927	0.0503	1				
	0.8792	*0.000*	*0.000*	*0.2545*					
ABM	−0.1261	−0.1948	0.3539	−0.0694	0.3281	1			
	0.0041	*0.000*	*0.000*	*0.1153*	*0.000*				
ADM	−0.0266	−0.1628	0.1455	−0.1544	0.1593	0.1345	1		
	0.5469	*0.0002*	*0.0009*	*0.0004*	*0.0003*	*0.0022*			
AIM	0.0255	−0.2394	−0.1677	−0.2535	−0.1695	0.0815	0.1118	1	
	0.564	*0.000*	*0.0001*	*0.000*	*0.0001*	*0.0643*	*0.0111*		
ALM	−0.0428	−0.2366	0.1164	−0.1716	0.1348	0.1499	0.1161	0.0035	1
	0.3314	*0.000*	*0.0081*	*0.0001*	*0.0022*	*0.0006*	*0.0083*	*0.9376*	

Source Author's own computations. *Data source* The RBI Database of Indian Economy
Notes The values in italics below each correlation value show the significance in *p*-values of the correlation between each pair
This table displays the correlation of REPO with the other independent variables in the panel data analysis. The correlation coefficients among the independent variables are also provided

Table 4 Results from panel regression

Equations	Equation 1	Equation 2	Equation 3	Equation 4
Dependent variable	BORROWING	DEPOSIT	INVESTMENT	LOAN
Independent variable:				
REPO	0.3836***	-3.73×10^{-05}	0.0014	0.0128***
Autoregressive coefficients:				
BORROWING_{t-1}	0.0262***			
DEPOSIT_{t-1}		0.7923***		
INVESTMENT_{t-1}			0.7107***	
LOAN_{t-1}				0.7726***
Control variables:				
ROA	−0.3820***	0.0801***	0.0669***	0.0847***
M1	9.4914***	0.2247***	0.8726***	0.2133***
TIER1	−0.0191*	−0.0068***	−0.0027	4.63×10^{-05}
GDP	−12.5544***	0.0158	−0.8237***	0.0862
ABM	0.4062***			
ADM		0.0340***		
AIM			−0.0842***	
ALM				−0.2116***
GMM robustness test				
Sargan–Hansen J statistic	40.7525	38.4007	39.1460	32.8118

Source Author's own computations. *Data source* The RBI Database of Indian Economy
Notes '***' represents that a value is significant at 1% level, '**' represents significance at 5% level, and '*' represents significance at 10% level
The table shows the results of regression equations from 1 to 4. Arellano–Bond GMM has been fitted to the data to control for autocorrelation in the dependent variables. The Sargan–Hansen J statistic tests the null hypothesis that the instruments are robust and the model is valid (acceptance of null hypothesis indicates a valid model)

the RBI,[3] which shows that in recent times, the percentage of short-term liabilities used to fund long-term assets has gone up significantly. Thus, despite repo rates going up, banks may still borrow more to finance their long-term assets. Since an increase in short-term policy rate has a significant impact on the interest rates of long-term assets (Bernanke & Gertler, 1995), banks may borrow more to fund loans and advances from which they earn even higher returns.

The positive and significant (at 1% level) impact of REPO on LOAN is again counterintuitive. As RBI increases their benchmark rate, loans' interest rates are expected to increase with the demand for loans going down. However, as the RBI reports suggest, increase in REPO may not have enough stalling effect on loans

[3] Report on trend and progress of banking in India 2016–17. Published yearly by RBI and available for download on its Web site.

as some sectors such as retail and rural credit witness double-digit growth and robust increase in demand for loans during the study period.

Changes in REPO did not have any significant impact on DEPOSIT and INVESTMENTS during the study period. However, the coefficients for all lagged variables were positive and significant (at 1% level), suggesting a positive impact of growth in all these variables being carried on to the next period. Among the control variables, the coefficient of ROA is consistently significant (at 1% level) in all equations, with a negative impact on BORROWINGS. Thus, more profitable banks borrowed less. An increase in the money flow (M1) indicates an increase in banking activity across the spectrum as evident from the positive and significant (at 1% level) coefficient values. The capital adequacy ratio (TIER1) of banks has the most significant (at 1% level) and a negative relationship with deposits, and on borrowings (at 10% level). The link with deposits is more due to the computational methodology of the Tier 1 ratio, but an increase in funding through the equity channel may increase borrowings.

It is apparent that in times of high GDP growth, banks borrow less, and they also reduce their investments. As per RBI report, banks have become flushed with more funds with the progress of the economy, and borrowings have declined from their historically high levels. The average maturities for bank borrowings and deposits increase significantly (at 1% level) because banks borrow more when they can borrow for longer maturities and accept more long-term deposits. In contrast, banks prefer lower maturities for both their investments and loans as this helps in faster recovery of funds blocked in assets.

As the RBI revises repo and CRR rates, the more immediate impact is felt on the fortnightly movement of funds. It is more easily measurable for the aggregate level movement of funds. The results of the Chow breakpoint test for changes in the level of aggregate bank credit and interbank liabilities (excluding those to RBI) are presented in Table 5. Panel A of Table 5 shows the impact of change in repo rate on change in levels of credit and liabilities. Changes in repo rate have a significant and measurable impact on the aggregate credit level for all revisions except the first (on April 5, 2002) and last (August 4, 2017) which may be due to insufficient data point on both ends. Bank credit levels react immediately to the RBI monetary policy intervention. However, after 2004, the changes in repo no longer affect the interbank liabilities of banks. Since the interbank liabilities of banks, which exclude borrowings from RBI, consist mostly of short-term money market (e.g., overnight loans and call money) obligations, they are not as responsive to RBI's rate changes as bank credit.

The findings for changes in CRR (Panel B of Table 5) mirror the results of changes in the repo rate. Bank credit responds significantly to changes in CRR, except for the first two instances, which may be due to insufficient data points. As evidence from panel data suggests, banks often borrow even at a higher interest rate to fund their long-term assets. Thus, the volume of aggregate fortnightly interbank liabilities does not necessarily respond to changes in RBI's policy rates of repo and CRR.

4 Concluding Remarks

This chapter strives to elucidate the impact of monetary policy shocks on the banking business (borrowing, lending, deposits, and investments) at an aggregate level. First, by employing a dynamic panel data method, this study reveals that the monetary

Table 5 Results from Chow breakpoint test

Panel A: Changes in repo rate				Panel B: Changes in CRR			
Date	ΔREPO (%)	CREDIT	LIAB	Date	ΔCRR (%)	CREDIT	LIAB
05-04-2002	−6.06	1.6542	3.4818**	16-11-2001	−26.57	0.6361	4.1066***
15-11-2002	−6.45	9.6060***	3.2465**	11-01-2002	−4.45	0.5481	3.9979***
21-03-2003	−1.42	6.5468***	3.4416**	14-06-2002	−9.53	8.1996***	4.2995***
02-04-2004	−15.42	5.0624***	2.9146**	29-11-2002	−5.13	7.07352***	3.4007**
28-10-2005	4.08	4.5171***	0.6977	27-06-2003	−5.41	3.9052***	2.5367*
03-02-2006	3.92	4.9118***	1.0392	01-10-2004	5.41	6.2759***	3.1113**
09-06-2006	3.77	4.6228***	0.9686	15-10-2004	5.13	6.4629***	2.9799**
04-08-2006	3.64	4.5602***	0.9933	05-01-2007	4.88	5.6223***	0.8674
10-11-2006	3.51	5.5176***	0.7527	19-01-2007	4.65	5.5436***	0.8930
02-02-2007	3.39	5.5437***	0.8524	02-03-2007	4.45	5.6553***	0.8151
13-04-2007	3.28	6.1943***	0.8698	16-03-2007	4.26	5.9581***	0.9168
01-08-2008	5.72	5.3888***	0.8420	27-04-2007	4.08	6.0831***	0.8919
16-01-2009	−16.71	6.5715***	0.4027	11-05-2007	3.92	5.9211***	0.9233
24-04-2009	−5.13	5.5058***	0.3123	17-08-2007	7.41	4.3449***	1.4887
23-04-2010	4.88	4.7141***	0.7050	23-11-2007	6.90	4.7381***	1.1991
30-07-2010	4.45	4.8667***	0.6263	09-05-2008	3.28	5.2351***	0.9024
05-11-2010	4.08	4.1010***	0.7878	23-05-2008	3.17	5.2965***	0.8636
28-01-2011	3.92	4.5090***	0.7961	06-06-2008	3.08	5.3002***	0.8580
29-07-2011	6.45	4.5741***	0.7822	01-08-2008	2.90	5.3882***	0.8420
04-11-2011	2.99	4.2675***	0.9803	12-09-2008	2.82	4.9062***	0.6575
20-04-2012	−6.06	5.5630***	0.5065	30-01-2009	−9.53	6.3025***	0.3729
03-05-2013	−3.39	4.5646***	0.6285	26-02-2010	9.53	4.4874***	0.8676
01-11-2013	3.28	4.5877***	1.3997	12-03-2010	4.45	4.5125***	0.8102
07-02-2014	3.17	4.5040***	1.1849	07-05-2010	4.26	4.6773***	0.7472
06-03-2015	−3.28	3.6255**	0.8539	10-02-2012	−8.70	4.5879***	0.6904
12-06-2015	−3.39	3.5762**	0.7070	23-03-2012	−14.66	4.9478***	0.6464
02-10-2015	−7.15	2.9300**	0.5534	05-10-2012	−5.41	4.2908***	1.0231
15-04-2016	−3.77	4.6476***	0.3428	16-11-2012	−5.72	4.1793***	1.0478
14-10-2016	−3.92	2.7669**	0.0984	*(This space has been intentionally left blank)*			

(continued)

Table 5 (continued)

Panel A: Changes in repo rate				Panel B: Changes in CRR			
Date	ΔREPO (%)	CREDIT	LIAB	Date	ΔCRR (%)	CREDIT	LIAB
04-08-2017	−4.08	0.2507	0.4379				

Source Author's own computations. *Data source* The RBI Database of Indian Economy
Notes '***' represents that a value is significant at 1% level, '**' represents significance at 5% level, and '*' represents significance at 10% level.
The regression equations used for the breakpoint test with their parameter values and with adjusted R-squared (R^2_{Adj}), p-value of regression F-stat (Prob_F), and Durbin–Watson stat (DW) are below:
$\Delta\text{CREDIT}_t = 0.0036 + 0.7106\Delta\text{AD}_\text{t} - 0.1807\Delta\text{AD}_{\text{t}-1}$, with $R^2_{\text{Adj}} = 0.54$, $\text{Prob}_F = 0.00$, $\text{DW} = 1.8$
$\Delta\text{LIAB}_t = -0.0047 - 0.1568\Delta\text{LIAB}_{t-1} + 1.3604\Delta\text{AD}_t$; $R^2_{\text{Adj}} = 0.10$, $\text{Prob}_F = 0.00$, $\text{DW} = 2.0$
The table above shows the results of Chow breakpoint test for analyzing the structural breaks in the logarithmic changes in credit (CREDIT) and interbank liabilities (LIAB) of Indian banks. The structural breaks are tested for dates on which a change in either repo rate (Panel A) or the CRR (Panel B) was announced by the RBI. ΔREPO is the percentage change in repo rate as announced by the RBI on the given date. ΔCRR is the percentage change in CRR as announced by the RBI on the given date.

policy interventions of RBI through repo rate may not have the intended impact on the interbank borrowing and bank lending. The banks are borrowing and lending more despite increases in the repo rate that may suggest a robust interbank borrowing channel and a strong demand for loans in an expanding economy. Second, the results also indicate that the impact of prior period banking activities positively impacts the current period activities. It is observed from the results of Chow breakpoint test that the revision of CRR and repo rate of RBI have an immediate and measurable impact on the aggregate bank credit. However, the policy rate revisions have lost its relevance for interbank borrowings since 2004.

Thirdly, it can be said that the RBI's monetary policy interventions work to some extent, especially on the bank's total borrowing over the year and its total loan disbursement in a year. Several other factors such as bank's profitability, the money supply in the economy, bank's risk capital, GDP, and maturities of its borrowing and lending instruments also play an important role in its business activities over the year. Finally, the study also points out that on a fortnightly basis, the aggregate credit of banks is the one which is directly impacted, and the response time is relatively quick. Though, the bank's short-term interbank liabilities do not seem to be affected. As the economy grows, the banking system of the country plays an increasingly important role. Overall, this study evinces that the research on the Indian banking system is always relevant and, with its rapidly changing dynamics, will always be necessary.

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Shadow Banking and Non-banking Financial Companies in India: An Overview

Sankarshan Basu and Jaslene Bawa

1 Introduction

The Indian financial sector is large, diverse and fast evolving with a number of players meeting different financial needs. The sector comprises players such as scheduled commercial banks (These SCBs are further classified into public sector banks, private sector banks, small finance banks and foreign banks), co-operative banks, payment banks, regional rural banks, development financial institutions, insurance companies, non-banking financial institutions (NBFI), mutual funds, pension funds and other small financial companies.

There are 133 scheduled commercial banks which provide bank loans worth INR 102.82 billion and total assets worth INR 155.21 billion as total assets reported on July 31, 2020.[1]

The total number of RBI registered Non-Banking Finance Companies are 9,601 as on March 31, 2020. Of these 66 are deposit accepting NBFCs (NBFs-D) and roughly 2.89% of the total number of RBI registered NBFCs are termed as systematically important non-deposit accepting NBFCs (NBFCs ND-SI). The NBFCs consolidated balance sheet size is roughly 20% of the balance sheet size of the scheduled commercial banks (SCBs). (Source: Financial Stability Report, June 2020). NBFIs are further classified into NBFCs and housing finance companies (HFC) forming 70%

S. Basu (✉)
Finance and Accounting, Indian Institute of Management, Bangalore, India
e-mail: sankarshan.basu@iimb.ac.in

J. Bawa
Finance and Accounting, FLAME University, Pune, India
e-mail: Jaslene.bawa@flame.edu.in

[1] Weekly Statistical Supplement—All Scheduled Commercial Banks—Business in India and Quarterly statistics on Deposits and Credits of Scheduled Commercial Banks, Reserve Bank of India (RBI).

P. Mukherjee (ed.), *Revisiting the Indian Financial Sector*, India Studies in Business and Economics, https://doi.org/10.1007/978-981-16-7668-0_10

and 30% of the combined balance sheet. NBFIs are further classified into ten categories, namely (a) asset finance companies, (b) investment companies, (c) infrastructure finance companies, (d) loan companies, (e) non-banking financial company—factors (NBFC-Factors), (f) non-banking financial company—microfinance institution (NBFC-MFI), (g) mortgage guarantee companies (MGC), (h) NBFC—non-operative financial holding company (NOFHC) and (i) systemically important core investment company (CIC-ND-SI).

Non-banking financial companies complement the scheduled commercial banks (SCBs) in extending credit in the economy. While a lot has been said about most of these institutions, information available about non-banking financial institutions (NBFIs) has been relatively less given the lack of focus on the same. In this chapter, we try to look at the state of the non-banking financial institutions in India in more detail and depth. But before that, we wish to digress slightly to a new phenomenon of shadow banking—a practice that has evolved in the last 15 years and is also very widespread in India even at the cost of increased risks for the financial system due to lack of appropriate regulation. The next two sections focus on the literature on shadow banking in general and India in specific, followed by a section on NBFCs in India. The final section concludes the chapter.

2 Define Shadow Banking

McCulley[2,3] coined the term "Shadow banking" for the first time at the annual financial symposium hosted in 2007 by the Kansas City Federal Reserve Bank in Jackson Hole, Wyoming. Subsequently, Adrian and Shin (2010) narrated a formal explanation such as "Unregulated financial institutions undertaking liquidity transformation, maturity transformation and credit transformation or a regulated financial entity undertaking such activities in an unregulated conditions would also classify the institution as a Shadow bank."

A few academic studies have showcased mutual funds in the context of shadow banking (Cherenko & Sunderam, 2016; Duygan-Bump et al., 2013; Jiang et al., 2017; Morris et al., 2017; Shek et al., 2017; Sunderam & Cherenko, 2014). These studies indicated that mutual funds perform the function of maturity and liquidity transformation through mutual fund schemes (open-ended) like banking institutions and are engaged in shadow banking activities. However, it needs to be noted that these mutual funds do not provide any mandated protection to the investors in terms of the capital invested in case of losses from the investments. In case of an adverse event, large asset funds may possess a higher internal loss absorption capacity, but

[2] IMF, https://www.imf.org/external/pubs/ft/fandd/2013/06/basics.htm#:~:text=Shadow%20banking%2C%20in%20fact%2C%20symbolizes,Bank%20in%20Jackson%20Hole%2C%20Wyoming; accessed on September 9, 2020.

[3] Federal Reserve Bank of Atlanta, Shadow Banking Interview of Paul McCulley, available on the Internet at, https://www.frbatlanta.org/news/conferences-and-events/conferences/2012/120409-fmc/media/mcculley-interview.aspx, accessed on September 9, 2020.

at some level, the net asset value (NAV) is adversely impacted, and the fund house would possibly be faced with an erosion of their fund base.

A few prominent studies have focused on financial stability and linked it with shadow banking. These studies have displayed that systemic risk[4] has a larger impact when shadow banking exists in a financial system; when under an inappropriately regulated environment, the interconnectedness within the various players of the financial system is high, when illiquidity, insolvency and losses occur, they are quickly transmitted via a network of interrelated institutions that possess a joint beneficial business relationship in times of financial distress (Acharya et al. 2012; Acharya et al. 2016; Acharya and Thakor 2016; Acharya, 2017; Bengtsson, 2013, Billio et al., 2012; Chen et al., 2010; De Bandt & Hartmann, 2000; Feroli et al., 2014; Hanouna et al., 2015; Goldstein 2017; Ghosh et al. 2012; SEC, 2015; Song and Xiong 2018). This makes it relevant to focus on the fact that the conventional definition of systemic risk which in practice covers the exposure of an individual bank to depositor runs and is limited as the description of systemic risk extends far beyond the conventional explanation, and similar to a contagion effect, this collapse is spread from one establishment/organization to another organization, one market to another market and one system to another system.

Further owing to the interlinkages, it becomes important to note, what impact the leverage, liquidity, losses of financial institutions have in a shadow banking system (Reinhart & Rogoff, 2009). Hence, one needs to focus on shadow banking.

Shadow banking has long been present as a complement to the formal banking and financial channels and has gained prominence since 2007–2008, specifically as an aftermath of the global financial crisis. Existence of a shadow bank is based on the fact that such an institution could undertake the primary functions of a financial intermediary and more so of a credit intermediary (e.g., a bank) like liquidity, credit and maturity transformation, without having any direct access to the liquidity facilities offered by the country's central bank or even have access to the deposit insurance guarantees mandatorily available to the banking sector (Chernenko & Sunderam, 2014; Duygan-Bump et al., 2013). Shadow banking as a concept has gradually evolved and has become significant especially when credit intermediation exists outside the traditional regulated banking framework.

An example of this is available in the developed markets, where the debt mutual fund and money market mutual funds (MMMF) schemes performed the role of shadow banks. When business was normal, the problem of the MMMF performing the shadow banking function did not come to the fore. However, when the global financial crisis (sub-prime mortgage crisis in USA) occurred, it adversely affected these mutual funds, their returns and valuations. The reason for these mutual funds' adverse impact was that their schemes had an indirect exposure to low quality assets (residential and commercial mortgages) through debt instruments based on the mortgage cash flows. As the crisis deepened, scheme and fund investors wanted to redeem their investments creating a huge redemption pressure on the funds/schemes. Typically,

[4] Systemic risk is defined as a risk event that pressurizes the financial systems' stability or threatens the public confidence in the system.

redemption is not an issue but given a downward spiraling market and poor quality of the underlying assets (mortgage securities), the funds/schemes' ability to liquidate was severely compromised leading to potential default like situations. As a last resort, the funds had to resort to distressed asset sale (fire sales) and in some cases suspend redemptions until some market stability was restored and an orderly exit plan was established. Examples of funds unable to address the investor redemption requests due to high exposure to poor quality assets are as follows: (a) Reserve primary fund, a USA-based MMMF, had a position worth US$ 785 million in Lehmann issued debt securities—upon inability to meet investor redemptions the fund became illiquid[5]; both US funds and European funds were adversely affected. (b) In Europe, three debt-oriented mutual fund schemes[6] such as Parvest Dynamic ABS (Luxembourg domiciled), BNP Paribas Euribor (French domiciled) and BNP Paribas ABS Eonia[7] suspended investor redemptions for a period of 20 days between August 08, 2007, and August 28, 2007, to contain the fall in prices owing to a collapse in the US markets. As on July 2007, these three funds held—35% of their fund assets that were held as open positions to US sub-prime asset backed securities (ABS).

US and European MMMFs portfolio exposure to mortgage securities generated a huge systemic risk, which went undetected till the 2007–2008 crisis. This could be attributed to a lack of risk monitoring at these non-banking financial institutions and came to the fore once the crisis intensified (IDC, 2015).

This led the US and European financial markets to set up a risk monitoring framework for MMMF (functioning as shadow banks). The regulators introduced a slew of measures which increased the shadow banks disclosure norms, portfolio diversification norms, redemption norms and risk monitoring mechanisms. The Financial Stability Board (FSB) has keenly adopted measures to monitor the unanticipated systemic risk that might arise due to the shadow banking activities. This stance will help minimize the systemic risk in the financial system and benefit the overall financial system through the opportunities created.

Over the years, the US market has witnessed a high volume of shadow banking activity with European markets witnessing it on a relatively lower scale. Shadow banking is also sprouting up in emerging economies—especially China, India and other BRICS markets.

Shadow banking in China exists through the bank issued wealth management products (WMPs). WMPs offer a depositor an opportunity to invest surplus funds available in their individual bank accounts into various short maturity debt instruments like short-term bonds and money market instruments. In practice, the banks employ the money obtained through the WMPS in relatively high-risk assets. The

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[5] Securities Exchange Commission (SEC) Web site, Reserve Primary Fund Distributes Assets to Investors, Jan 29, 2010, available on the Internet at, https://www.sec.gov/news/press/2010/2010-16.htm, accessed on Sep 20, 2020.

[6] By definition, an asset backed securities (ABS) fund is required to invest a minimum of 80% of their fund asset positions in securitized assets, i.e., asset backed securities.

[7] BNP Paribas Documents, Background Information on suspension and reopening of ABS funds in August, available on the Internet at, https://invest.bnpparibas.com/sites/default/files/documents/5761.pdf, accessed on Jan 20, 2021.

bank depositors mistakenly believe that like other bank deposit products, WMP investments are bank guaranteed. Little do they realize that in case of an adverse market event, these WMPS might witness a significant drop in investment value, and a bank depositor may lose their deposited funds. In an extreme case, it could possibly even spark bank run (Acharya et al., 2017). On the other hand in India, non-banking financial institutions, i.e., non-banking financial companies (NBFCs) function as shadow banking institutions and complement the existing banking facilities and products, due to relatively low level of banking penetration and financial inclusion across the country.

The examples, enumerated in this section, suggest that interlinkages between traditional banks and the short-term liquid fund (like short-term debt funds and money market funds) can lead to a high magnitude of systemic risk across the financial system. Hence, monitoring shadow banking lending activities and measuring the degree of connectivity among traditional banks and shadow banks and its potential impact on the financial system is extremely essential in order to evaluate the systemic risk.

3 Shadow Banking in India

Global finance companies have an asset base of US$4.7 trillion; India has a fair share of shadow banking institutions—in particular, it is the non-banking financial companies (NBFCs) that perform the function of a shadow bank. These Indian finance companies form 12% of the global finance companies' assets with more than US$506 billion[8] in 2018. The companies' assets have been growing at a double-digit rate over the past few years. NBFCs tend to fill the gaps in the banking sector primarily in terms of access and customized products, and as Acharya et al. (2013) have shown, they perform maturity, liquidity transformation and leverage functions similar to banks. Figure 1 depicts the how much other financial intermediaries (OFI)[9] sector in India contributes to the total national financial assets (TNFA). This sector has witnessed an annualized growth rate of 22.4% in 2018,[10] higher than the 15.5% over the last five years (2012–2017). Finance companies have contributed to 60% of the growth,

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[8] FSB, Global Monitoring Report on Non-Bank Financial Intermediation, 2019, January 19, 2020, available on the Internet at, https://www.fsb.org/wp-content/uploads/P190120.pdf, accessed on September 22, 2020, page 17.

[9] OFIs refer to those financial corporations whose primary activity is financial intermediation; i.e., entities that route resources to borrowers from lenders via auxiliary financial activities or their own account and are directly associated to financial intermediation. However, these corporations are not regarded as deposit acceptors (IMF 2004). OFIs include asset management companies; insurance corporations; factoring corporations, investment fund houses; finance; pension funds; securities dealers and leasing entities. We consider NBFCs as OFIs in India.

[10] FSB, Global Monitoring Report on Non-Bank Financial Intermediation, 2019, January 19, 2020, available on the Internet at, https://www.fsb.org/wp-content/uploads/P190120.pdf, accessed on September 22, 2020, page 14.

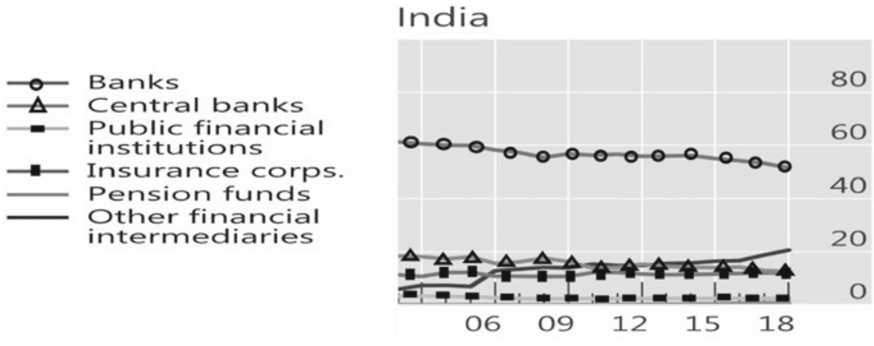

Fig. 1 Share of total national financial assets (by percentage %) in 2018. *Source* FSB, Global Monitoring Report on Non-bank financial intermediaries, 2019, January 20, 2020

and investment funds have contributed 35%. The OFI sector forms more than 20% of the total national financial assets and has been increasing as a proportion of the TNFA.

The share of banks in the national financial assets is on the decline and has decreased from 60% odd to 50% in 2018.

NBFCs complement the banking facilities in India largely catering to the unbanked sector. While significant progress has been made in the segment over the years, yet close to 199 million people are yet to be brought under a formal banking segment and therefore included in the formal financial system—these people also need access to various banking and financial products. NBFCs operate in this unserved space along with the banked sector offering banking and other financial products. These NBFCs tend to operate as shadow banks, and a number of NBFCs are sponsored by the established Indian scheduled commercial banks. Though not a perfect comparison, on the basis of the customers served and the business model, these NBFCs do pose similar risks particularly in a crisis situation where there is an increase in risk aversion among depositors and investors in light of the substantial maturity, liquidity and leverage transformations undertaken by these NBFCs.

NBFCs rely on two primary sources of funding, majorly, banks (through working capital and term loans), insurance, asset management companies and OFI (through debentures and commercial paper) to lend further to their end borrowers.

Interestingly, it is also observed that in a number of cases, an NBFC, bank and AMC may have a common exposure to the same borrower/s. The reason behind this joint exposure is that the common borrower would have created an exposure with all the players, procured a loan from the bank, issued debentures and commercial paper in the primary market and might also hold a NBFC loan exposure. In case of any kind of financial distress of this borrower/s, his/her debt servicing ability in terms of loan principal and interest payment for the respective debt instrument or bank loan becomes questionable impacting the bank, the AMC as well as the NBFC concerned. Thus, it creates a larger systemic risk for the entire system.

It is also imperative to appreciate the effect of shadow banking in India, particularly given the high level of interconnectedness of the different players within the Indian financial system. To better understand this, let us look at a few numbers: Bilateral exposure in the financial system in India has increased from INR 33 trillion in December 2018 to INR 35.8 trillion in March 2020, with the share of scheduled commercial banks in the exposure at 44.6%, followed by NBFCs at 14.2%, AMCs (mutual funds) 12%, AIFIs 9.8% and HFCs 8.9%. AMC-MFs, followed by insurance companies, were the largest fund providers in the bilateral system. NBFCs were the largest fund receivers, followed by HFCs. AMCs and insurance companies provided INR 7.18 trillion and INR 5.69 trillion, respectively; however, NBFCs received INR 7.95 trillion, HFCs INR 5.46 trillion and private sector banks INR 4.81 trillion.[11]

This points to the need to understand the essence of shadow banking in India and be mindful of the "degree of connectivity" among the NBFCs, the AMCs and banks. This will help have a better understanding of the systemic risk inherent in the Indian system and its impact in case of the event of a default.

4 Overview of Financial Intermediation Through Non-banking Finance Companies (NBFC)

NBFCs registered under The Companies Act, 1956, have primary businesses such as chit funds, lending, hire-purchase, leasing, insurance, trading as well as securities acquisition such as shares, bonds, debentures and others[12] (Fig. 2). The number of NBFCs is huge in India—data from March 2020 show the existence of 9,601 NBFCs, and 278 of these are non-deposit taking systematically important (NBFC ND SI). Further, it is interesting to observe that these 278 NBFC ND SI contribute to more than 86.9% of the total assets of the NBFC sector.[13] The data in Table 1 show the broad ownership categories, the number of NBFC ND-SI and the asset size in the period 2014–2019. The data also highlight the fact that the entities under NBFC ND SI category have reduced by over 46.6%—from 493 in 2014 to 263 in 2019.[14]

[11] RBI Financial Stability Report, July 24, 2020, "Chapter II: Financial Institutions: Soundness and Resilience" available on the Internet, https://www.rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=1148, accessed on September 21, 2020.

[12] Reserve Bank of India Web site, Frequently Asked Questions, Definition of NBFC, Jan 10, 2017, available on the Internet at, https://www.rbi.org.in/Scripts/FAQView.aspx?Id=92, accessed on Jan 26, 2021.

[13] FSB 2017 report, available on the Internet at, https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/7CHA7201709E69A4012B24EE590B260B1F151BB97.PDF, accessed on Jan 15, 2021.

[14] The reduction in the NBFC ND SI category can be related to revised regulatory guidelines that required these entities to have a threshold asset size requirement INR 5 billion instead of the prior INR. 1 billion (Table 2) leading to disqualification of numerous NBFCs that were earlier granted status of NBFC ND SI.

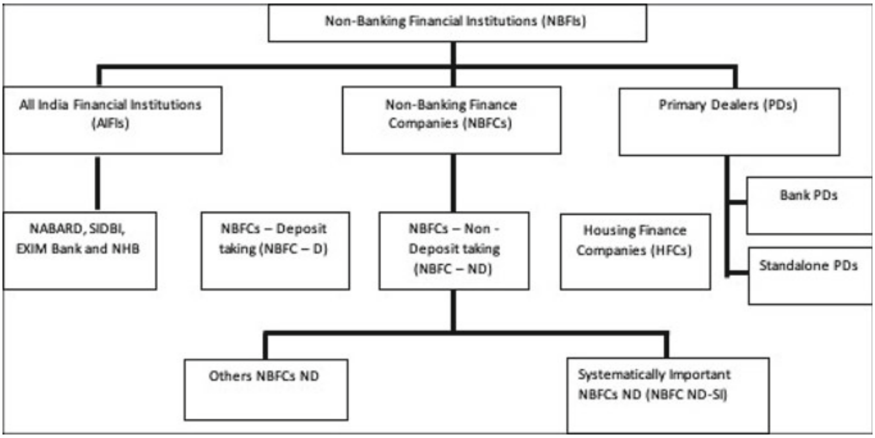

Fig. 2 Categories of NBFIs in India. *Source* Reserve Bank of India (RBI, Non-Banking Financial Institutions (NBFIs), available on the Internet at, https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0RTP241219FL760D9F69321B47988DE44D68D9217A7E.PDF, accessed on Sep 21, 2020)

Table 1 presents NBFCs registered with RBI classification according to the ownership category. Primarily, NBFCs are formed under the Companies Act 2013. The NBFC ownership is classified into a) government or b) non-government. If an NBFC is deemed as government owned, the majority stake is with the Government of India. Further, the non-government is classified into public Ltd; i.e., NBFCs listed on the stock exchange in India and private Ltd are the ones not listed on the stock exchange. The Table 1 columns provide details about the number of registered NBFC ND SIs and their asset size according to the ownership category for a period between March 2014 till March 2019. The numbers mentioned in bold under the "Number" column signify the NBFC ND SIs numbers in a specific ownership category as a percentage of the total number of NBFCs in the system. The asset size mentioned in bold under the "Asset size" column signifies the NBFC ND SIs asset size in a specific ownership category as a percentage of the total asset size in the system. The non-government-owned, public-limited companies'[15] are 45.63% of the total number of NBFC ND SI (263 companies), government-owned are 11%, and private limited companies are 43.35% of the total number of registered NBFC ND SI. During the same period, private limited companies asset size decreased to INR 4.0 trillion from INR 6.8 trillion. However, the public-listed companies asset size increased to INR 12 trillion from INR 1.7 trillion. A main reason behind this growth could be the NBFCs such as Ujjivan Financial Services, MAS Financial Services, ICICI Securities, IndoStar Capital Finance hitting the financial markets via the initial public offerings (IPO)[16]

[15] Those NBFCs listed on the stock exchange are public-limited companies, privately owned are private limited, and government-owned are government companies.

[16] MoneyControl, NBFCs laugh their way to the bank as rich investors try to cash in on IPOs, available on the Internet at, http://www.moneycontrol.com/news/business/ipo/nbfcs-laugh-their-way-to-the-bank-as-rich-investors-try-to-cash-in-on-ipo-mania-2328453.html, accessed on Jan 15, 2017.

Table 1 Number of NBFC ND-SI and their asset size

Ownership Category	March FY2014		March FY2015		March FY2016		March FY2017		March FY2018		March FY2019	
	Number—493	Asset size—INR. 12.7 trn	Number—471	Asset Size—INR. 15.2 trn	Number—220	Asset size—INR. 14.8 trn	Number—220	Asset size—INR. 16.9 trn	Number—249	Asset size—INR. 20 trn	Number—263	Asset size—INR. 26.6 trn
Government (% of total)	3.04	32.81	3.18	35.04	6.82	38.87	6.82	37.12	6.02	37.12	11.03	39.77
Non-government (% of total)	**96.96**	**67.19**	**96.82**	**64.96**	**93.18**	**61.13**	**93.18**	**62.88**	**93.98**	**62.88**	**88.97**	**60.23**
Public Ltd. (1)—% of total	51.12	13.38	51.59	13.92	47.7	13.66	47.73	48.87	42.17	48.87	45.63	45.17
Private Ltd. (2)—% of total	45.84	53.81	45.22	51.04	45.45	47.47	45.45	14.00	51.81	14.01	43.35	15.06
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source Compiled by authors, Reserve Bank of India, Financial Stability Report, Report on Trend and Progress of Banking in India 2016–17 and 2017–18, 2018–2019, Page 142, Page 40, Page 101, respectively; asset size is in INR trillion, FY—financial Year, i.e., March 31

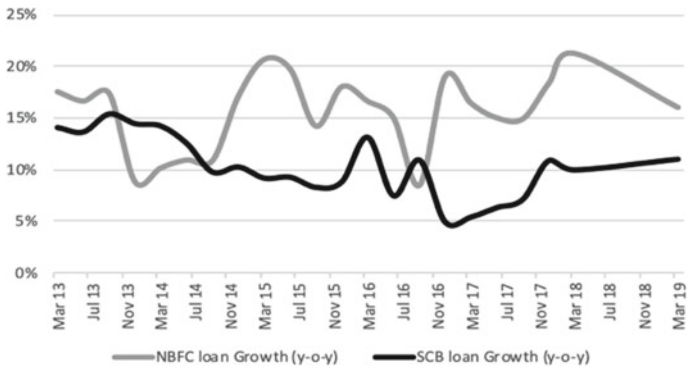

Fig. 3 Loan growth of NBFC versus SCBs (y-o-y). *Source* Financial Stability Reports and Report on Trend and Progress of Banking in India, RBI

route to raise funds and the capital issuance through commercial paper borrowings and debentures.

Though the number of registered NBFC ND SIs has reduced by over 46% in the 5 year period due to the increased asset threshold limits for NBFCs, the annual rate of loan growth for NBFCs in the same period has been quite high—in double digits. The NBFC sector loans have grown at a 17.79%—compounded annual growth rate (CAGR) over the seven-year period to INR 22.7 trillion in March 2019[17] from INR 7.2 trillion in March 2012. This parallel funding mechanism has been outdoing the (SCB)[18] loan growth. While SCBs provide 95% of the Indian population with access to banking facilities, yet since 2012, the annual NBFC loan growth has outdone SCBs loan growth (Fig. 3).

Figure 3 displays the quarterly loan growth rates during the period March 2012 to September 2019 for both NBFCs and SCBs. On a quarter to quarter basis, rate of loan growth for NBFC has been significantly higher when compared to the SCBs rate of loan growth; in particular, it can be observed that rate of growth for NBFC loans was higher than the SCBs rate of loan growth in 18 of the 22 reported quarters. The NBFCs registered a lowest loan growth in the December 2016 quarter, i.e., (8.5%

[17] RBI, Non-Banking Financial Institutions (NBFIs), available on the Internet at, https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0RTP241219FL760D9F69321B47988DE44D68D9217A7E.PDF, accessed on Sep 21, 2020, Page 101.

[18] RBI Web site, SCB definition: "All banks included in the second schedule to the Reserve Bank of India Act, 1934. They are categorized into five different categories: (1) State bank and its associates, (2) Nationalized banks, (3) Private sector banks, (4) Foreign banks and (5) Regional rural banks"; available on the Internet at, https://www.rbi.org.in/scripts/PublicationsView.aspx?id=14655, accessed on Jan 28, 2018.

y-o-y). This was due to demonetization announced on November 08, 2016, where the government withdrew INR 500 and INR 1000 currency notes as legal tender.[19] Typically, NBFC borrowers category ranged from small to medium income level. These category of borrowers formed a major portion of the NBFCs lending portfolio, and these borrowers mostly held transactions in cash with the NBFC. Since dealing in certain denominations of cash was suspended, the NBFC business was affected significantly during demonetization.

The main reason behind looking at the context of the growth in the NBFC loan outstanding which has partially substituted the SCB supply is as follows:

Given the huge non-performing assets (NPAs) that the scheduled commercial banks (SCBs) were saddled with since the financial crisis of 2007–2008, the ability of further lending by the SCBs had been severely impacted.

The gross NPAs (GNPA) of SCBs in March 2019 were around INR 9.3 trillion of the total advances worth INR 97.1 trillion (March 2018: Gross NPA 9.9 trillion which formed 11.60% of the gross advances worth INR 85.3 trillion[20,21]). Table 2 presents the advances data for twenty banks (sixteen of which are public sector banks and four are private sector banks), gross NPA and the gross NPA as a percentage of the advances. These highlighted 20 banks in Table 2 contribute about 78% of the total banking loans and advances and 85% of the total NPAs in the banking system[22]—a more detailed scrutiny reveals that these 80% of these 20 banks belong to the public sector banks. These PSBs contribution to total NPAs in the banking system is 75%, whereas 9.7% of the total NPAs is contributed by four private sector banks.

[19] The Hindu, November 08, 2016, Demonetisation of Rs. 500 and Rs. 1000 notes: RBI explains, available on the Internet at, https://www.thehindu.com/news/national/Demonetisation-of-Rs.-500-and-Rs.-1000-notes-RBI-explains/article16440296.ece, accessed on September 25, 2020.

[20] RBI Bulletin, Business in India: All Scheduled Banks and All Scheduled Commercial Banks, June 11, 2018, available on the Internet at, https://rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=17609, accessed on July 14, 2018.

[21] Chapter II: Financial Institutions: Soundness and Resilience Reserve Bank of India Publications, June 26, 2018, available on the Internet at, https://rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=902, accessed on July 14, 2018.

[22] Reserve Bank of India (RBI), Statistical Tables Relating to Banks in India, available on the Internet at, https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications#!4, accessed on September 21, 2020.

Table 2 Fund-based exposure of 20 SCBs and gross NPAs as on March 31, 2019

Bank name	Advances As a % of total SCB advances	Gross NPA as a % of total SCB gross NPAs	Gross NPA to advances
Public sector banks			
SBI	22.51%	18.45%	7.90%
IDBI	1.51%	5.34%	34.08%
PNB	4.72%	8.38%	17.12%
Canara	4.41%	4.19%	9.17%
Oriental Bank of Commerce	1.64%	2.32%	13.63%
BoB	4.83%	5.15%	10.29%
Indian Bank	1.87%	1.43%	7.37%
Central Bank of India	1.51%	3.46%	22.08%
Allahabad Bank	1.46%	3.07%	20.18%
UCO Bank	1.02%	3.19%	30.09%
Corporation Bank	1.25%	2.21%	17.09%
Union Bank	3.06%	5.20%	16.41%
Bank of India	3.51%	6.48%	17.79%
Indian Overseas Bank	1.37%	3.57%	25.19%
Dena Bank	0.54%	1.36%	24.57%
Bank of Maharashtra	0.85%	1.64%	18.54%
Private sector banks			
HDFC	8.44%	1.20%	1.37%
ICICI	6.04%	4.88%	7.79%
Axis	5.10%	3.18%	6.02%
Kotak Bank	2.12%	0.48%	2.17%
Total SCBs (INR trillion)	**97.1**	**9.4**	**9.64%**

Source Compiled by authors from statistical tables relating to Banks in India, RBI, for scheduled commercial banks (SCB)

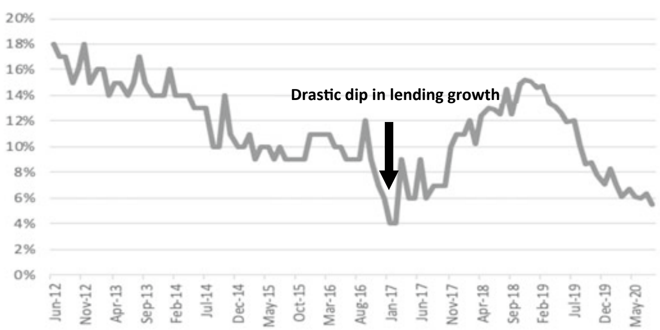

Fig. 4 Non-food bank loan growth at SCB level (y-o-y). *Source* RBI Bulletin, Scheduled Commercial Banks Business in India

While this is data from March 2019 only, the GNPA has been steadily rising (almost doubling) over the years and also particularly due to the withdrawal of the restructured assets scheme by RBI. This resulted in poor loan disbursement as banks had insufficient financing. Existing borrowers failed to repay their instalments on the principal and interest on loan due, post a period of 90 days of continuous non-repayment – the banks according to regulations were required to make provisions for the NPA. This resulted in rising NPAs. Faced with the rising NPA issue and its consequent potential impact on the Indian financial system, RBI announced the prompt corrective action (PCA)[23] mechanism and placed 11 banks under PCA, thereby curtailing standard banking operations for these banks. Further, a few of these 11 banks were also restricted from lending activity as they were at Threshold 3 in the PCA framework. The situation has shown some improvements in recent times with capital infusion into these banks by the government, and SCBs have restarted lending, yet the amount lent is quite small, and the gap has been serviced by the NBFCs. Figure 4 shows the movement of the non-bank credit[24] growth, and we observe that while the credit growth dipped drastically in early 2017, some recovery has occurred between June 2017 to early 2019 and again in March to June 2020. However, the loan growth is yet to return to the 2012 levels. The period during March to June 2020 has witnessed a drop in lending owing to the COVID-19.

NBFCs lending filled up the lacuna left from a slow bank lending (Fig. 3) *during the period 2013 to early 2018, and this* was further boosted by the revision in the loan norms for individual borrowers to INR 100,000 from INR 50,000 in April 2015.

However, post the failure of Infrastructure Leasing and Finance Services (IL&FS) after September 2018 and Deewan Housing Finance Limited (DHFL) in the early 2019, the lending for NBFCs has also been on a decline. These two NBFCs and HFC

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[23] Reserve Bank of India (RBI), Revised Prompt Corrective Action (PCA) Framework for Banks, available on the Internet at, https://rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=10921, accessed on July 25, 2018.

[24] Non-bank credit comprises agriculture and allied activities, industry (micro and small, medium and large), services and personal loan.

failed owing to governance and asset liability mismatch problems. This situation left other NBFCs facing a lot of problems while raising finance in the market due to the IL&FS and DHFL fallout. A dip in lending is witnessed at an aggregate level for both NBFCs and SCBs and is largely attributed to the consumption slowdown in the Indian economy.

Unlike banks, NBFCs fund their lending through market borrowings in the form of bank borrowings (working capital loans and term loans), debentures, commercial papers and borrowings from other various financial institutions apart from direct market borrowings; this is unlike traditional banks who fund their lending activities through deposit mobilization. These amounts can be very high—for example, loans taken by NBFCs from banks, as on March 31, 2019, were INR 6.07 trillion, i.e., 19.6% of the total assets. Further, bank exposure to NBFC floated commercial paper stood at INR 1.54 trillion, while the exposure to NBFC issued debentures stood at INR 9.05 trillion. This formed about 73.2% of the NBFC loans and advances.

In addition to banks, AMCs also hold exposure to NBFC issued debt like commercial paper and debentures. The AMCs net exposure[25] to NBFCs has increased gradually 38.67 times to INR 3.2 trillion in March 2020[26] from INR 83 billion in March 2012. Further, with a number of these AMCs being floated/sponsored by the banks, the NBFCs therefore have both direct and indirect exposure to the banking sector, and total exposure is huge.

The point of concern in the Indian NBFC sector is not just that the banking sector exposure is huge. The primary issue stems from the fact that NBFCs indirect exposure to the banking sector is not completely accounted for in the banking sector, thereby increasing the unaccounted for risks in the banking sector. While the regulator (RBI) has prescribed exposure limits taken by banking institutions[27] and AMCs[28] on independent levels to NBFCs, there is no such prescription when it comes to addressing the issue of common exposure to a specific individual NBFC held by an AMC floated/sponsored by the same banking institution and the parent banking institution, specifically related to the off-balance sheet side. For example, AMCs may

[25] The AMCs included here are financial institutions-sponsored, bank-sponsored and corporate-sponsored AMCs.

[26] Reserve Bank of India, Financial Stability Report, 2013, 2014, 2015, 2020 available on the Internet at, https://rbi.org.in/Scripts/FsReports.aspx, and https://rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/0FSRJULY2020C084CED43CD1447D80B4789F7E49E499.PDF, accessed on Jan 23, 2021, Page 46.

[27] The upper limit of a banks direct exposure toward lending and investment activities of NBFCs is capped at 10% to 15% of the banks' capital funds. This figure is arrived at according to the last audited financial statements. This upper limit pertains to an individual NBFC/ NBFC Infrastructure Finance Corporation/NBFC Asset Financing Corporation. RBI exposure limit to an individual NBFC, available on the Internet at, https://www.rbi.org.in/scripts/BS_ViewMasCirculardetails.aspx?id=9875, accessed on Jan 19, 2018.

[28] An AMC can hold a maximum exposure of 25–30% to the NBFC sector issuances. AMCs exposure to a single NBFC debt securities issuance is capped at 10–15% of the net asset value (NAV). Live Mint, SEBI relaxes debt fund exposure limit for housing finance companies, Aug 11, 2016, available on the Internet at, http://www.livemint.com/Money/kJdEWM3z3hecPWSwKMvZtK/Sebi-relaxes-debt-fund-exposure-limit-for-housing-finance-co.html, accessed on Jan 23, 2018.

have open exposure to structured obligations that might then sweep this exposure under the carpet while estimating the aggregate exposure to such NBFCs.

In this context, another point that is of interest is how are the NBFCs funding their loan growth? Most of the lending activity of a NBFC is funded through borrowings by using instruments like debentures, bank borrowings, commercial papers as well as borrowings from other various financial institutions. In Table 3, we present the broad funding composition of Indian NBFCs between 2013 and 2019 in a diagrammatic format.

Banks and debenture issuances (49% of total NBFC total assets) are the major source of fund providers to NBFCs. The NBFCs funding composition is highly influenced by the interest rate cycle in the economy—in an increasing interest rate regime, the share of bank borrowings increases as the marginal cost of funds-based lending rate (MCLR)[29] does not change rapidly compared to the interest rate changes; in a decreasing interest rate regime, the NBFC relies on market debt instruments like commercial paper, debentures, etc.

Let us also take a brief look into the asset quality of NBFCs so that we are able to assess how the shadow banks perform in terms of loan recoverability. Figure 5 indicates that over the past few years the asset quality has been deteriorating.

5 Concluding Remarks

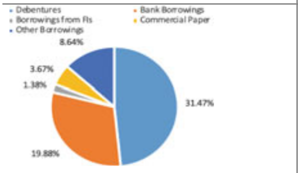
Owing to the deteriorating asset quality of the NBFCs, the fallout of the Infrastructure Leasing and Financial Services (IL&FS) and Deewan Housing and Finance Limited (DHFL), the RBI brought in a slew of measures to protect the NBFCs. A few of the measures are as follows: (a) RBI brought the housing finance companies (HFCs) under its supervision, (b) the NBFCs were required to maintain a 25% debenture redemption reserve requirement (DRR), and this DRR was removed to enable NBFCs to borrow at a lower cost, (c) NBFC ND SI issued bonds were provided partial credit enhancement (PCE) facility by banks, (d) large NBFCs are required to appoint a chief risk officer (CRO), (e) a revised guideline was set up to increase the NBFCs standard of asset–liability management (ALM) framework. These guidelines require a more granular maturity buckets for the assets and liabilities at the NBFCs, along with setting up liquidity risk monitoring mechanisms—such as stress testing and funding diversification. (f) Maintaining a liquidity coverage ratio (LCR) starting at 50% for all NBFC-D and NBFC-ND with an asset size of INR 100 billion and above

[29] MCLR definition is available on the Reserve Bank of India (RBI) Web site, https://m.rbi.org.in/scripts/FAQView.aspx?Id=111, accessed on February 20, 2020. MCLR is deemed as the lowest interest rate offered by a lender such as a bank. MCLR is usually linked with the banks' funding costs and repo rate. Thus, if there is slight upward or downward movement in the repo rate, it is likely to affect the bank lending rate at which a borrower borrows funds from the banks.

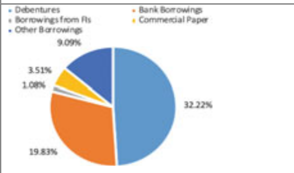
Table 3 Funding composition of NBFCs (borrowing type as percentage of total assets and borrowing type as a percentage of total borrowings)

Type of borrowing as a percentage of total assets

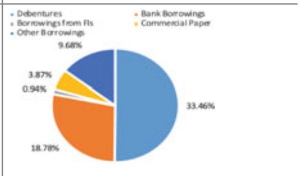
March 2013 (INR. 12.8 trn)



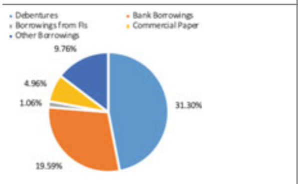
March 2014 (INR. 14.1 trn)



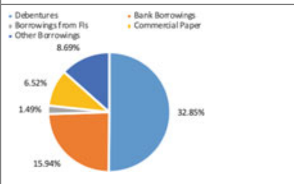
March 2015 (INR. 14.8 trn)



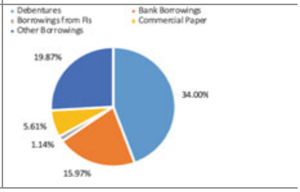
March 2016 (INR.17.2 trn)



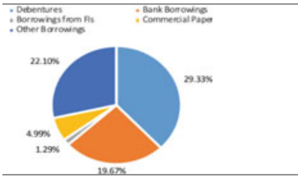
March 2017 (INR.19.7 trn)



March 2018 (INR. 26.2 trn)

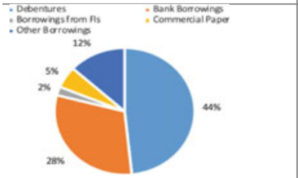


March 2019 (INR. 30.9 trn)

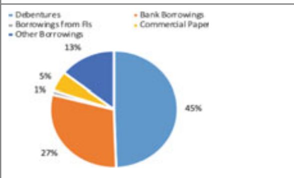


Type of borrowing as a percentage of total borrowings

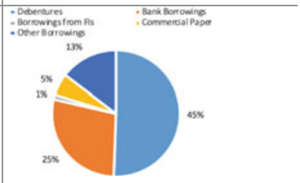
March 2013 (INR. 9.0 trn)



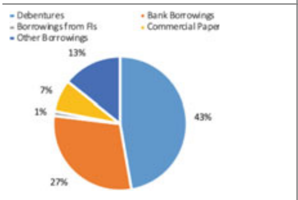
March 2014 (INR. 10.2 trn)



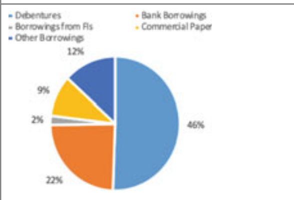
March 2015 (INR.10.9 trn)



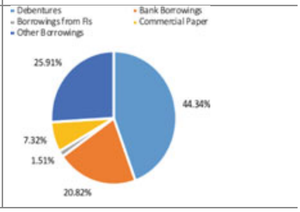
March 2016 (INR.12.6 trn)



March 2017 (INR. 14.2 trn)



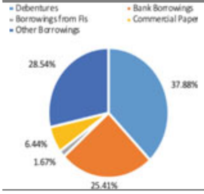
March 2018 (INR. 20.1 trn)



March 2019 (INR. 23.9 trn)

(continued)

Table 3 (continued)

Type of borrowing as a percentage of total assets


Source Compiled by authors, Reserve Bank of India, Report on Trend and Progress of Banking in India 2016–17, 2018–19, Page 144 and Page 101, respectively, and Financial Stability Report

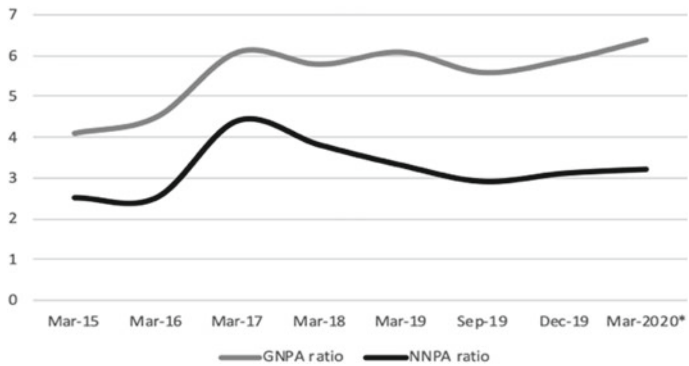


Fig. 5 NBFCs asset quality. *Source* RBI Financial Stability Report, July 2020, page 38

and 30% for all NBFC-ND with an asset size between INR 50 billion and INR 100 billion from December 01, 2020, to 100% on December 01, 2024.[30]

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Issues in Corporate Finance

The Impact of the Largest Shareholder on Dividend Payout Policy: Evidence from Indian Business Groups

Poulomi Lahiri

1 Introduction

Ownership structure of firms differs across the globe. The divergence or convergence between ownership and control within a firm creates the agency cost problem which is the root cause of all corporate governance problems. The dispersed ownership structure is dominant in developed countries like the USA and UK. However, the concentrated ownership structure is widespread in India, other South-East Asian countries as well as Continental Europe and Latin American countries. The dispersed ownership structure, i.e., the separation between ownership and control, may create the conflict of interest between shareholders and managers and thus lead to the type I or vertical agency problem (Berle & Means, 1932; Jensen & Meckling, 1976). There is increasing evidence across countries that support such a view. On the other hand, the concentrated ownership structure, i.e., overlap between ownership and control, leads to the type II or horizontal agency problem between controlling shareholders and minority shareholders (Roe, 2004). Again, there is substantial evidence that shows the significant presence of a concentrated ownership structure where both ownership and control lie in the hands of a shareholder group/block or by an individual and aggravate the horizontal or type II agency problem. The agency cost (the vertical as well as the horizontal) aspect of ownership structure could be mitigated through the dividend channel of the corporate governance mechanism. The dividend is a guaranteed regular income paid to shareholders irrespective of their identity whether the shareholder is large/controlling shareholders or small dispersed/minority shareholders.

The relationship between ownership structure and dividend payout could be explained through several alternative theories. In the broad-spectrum, all these theories belong to two distinct alternative classes of literature which opined that dividend could be used as a means for mitigating the agency aspect of corporate governance

P. Lahiri (✉)
ICSSR-IDSK Post Doctoral Fellow, Institute of Development Studies Kolkata (IDSK), DD 27/D, Sector I, Salt Lake, Kolkata, West Bengal 700064, India

P. Mukherjee (ed.), *Revisiting the Indian Financial Sector*, India Studies in Business and Economics, https://doi.org/10.1007/978-981-16-7668-0_11

problems and also an outcome of agency conflicts. The first broad group argues that higher dividend payout may discipline self-interested manager or insider of a firm by reducing the free cash flow available to manager's discretion and thereby forcing the firm to raise additional funds from the external capital market under the active monitoring of investment intermediaries, and thus, the agency problem could be resolved. In other words, dividend payment is considered as a relevant monitoring/bonding mechanism through which agency problems could be addressed (Easterbrook, 1984; Rozeff, 1982). There are a good number of empirical studies that support such a view (Born & Rimbey, 1993; Moh'd et al., 1995). Moreover, higher dividend payout could discipline the managerial discretion by reducing the volume of free cash flow which could be squandered by either managers or insiders through investing in a bad project, and thus, the over-investment problem could be wiped out (Jensen, 1986). Thus, the dividend could be used as a cost-effective alternative to active shareholder monitoring. On the other hand, the second group argues in favor of the legal protection hypothesis which is commonly known as "the outcome model" which states that minority shareholders with effective legal protection could force managers to distribute higher dividends, thereby reducing excess free cash flow. The magnitude of dividend payment would differ across countries under different legal systems (common law and civil law) (La Porta et al., 2000).

The effect of ownership structure and dividend payout is extensively examined in both developed and developing countries. Most of the existing studies related to the ownership structure and dividend payout have been explored mainly from the perspective of ownership composition, ownership concentration, and large shareholders. However, very few studies have been carried out from the perspective of the largest shareholder. The largest shareholder could be a distinct class of shareholder who provides a massive investment in a corporate firm. Nonetheless, this huge investment of the largest shareholder is associated with some costs. The cost of monitoring is high for the largest shareholder, but the reward from monitoring would be higher for him/her with a higher level of shareholding. The largest shareholder may influence the dividend policy decision of a firm by exerting his/her power and discretion to protect his/her level of investment. Broadly speaking, the largest shareholder may compel the top management of a company to grant higher dividends to shareholders by virtue of their legal rights, thereby disgorging excess free cash flow from the hand of discretionary management. Alternatively, among large shareholders, the largest shareholder with a small amount of equity stake may efficiently monitor the management and use the monitoring mechanism as a substitute to dividend payment to maintain their reputation as their wealth is attached to the firm; otherwise, the small or minority investors would anticipate expropriation by the largest shareholder which in turn will reduce the value of the firm. When the largest shareholder is the ultimate owner of a firm or promoter with small amount of shareholding may align his/her interest with minority shareholders and disburse higher dividend to shareholders to signal the future prospect of the firm is robust. One manifestation of this view could be higher dividend payout may reduce the amount of free cash flow which could otherwise be expropriated by the largest shareholder. The higher dividend payout may indicate the unwillingness of expropriation of minority shareholders by the largest shareholder when there are several alternative ways of rent extractions. However, the largest shareholder being the ultimate owner of the firm may generate private benefits at the expense of minority shareholders and thus produce a negative impact on dividend payment (Shleifer & Vishny, 1997; Facio et al., 2001). Being a promoter of a company and having effective voting rights, the largest shareholder with a higher level of shareholding could disburse higher dividends to signal the minority shareholders that efficient monitoring is thoroughly maintained in those firms (Truong & Heaney, 2007).

It is evident from the existing literature that other shareholders have an incentive to monitor the activity of the largest shareholder (Edwards & Weichenrieder, 1999). The efficient monitoring role of the second-largest shareholder over the largest shareholder is well recognized in the extant literature. A group of studies observe that the second-largest shareholder with a higher level of institutional shareholding reduces the level of payment of dividend of the companies through active monitoring over the largest shareholder in concentrated ownership structure (Gonzalez et al., 2017). On the other hand, other studies admit that as the voting rights of the second-largest shareholder increase, the dividend payment would increase which highlights the monitoring role of the second-largest shareholder (Gugler & Yurtoglu, 2003; Truong & Heaney, 2007).

Most of the existing literature from developed and developing countries such as eurozone countries, Latin American countries, and USA shows nonlinear relationship between the largest shareholder and dividend payout policy (Correia da Silva et al., 2004; Crutchley et al., 1999; Gugler, 2003; Khan, 2006). However, the presence of the second-largest shareholder may change the result (Gugler & Yurtoglu, 2003; Truong & Heaney, 2007).

This chapter makes an attempt to study the relation in the Indian context. Indian corporate firms are mainly classified into business groups and stand-alone firms. By definition, business groups are collections of legally independent firms having some common characteristics of pyramiding, dual-class shares, and board interlocks. Indian business groups are highly concentrated in the hand of large controlling families (Manos, 2012). However, the structure of group firms differs from one group to another. Stand-alones are independent operating firm not a subsidiary of any company.

Indian ownership structure is primarily divided into promoter or promoter group or controlling shareholders and non-promoters. More precisely, according to the SEBI guidelines, in India, promoter or promoter group have effective control on day-to-day activities of a company either directly or indirectly. Promoter or promoter group could be shareholder, director, or otherwise name of the person or persons disclosed in the offer document of a company under the provision of the Listing Agreement. Promoter or promoter group are personally liable for any fraud or scam and mismanagement of a company. However, the definition of controlling shareholder is a more placid one which could reduce the burden attached to promoters if something goes wrong. Non-promoters are mainly institutional investors and non-institutional investors. Non-promoter institutional investors include financial institutions (mutual funds, banks, insurance companies, foreign institutional investors, and venture capital funds) and government. Non-promoter non-institutions include corporate bodies (an organization or group of persons that act as an entity such as associations, trusts, partnerships, or any other type of entity) and individual shareholders.

In Indian business group affiliated firms, promoters could be individuals, family members, corporate bodies, financial institutions and banks, and other types of entities who conceive, form, and promote a company with controlling stakes more than outside shareholders (minority shareholders). The corporate governance literature shows that Indian business groups are highly concentrated in the hand of families which is a unique feature of Indian ownership structure. These family-owned business groups exhibit owner–manager relationship. In Indian business groups, promoters take a pivotal role in the financial decision-making process of the firm. Thus, the conflict of interest takes place between the promoter (controlling shareholders) and minority shareholders (outsiders) due to asymmetric information. Hence, type II or the horizontal agency problem crops up. We restrict our study to Indian business group especially to Indian family business group which holds three-fourths of the listed companies.

The corporate governance movement in India had gathered momentum since the last half of the 1990s. Clause 49 of the Listing Agreement was introduced in 2000. However, following the interim assessment and functioning of Clause 49 of the Listing Agreement, it has undergone sea changes in the year 2005 and the revised Clause 49 came into effect on January 2006. In India, Clause 49 of the Listing Agreement was introduced to give effective investor protection and provide better transparency in the corporate system. One of the important aspects of Clause 49 is to provide transparency in disclosure requirements of ownership variables which have gone through changes in recent years. Earlier, the ownership variable includes total control by taking into account the total direct and indirect cash flow rights. In this context, the disclosure reported the direct cash flow rights and the data on the person acting in concerts (PACs). But, in recent years, the disclosure of ownership variable as promoter shareholding could be considered as promoter control. The rights of shareholders, more precisely the minority shareholders, have improved in the recent past. Other corporate governance mechanisms such as board independence and takeover regulations have been improved to protect the interest of shareholders. On the one hand, enforcement of shareholders' rights under the Companies Act, 2013, is the responsibility of the Department of Company Affairs, whereas the SEBI enforces the Securities Law regarding issuance of direction and practice of financial intermediaries and redresses grievances of investors concerning dividend payment and transfer and allotment of shares, etc. But, it is evident from the existing literature that the investor and shareholder protection laws are designed following international best practices, while their enforcement is quite weak in India (Kumar, 2006). Dividend payout policy is more or less stable in India, and the tax on dividends is exempted since 2002 (Kamat & Kamat, 2010).

Given this background, this study tries to explore the effect of the largest shareholders on dividend payout policy. It further tries to examine whether the presence of other shareholders especially the second-largest shareholder makes any difference in the existing dividend payout policy through active monitoring over the largest shareholder.

The rest of the study is arranged as follows. In Sect. 2, we discuss the methodology. Section 3 discusses our database and variables to be used. The empirical analysis is discussed in Sect. 4, and Sect. 5 includes concluding remarks.

2 Methodology

Grienstein and Michaely (2005) discussed the issue of endogeneity of ownership and dividend payout policy. From their view, it is clear that the largest shareholder could set the dividend payout policy of a firm and simultaneously dividend payment designed by managers could induce the largest shareholder to set out their equity stake in that company. However, in India higher or lower dividend payouts of a company usually do not influence the largest shareholder or second largest to increase or reduce their shareholding pattern. The average shareholding pattern of the largest shareholder and second-largest shareholder (as a promoter as well as non-promoter) from our sample of 356 listed companies is presented below.

It is evident from Fig. 1 that the mean shareholding pattern of the largest shareholder follows a more or less stable path in India over the years.

Figure 2 displays on average an increasing trend of the shareholding pattern of the second-largest shareholder as a promoter over the years. But, there is a decline in the shareholding of the second-largest shareholder as a promoter since 2007 and touched the nadir point in the year 2009 due to the financial recession around the world. Later on, it seems to be remaining stable over time.

Figure 3 presents a slightly increasing trend of the average shareholding of the second-largest shareholder as non-promoters.

From the above figures, we can sum up that on average the shareholding pattern of the largest and second-largest follows a more or less stable path over the years.

The dividend payout (mean) is depicted in the following figure.

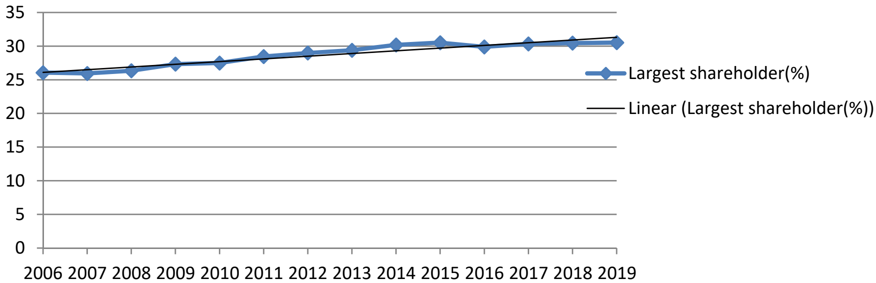

Fig. 1 Average percentage shareholding of the largest shareholder. *Source* Author's calculation

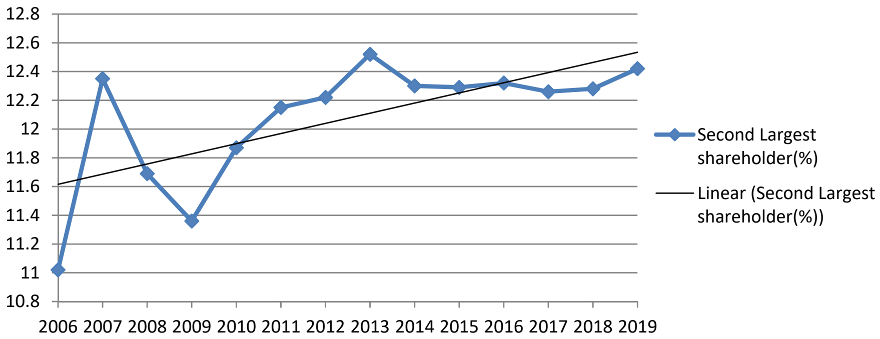

Fig. 2 Average percentage shareholding of the second-largest shareholder as promoter. *Source* Author's calculation

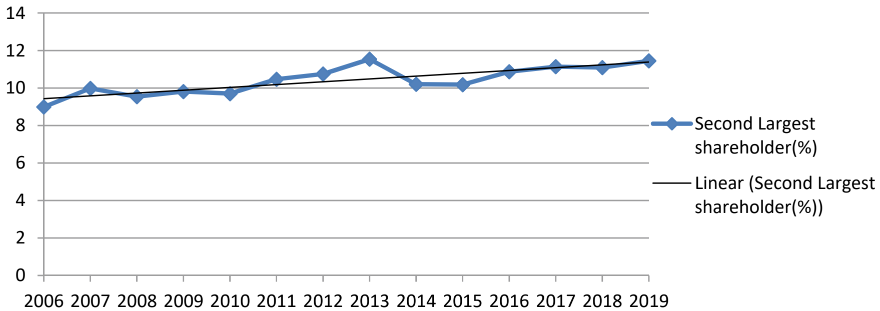

Fig. 3 Average percentage shareholding of the second-largest shareholder as non-promoter. *Source* Author's calculation

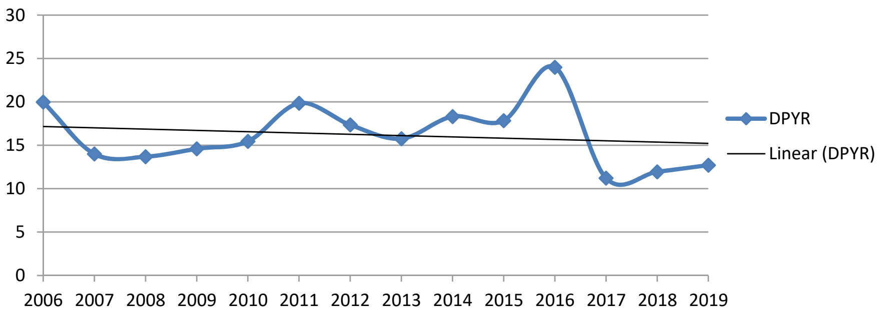

Fig. 4 Dividend payout ratio (mean). *Source* Author's calculation

It is evident from Fig. 4 that the dividend payout ratio (mean) of the companies remains the same during the period 2006 to 2019. It ranges from 10 to 25%.

To capture the endogeneity problem and cross-sectional variations or unobserved heterogeneity, the linear dynamic panel data (LDPD) estimation technique is used to explore the impact of the largest shareholder on dividend payout policy and the impact of the second-largest shareholder on it.

The LDPD is based on the "difference generalized method of moments (GMM)" (Arellano & Bond, 1991) and "system GMM" estimation (Arellano & Bover, 1995; Blundell & Bond, 1998) techniques. The LDPD estimation is composed of generalized method of moments (GMM) instruments and standard instruments. Lagged dependent variable and explanatory variables are used as GMM-type instruments for the difference equation. For the level equation, the differences in the variables are used as GMM instruments. Looking at the matrix size, we may specify sets of standard instruments for both the difference and level equations. We can also include additional instruments in the LDPD estimation. The LDPD estimation is robust to heteroscedasticity problem. To address the standard error bias problem, Windmeijer (2005)'s two-step robust standard error estimation has been performed.

To explore the impact of the largest shareholder on dividend payout policy, this study first incorporates the percentage shareholding of the largest shareholder who belongs to a promoter or promoter group (LSP). To capture the nonlinearity of the ownership structure variable such as the shareholding of the largest shareholder, the square term of LSP has been included in our model. In the next objective, this study tries to explore whether the second-largest shareholder has any impact on dividend payout policy. This study further tries to see whether the interaction term between the percentage shareholding of the largest shareholder and the second-largest shareholder could have any impact on dividend payout policy. The monitoring role of the second-largest shareholder over the largest shareholder is represented in this model. This second objective is examined from two corners: (i) when the largest shareholder, as well as the second-largest shareholder (SLP), belongs to a promoter and promoter group, and (ii) when the largest shareholder belongs to a promoter group and the second-largest shareholder is a non-promoter (SLNP). We have further partitioned our non-promoter data into institutional and non-institutional parts and try to explore the same objective.

3 Data and Variables

To explore the impact of the largest shareholders on dividend payout policy, we initially get information about 1424 firms enlisted at the NSE for the period 2006–2019. We have taken information on the equity holding of major investors in a company. We have excluded all those companies which have never distributed dividend to the shareholders. Then, our sample has reduced to 450 firms. Out of these 450 firms, we have deleted all those companies in which the promoter shareholding becomes nil. In other words, we reject all those companies that have changed their shareholding pattern from promoter to non-promoter over time. We have deleted all banks' information as they have undergone sea changes during this period. We keep firms that provide regular information about major investors in a company and on other firm-specific relevant variables for the period of 2006–2019. The other firm-specific variables are also collected from the ProwessIQ database. Finally, we get 356 firms throughout the period. All these firms belong to a promoter group. We restrict our studies to Indian business group as it is evident from the existing literature that India has a large number of business group controlled corporate firms and about 75% of listed companies are owned and controlled by a family business group (Khanna & Palepu, 2000; Manos, 2012). Out of these 356 firms, we get 258 firms where the largest shareholder and the second-largest promoter belong to the promoter or promoter group. There are only 98 firms where the largest shareholder is a promoter group and the second-largest shareholder is a non-promoter. We have further divided the non-promoter as institutional (17 firms) and non-institutional (81 firms) categories.

The starting point of our analysis is 2006. After several corporate scams in the 1990s, the need for the implementation of corporate governance mechanisms was felt. To cater effective and transparent corporate governance, the Securities and Exchange Board of India (SEBI) formed several committees—Kumar Mangalam Birla Committee Report on Corporate Governance, 1999; Naresh Chandra Committee Report on Corporate Audit and Governance, 2002; and Narayana Murthy Committee Report, 2003. All these committee reports are aimed at investor protection. Under corporate governance reform, the ownership disclosure requirement has undergone some important changes, following Clause 49. Hence, the immediate practice of better corporate governance reform measures followed by Indian corporate firms may result in improvement in the governance structure. Thus, we choose to begin our analysis from 2006 and to examine the effect we have considered the period till 2019. The subsections provide details of the variables and describe some descriptive statistics and preliminary observations about the sample.

3.1 Key Variables of Our Study

Following the existing literature, our dependent variable is the dividend payout ratio which is calculated by the total dividend as a percentage of profit after tax[1] (Lahiri, 2013, 2019).

The independent variable is the percentage shareholding of the largest shareholder and the percentage shareholding of the second-largest shareholder (Gonzalez et al., 2017).

[1] We have also used an alternative proxy for dividend payout ratio which is expressed as dividend to total assets. However, the results remain the same.

Based on the existing literature, we control leverage, growth opportunities, profitability, firm size, and board composition and vividly explain their effects (Baba, 2009; Lahiri, 2013, 2019; Shehu, 2015).

Leverage (LEV): Leverage is calculated as the ratio of the book value of total debt and total assets. Highly leveraged firms would pay lower dividends as developed by the pecking order theory (Myers & Majluf, 1984).

Growth opportunities (GROWTH): In this study, we use the price to market book ratio as the measure of growth opportunities. Following the maturity theory, nascent firms with high growth potential would distribute lower dividends, whereas matured firms with low growth potential tend to pay more dividends (Fama & French, 2002).

Profitability (PROFIT): It is defined as the profit after tax standardized by total assets. The effect of profitability on the dividend is ambiguous. Firms with higher profits would pay more dividends as suggested by the free cash flow theory (Jensen, 1986). On the other hand, the pecking order theory suggests highly leveraged firms will finance their new investment through retained profits and hence will tend to pay lower dividends. Thus, the pecking order theory predicts a negative association between profitability and dividend payouts.

Firm Size (FIRMSIZE): Firm size is one of the important indicators of the reputation of the firm. In this study, firm size is measured by the natural logarithm of net sales. The effect of firm size on the dividend is ambiguous. The maturity theory predicts a positive association between firm size and dividend because large firms with low growth distribute lower dividends (Fama & French, 2002). On the contrary, the trade-off theory and signaling theory suggest a negative relationship between firm size and dividend payment. Highly diversified larger firms are more vulnerable to bankruptcy and thus distribute lower dividends as suggested by the trade-off theory (Myres, 1984). On the other hand, following the signaling theory, larger firms face lower monitoring costs as they provide regular operational and financial information to the investors than smaller ones, hence do not suffer from asymmetric information problem, and as a consequence distribute lower dividends (Lahiri, 2013, 2019).

Board Composition: The board of directors plays a pivotal role in addressing the conflict of interest between managers and shareholders. In a dispersed ownership structure, the board of directors efficiently monitors the incumbent management to pacify the vertical agency problem that arises between professional managers and dispersed shareholders. However, in firms with concentrated ownership structure and control, the board of directors acts as a catalyst to address the horizontal agency problem which crops up between controlling shareholders who are insiders (a part of management) and the outside minority shareholders. Broadly speaking, in a concentrated ownership the role of the board of directors tries to protect minority shareholders against the expropriation by controlling shareholders. In India, the board of directors is of two types—executive directors and non-executive directors. Executive directors take part in the day-to-day operational and financial decision making of a company. However, non-executive directors act as an advisor to the company. Non-executive directors are further classified into non-independent directors or gray directors (who are very close to executive directors or the management of the company) and independent directors. Independent directors protect the interest of shareholders, especially the interest of minority shareholders when executive directors are closely tied to management and try to expropriate the minority shareholders. The independence of the independent director is greatly recognized in the corporate governance literature. It is the responsibility of independent directors to raise their voice against self-interested managers who usually deceive outside shareholders. According to Clause 49 of the Listing Agreement, the independent director holds one-third position on a board when the corporate firm is led by the executive chairman, whereas in the case of the non-executive chairman-led company, half of the directors should comprise the position of the independent directors. The board representation of independent directors is still too small in Indian corporate firms compared to other developed countries (Sarkar & Sarkar, 2012). The existing empirical literature reveals that as the proportion of executive directors increases in a board, it will enhance the firm performance by monitoring the incumbent management effectively and thus the company would disburse higher dividends (Roy, 2015). Moreover, the executive directors could be controlling shareholders and serve the interest of the self-interested management or interested to increase private benefits. Thus, the increase in the proportion of executive directors may have a negative impact on dividend distribution. The existing literature finds that the independence of independent directors helps to mitigate agency problems between insiders and outsiders by questioning the incumbent management and thus uphold the interest of outsiders. Hence, the role of good governance provided by independent directors would encourage corporate firms to distribute higher dividends (Roy, 2015). As discussed above, the non-independent directors are the relatives of the board of directors or management. Thus, the increase in the proportion of non-independent directors may discourage the firm to distribute higher dividends. The proxies for board composition are the proportion of executive directors (EXECDIR), the proportion of independent directors (INDEPDIR), and the proportion of non-independent directors (NONINDPD). In this study, the largest shareholder belongs to a promoter or promoter group and thus could be an executive director in accordance with the SEBI guidelines. Thus, we do not include the proportion of executive directors in our control variable. We incorporate the proportion of independent directors (INDEPDIR) and the proportion of non-independent directors (NONINDPD) as control variables into our study.

3.2 Some Observations from the Sample

The descriptive statistics of the variables are presented in Tables 1 and 2. From Tables 1 and 2, it is evident the shareholding by the largest shareholder and the second-largest shareholder is higher when both of them belong to the promoter or promoter group. Companies in which the largest and the second-largest shareholders

Table 1 Descriptive statistics for those companies where the largest and second-largest shareholders belong to the promoter group

Variables	Obs	Mean	S.D.
LSP1	3612	28.06	15.31
SLP2	3612	12.00	7.41
DPYR	3612	22.62	5.37
LEV	3612	1.53	7.44
FIRMSIZE	3612	3.98	0.67
GROWTH	3612	2.38	4.20
PROFIT	3612	0.96	0.17
PINDPD	3612	0.51	0.24
PNINDPD	3612	0.47	0.26

Source Author's calculation

Table 2 Descriptive statistics for those companies where the largest shareholder is promoter group and the second-largest shareholder is non-promoter

Variables	Obs	Mean	S.D.
LSP1	1372	17.64	12.14
SLNP2	1372	10.12	5.93
DPYR	1372	16.68	24.27
LEV	1372	1.67	5.36
FIRMSIZE	1372	4.01	0.66
GROWTH	1372	2.05	2.98
PROFIT	1372	0.85	0.35
PINDPD	1372	0.49	0.22
PNINDPD	1372	0.46	0.24

Source Author's calculation

are promoters provide higher dividend payout than companies with a combination of promoter and non-promoter. Companies in which the largest shareholder is a promoter and the second-largest shareholder is a non-promoter may have higher leverage and matured ones rather than companies in which the largest shareholder and the second-largest shareholders belong to a promoter group. However, the growth opportunities and profitability are high for those companies in which the largest and the second-largest shareholders are promoters. However, there is a minor difference in the proportion of independent and non-independent directors sitting on the boards of those companies in which the largest shareholder is a promoter and the second-largest shareholder is also a promoter as well as in that company where the largest shareholder is a promoter and the second-largest shareholder is non-promoter.

4 Empirical Analysis

The results of linear dynamic panel data estimation to explore the impact of the largest shareholder on dividend payout are displayed in Table 3 It is reported in model (1) that the coefficient of the largest shareholder has a negative and significant impact on dividend at 1% level of significance. But, the square term of the shareholding of the largest shareholder has a positive and significant impact on the dividend payout ratio. These two results imply that at a lower level of shareholding the largest shareholder distributes lower dividends but at a higher level of equity holding, the largest shareholder is in favor of distributing higher dividends.

Among control variables, growth opportunities have a negative and significant impact on dividend payout at 10% level of significance. It implies firms with higher growth opportunities will distribute lower dividends. Moreover, it is found from our model (1) that as the proportion of independent directors increases in a board of a company it will compel the company to distribute higher dividends and to protect the minority shareholders from rent extractions by promoters.

Our results are consistent with the existing studies which confer that the largest shareholding with a lower level of shareholding may use an efficient monitoring mechanism as a substitute for dividend and thus distribute a lower level of dividend to protect the value of their investment (Truong & Heaney, 2007). However, the largest shareholder with a higher level of shareholding will try to signal the minority

Table 3 Results for linear dynamic panel data regression to explore the impact of the largest shareholder on dividend payout

Variables	DPYR
	Model (1)
LP	−11.32 (4.81)***
LPSQUARE	0.156 (0.056)***
LEV	0.445 (0.472)
FIRMSIZE	−24.920 (16.04)
PROFIT	27.433 (25.731)
GROWTH	−1.307 (0.698)*
PINDPD	50.749 (13.141)***
PNINDPD	−29.731 (15.892)*
Observations	4984
AR(1)	0.15
AR(2)	0.58

Source Author's calculations
Standard errors are reported in parenthesis
***, **, and * denote level of significance at 1%, 5%, and 10%, respectively

shareholders their unwillingness to rent extractions and thus distribute higher dividends.[2] From our study, we get a convex relationship between the largest shareholder and dividend payout and hence supporting the existing empirical results (Crutchley et al., 1999; Khan, 2006). Independent directors usually protect the interests of the minority shareholders. Independent directors as spokespersons of the minority shareholders raise their voice against the promoter led oppressive policies which hurt the interests of the minority shareholders and further push the promoter or promoter group or controlling shareholders to change such policies in a country where the legal protection for minority shareholders are quite strong. Our results display that independent directors play a positive role in formulating dividend payout policy. Thus, our results support the view that shareholders with a good investor protection mechanism may exert pressure on the largest shareholder to distribute higher dividends and the largest shareholder with a higher level of shareholding may use dividend as a cost-effective substitute of the corporate governance mechanism (La Porta et al., 2000).

Next, the impact of the second-largest shareholder on dividend payout as well as the monitoring role of the second-largest shareholder is explained under two situations: (i) when the largest shareholder and the second-largest shareholder belong to a promoter group and (ii) when the largest shareholder is a promoter but the second-largest shareholder is a non-promoter.

The results for the first situation are displayed in Table 4. It is evident from the model (2) that the largest shareholder has a negative and significant effect on dividend payout. However, the square term of the largest shareholder's shareholding becomes insignificant in our model (2). On the other hand, the second-largest shareholder produces a negative and significant impact on the dividend payout policy. The control variable profit has a positive and significant impact on the dividend payout policy. Firms with higher profits will disburse higher dividends. Another control variable such as the growth opportunities has a negative and significant impact on dividend but at 10% level of significance. The proportion of non-independent directors has a negative and significant impact on dividend payout policy.

Overall, our results indicate that the largest shareholder has a negative and significant impact on the dividend payout ratio. It implies that the largest shareholder with a small amount of shareholding may use active monitoring as a substitute mechanism of dividend payout and thus pay lower dividends. Again, the second-largest shareholder has a negative and significant impact on the dividend payout ratio. One of the implications of this result is that the second-largest shareholder may actively monitor the largest shareholder, restrain the largest shareholder to exploit minority shareholders by generating private benefits for themselves, and hence distribute a lower amount of dividend. This explanation is consistent with existing theories (Gonzalez

[2] In India, family-owned business group firms have several ways (like high salaries and perks for the largest shareholder, dilution of shares, corporate asset misappropriation from companies at the lower tier of a pyramid to the largest shareholder of the parent firm) to extract rent from minority shareholders and the extraction gets aggravated through pyramiding, cross-holding, and tunneling. Minority shareholders at the lower tier of a business group face the most disgusting effect of rent extraction.

Table 4 Results for linear dynamic panel data regression when the largest shareholder and the second-largest shareholder belong to a promoter or promoter group

Variables	DPYR	
	Model (2)	Model (3)
LP	−0.690(0.368)**	−2.342(0.724)***
LPSQUARE	0.106(0.106)	−0.001(0.003)
SLP	−1.781(0.588)***	−10.157(3.056)***
INTLPSLP	–	0.214(0.078)***
LEV	0.530(0.378)	0.776(0.538)
FIRMSIZE	−5.882(4.334)	−6.070(4.346)
PROFIT	38.111(17.972)**	42.616(29.679)
GROWTH	−0.775(0.450)**	−0.521(0.594)
PINDPD	5.933(8.178)	8.684(10.625)
PNINDPD	−18.859(8.148)**	−35.809(12.286)**
Observations	3612	3612
AR(1)	0.15	0.14
AR(2)	0.61	0.66

Source Author's calculations
Standard errors are reported in parenthesis
***, **, and * denote level of significance at 1%, 5%, and 10%, respectively

et al., 2017). The other possible explanation could be as follows—the largest and the second-largest shareholders (both are promoters) act as a block and may collude with each other to extract the benefits from the minority shareholders, thus distributing lower dividends. This explanation also gathers support from the existing literature (Attig et al., 2008).

To disentangle these two aspects, we incorporate an interaction term between the largest and the second-largest shareholders in our study. Our results show that the coefficients of the largest shareholder and the second-largest shareholders show a negative and significant negative impact on dividend payout, respectively. But the interaction term between them produces a positive impact on the dividend. This implies as the percentage shareholding of the second-largest shareholder goes up it will induce the largest shareholder to disburse higher dividends. This result further indicates that by granting higher dividends to the shareholders, the corporate firms may use dividend as a signal to convey that the firm's position is robust and the promoter and controlling shareholders try to establish a good reputation to other shareholders especially to minority shareholders in order to fetch cheaper capital. One manifestation of this result is as follows: The monitoring activities of the second-largest shareholder could be canceled out by cooperative arrangements between the largest and the second-largest shareholders (they could use other forms of rent extractions from minority shareholders rather than reducing the level of dividend) and thus negate the monitoring role of the second-largest shareholder over the largest shareholder.

Table 5 Results for linear dynamic panel data regression when the largest shareholder is a promoter and the second-largest shareholder is a non-promoter

Variables	DPYR
	Model (4)
LP	−0.301(0.084)***
LPSQUARE	0.002(0.001)
SLNP	−0.015(0.044)
LEV	−0.004(0.031)
FIRMSIZE	−0.931(2.368)
PROFIT	14.222(2.060)***
GROWTH	−0.424(0.254)*
PINDPD	−12.527(2.311)***
PNINDPD	−4.264(2.153)***
Observations	1372
AR(1)	0.01
AR(2)	0.35

Source Author's calculations
Standard errors are reported in parenthesis
***, **, and * denote level of significance at 1%, 5%, and 10%, respectively

Among control variables, the proportion of non-dependent directors has a negative and significant impact on the dividend payout ratio.

The result for the second situation is displayed in Table 5 where the largest shareholder is a promoter group but the second-largest promoter is a non-promoter. It is evident from the model (4) that the largest shareholder has a negative and significant impact on the dividend payout ratio. It implies that the largest shareholder would be in favor of keeping retained earnings intact in order to generate private benefits for themselves instead of distributing dividends to the shareholders. The coefficient of the second-largest shareholder is insignificant in this model. Thus, the second-largest shareholder could not restrain the largest shareholder from rent extraction by expropriating the minority shareholders. The monitoring role of the second-largest shareholder is not found in our respective model.

Among control variables, profit has its usual positive impact on dividend payout ratio. The growth opportunities of the firm have a negative and significant impact on the dividend payout ratio. The proportion of independent directors has a negative impact on the dividend payout ratio. It implies that the independent directors could collude with the promoters to share in the private benefits of control extracted by promoters. Furthermore, the proportion of non-independent directors has a negative and significant impact on the dividend payout ratio.

We have further partitioned the non-promoters into institutions and non-institutions. The monitoring role of the second-largest shareholder is explained for firms in which the largest shareholder is a promoter but the second-largest promoter is a non-promoter institution. The result is displayed in Table 6. It is evident from

Table 6 Results for linear dynamic panel data regression when the largest shareholder is a promoter and the second-largest shareholder is an institutional non-promoter

Variables	DPYR
	Model (5)
LP	0.506(0.960)
LPSQUARE	−0.034(0.018)*
SLNPINST	1.323(0.880)
LEV	4.317(2.688)
FIRMSIZE	0.180(6.838)
PROFIT	37.680(5.891)***
GROWTH	1.284(0.817)
PINDPD	10.502(15.638)
PNINDPD	−11.126(15.482)
Observations	238
AR(1)	0.20
AR(2)	0.22

Source Author's calculations
Standard errors are reported in parenthesis
***, **, and * denote level of significance at 1%, 5%, and 10%, respectively

model (5) that the largest shareholder with a small level of shareholding has no impact on the dividend payout ratio. However, the largest shareholder with a higher level of shareholding disburses a lower level of dividend, thus supporting the expropriation of the minority shareholders. The second-largest shareholder does not have any impact on the dividend payout policy. Thus, our model (5) negates the active monitoring role of the second-largest shareholder over the largest shareholder. Among control variables, profit has a positive and significant impact on dividend payout policy.

In India, most listed companies are controlled by promoter or promoter groups which are mainly family-owned. Thus, the promoters control the day-to-day decisions of a company. Under weak execution of legal protection mechanism for minority shareholders, promoters as controlling insiders in a company could expropriate minority shareholders through a cobweb of complex ownership arrangements such as pyramiding, cross-holding, and tunneling in India with the concentrated ownership structure. The promoter and promoter group are the largest group of blockholders in India. In India, the percentage of outside block holding or non-promoter holding is still smaller compared to promoter holding. Within non-promoter holding, institutional investors being large and resourceful could be an active monitor and act as a countervailing block against self-interested promoters. The institutional investors having large equity stakes and guarded by strong legal rights could resist the promoters from expropriating minority shareholders. However, in India, institutional investors with diversified portfolios may not be interested to monitor the promoter or promoter group as their firm-specific risk is low. Again, when the shareholding of the institutional investors is quite low, then it could be advantageous for them to

Table 7 Results for linear dynamic panel data regression when the largest shareholder is a promoter and the second-largest shareholder is a non-institutional non-promoter

Variables	DPYR
	Model (6)
LP	−0.115(0.158)
LPSQUARE	0.002(0.003)
SLPNONINST	−0.152(0.064)***
LEV	0.014(0.034)
FIRMSIZE	−0.246(2.565)
PROFIT	10.720(1.882)***
GROWTH	−0.655(0.174)***
PINDPD	−9.120(2.796)***
PNINDPD	−8.170(1.729)***
Observations	1134
AR(1)	0.03
AR(2)	0.47

Source Author's calculations
Standard errors are reported in parenthesis
***, **, and * denote level of significance at 1%, 5%, and 10%, respectively

cooperate with promoters in order to protect their investments and act against the spirit of minority shareholders.

Again, the monitoring role of the second-largest shareholder is explained for firms in which the largest shareholder is a promoter but the second-largest promoter is a non-promoter non-institution and displayed in Table 7. It is evident from the model (6) that the largest shareholder does not affect dividend payouts. However, the second-largest shareholder has a negative and significant impact on the dividend payout policy. However, the monitoring role of the second-largest shareholder over the largest shareholder is not observed in the model (6). Non-institutional investors are small dispersed shareholders. In India, the legal protection for shareholders is good in the book but the execution is at best weak.

The control variables such as growth opportunities, profit, and the proportion of non-independent directors have shown their usual impact on dividend payout ratio. The proportion of non-independent directors has shown a negative and significant impact on dividend payout, as reported in models (4) and (5).

5 Summary and Conclusion

This study endeavors to explore the effect of the largest shareholders on dividend payout policy. It is further tried to examine whether the presence of other shareholders especially the second-largest shareholder makes any difference in the existing dividend payout policy through active monitoring over the largest shareholder.

Using a sample of Indian business group firms for the period from 2006 to 2019 and applying the linear dynamic panel data estimation technique for 356 firms, this study finds that the largest shareholder and the dividend payout show a convex relationship. Our result is consistent with the existing studies (Crutchley et al., 1999; Khan, 2006). As the share of independent directors' increases, the dividend payout ratio will also increase. It implies that independent directors with a higher proportion in a board as well as with strong voting rights may exert pressure on the largest shareholder to distribute higher dividends to protect the rights of the minority shareholders. Moreover, the largest shareholder with a higher level of shareholding may use dividend as a cost-effective substitute of the corporate governance mechanism as observed by La Porta et al. (2000). The second objective of this study is to explore the monitoring role of the second-largest shareholder which is explained under two conditions: (i) when the largest shareholder and the second-largest shareholder belong to a promoter group, and (ii) when the largest shareholder is a promoter but the second-largest shareholder is a non-promoter.

Using a balanced panel data for 258 Indian business groups during the period 2006–2019 and applying the linear dynamic panel data regression, our study finds that the largest shareholder and the second-largest shareholder have a negative and significant impact on dividend payout ratio in the first case where the largest and the second-largest shareholders belong to the promoter group. It could be explained from the perspective of the monitoring theory. The largest shareholder with a smaller level of shareholding may use monitoring activity as a substitute for the dividend payout. Again, the second-largest shareholder being an efficient monitor may restrain the largest shareholder to exploit minority shareholders, and thus, a lower amount of dividend payment is expected. Our results can be explained from another perspective—the largest and the second-largest shareholders (both are promoters) act as a block (inside block holders) and may collude with each other to extract the benefits from the minority shareholders, thus distributing lower dividends.

To disentangle these two aspects, we incorporate an interaction term between the largest and the second-largest shareholders in our study. Our results negate the possible monitoring role of the second-largest shareholder. To maintain a good reputation to the minority shareholders and in order to increase the value of the firm, the largest and the second-largest shareholders (expressed by the interaction term) as a block are willing to distribute higher dividends when they have other possible ways of rent extractions.

Secondly, the monitoring role of the second-largest shareholder is not found for Indian business groups where the largest shareholder is the promoter and the second-largest shareholder is the non-promoter. Outside block holding, i.e., non-promoter's holding is quite low in India and the cost of monitoring is pretty high for them and thus does not use monitoring activity as an alternative corporate governance mechanism. Finally, the non-promoter data is also categorized into institutions and non-institutions. Our sample does not provide any support for the monitoring role of the second-largest shareholder. The promoter and promoter group are the largest group of blockholders in India. Within non-promoters, the institutional investors are by nature large shareholders and endowed with resources and legal rights and thus can monitor the management of the company very effectively. However, in India, institutional investors with diversified portfolios may not be interested to monitor the promoter as their firm-specific risk is low. On the other hand, with a smaller level of institutional holding in comparison with promoters, the institutional investors think it could be advantageous for them to cooperate with promoters in order to protect their investments and act against the rights of minority shareholders by shirking the task of the monitoring. Again, the non-institutional investors are small and dispersed in nature. They could not coordinate with each other to become an active monitor or act as a block. Moreover, the monitoring cost is very high in India, and hence being a tiny part of the non-promoter shareholding, it is very difficult for them to monitor the promoter-led management.

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Regime Switching Dynamic Currency Exposure of Indian Stock Market

Gagari Chakrabarti

1 Introduction

Financial markets are often comprehended as inherently fragile that are prone to irrational exuberance followed by unfound pessimism and crises. Faced with such a system, researchers and analysts often seek to explore the nature of risks, roots of crises and the channels through which they reverberate from the centre to periphery. The recent era of financial integration makes the markets to be essentially interdependent and opens up significant channels of risk transmission. The extent of such interdependence and its possible changing nature over different phases of market movement would be critical and crucial for stability of a financial market and, hence, for the investors too who play in it (Aysun & Guldi, 2008; Chue & Cook, 2008; Kiymaz, 2003; Lin, 2011). This is particularly the area where the present study intervenes with a focus on an emerging market, namely India. The study finds its motivation from the empirical evidence in the literature that documents the presence of significant exchange rate exposure in the emerging markets of Asia from 1997 to 2010. Such exposure has been found to be more prominent or even devastating during the 1997 Asian crisis and the 2008 global crisis periods. This has been particularly true despite the frequent interventions of central banks during these periods (Chue & Cook, 2008; Lin, 2011). Such studies, however, are indeed missing in the context of India. The study covers a period of roughly twenty-one years from January 1999 to July 2020. Waves of crises have hit the Indian financial market over this period. Some of these shocks have remained confined to regional territory, while some assumed the dimension of widespread crisis. Starting from the Internet bubble in the last few

G. Chakrabarti (✉)
Department of Economics, Presidency University, 86/1 College Street, Kolkata, West Bengal 700073, India
e-mail: gagari.econ@presiuniv.ac.in

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years of the twentieth century, the period has witnessed the severity of global financial meltdown of 2007–08. With the recent pandemic, one of the worst financial crises is anticipated to set in.

The study, following the standard theories of portfolio diversification, takes the responsiveness of an asset to the market movement as a measure of its non-diversifiable non-idiosyncratic risk. It however differs in its approach towards market risk. It conjectures that the risks for any local stock market may be located in other relevant financial markets, but not in a non-stochastic way as is apprehended in the standard market models such as CAPM. Hence, to start with, the study extends the concept of market risk to encompass foreign exchange exposure. Thus, the exploration of market risk is not merely an exploration of how does the Indian market responds to the global stock market, but it is to be an inquiry into the nature of its responsiveness to the changes in real effective exchange rate as well. The study, at the same time, feels the necessity to make such currency risk dynamic or time-varying. Leaving the exposure to be constant over time would lead to underestimation of risk. Available literature suggests that exchange rate exposure is indeed unstable over time and exhibits asymmetric behaviour during currency appreciations and depreciations (Al-Shboula & Anwar, 2014; Koutmos & Martin, 2007; Hunter, 2005; Lim, 2005; Long et al., 2014). Using a Markov switching model, the study models the behaviour of such time-varying exposure over regimes. Further escalation in risk, however, is possible if volatility spills over from different financial markets. Using a discrete threshold regression model, the study locates such channels in the stock and the foreign exchange markets. Specifically, the study seeks to answer the following set of questions:

Question 1: How do the time-varying currency exposures for Indian stock market move over time and pass through different regimes?

Question 2: Whether and how such exposures get affected by the movements in the domestic stock market? Do such relationships vary across stock market regimes?

Question 3: Do movements in foreign exchange market affect time-varying exposure? If so, do such relationships vary across foreign exchange regimes?

The study contributes to the literature by expanding the concept of market risk to incorporate foreign currency exposure and by making such non-idiosyncratic risk time-varying. The use of regime switching model to analyse the nature of dynamic market risks over different regimes is indeed lacking in the literature. Such an analysis may be of relevance for investors, researchers and policy-makers. The issue bears significance as it is the non-diversifiable market risk that bothers the investors most. Any knowledge about its behaviour over time and across regimes would help them design suitable investment strategies. The issue finds relevance among the policy-makers who seek to ensure stability in a market that is vulnerable to the shocks in the global market.

The rest of this chapter is organized as follows. Section 2 provides a brief literature review, and Sect. 3 describes the data and methodology. Section 5 concludes the chapter.

2 Current Literature in the Field

2.1 Literature on Time-Varying Exposure

A large body of the literature documents the presence of exchange rate exposure on stock market. In traditional flow-oriented approach, depreciation of domestic currency makes exports cheaper and creates additional foreign demand for local goods. Hence, domestic firms expect higher cash flows with resultant increase in their stock prices (Dornbusch & Fischer, 1980). Thus, a causality runs from exchange rate to stock prices. The portfolio balance theory or the stock-oriented approach however maintains that the causality instead runs from stock prices to exchange rate (Branson, 1983; Frankel, 1983). The available studies on exchange rate exposure are generally firm-level, industry-level and cross-country analyses that make use of aggregate macroeconomic data (Lin, 2011). Bekeart and Harvey (1995) proposed a measure of capital market integration arising from a conditional regime switching model and found emerging markets to exhibit time-varying integration. Firms in advanced markets, such as Germany, are found to have greater exposures when they sell abroad. Chue and Cook (2008) estimated the extent of foreign exchange exposure for the emerging market companies over the period of 1999–2006. A cross-country comparison using an instrumental variable method documented depreciations to have negative impacts on emerging market stock returns. The tendency however disappeared after 2002. Lin (2011) examined the asymmetric impact of foreign exchange exposure on stock returns in the Asian emerging markets for a period from 1997 to 2010. Aysun and Guldi (2008) found a significant proportion of firms from five emerging markets such as Brazil, Chile, Korea, Mexico and Turkey to be exposed during the period 1995–2006. Parsley and Popper (2006), however, found a quite surprizing result that is better known as exposure puzzle. They found 0% firms in Philippines to be exposed to US dollar movements. The proportion is not significant in other emerging Asian markets such as Indonesia (2%), Taiwan (3%), Korea (4%), Thailand (10%) and Malaysia (27%). Such exposure puzzle was solved by Du et al. (2014) for Taiwan who emphasized that currency fluctuations in emerging markets affect their capital markets through the co-movement with the market factors.

The literature documents different approaches towards measuring time-varying currency exposure (henceforth, TVE). Williamson (2001), Entorf and Jamin (2003), Bodnar and Wong (2003), and Dominguez and Tesar (2006), for example, employed conventional methods like moving window regression, dummy variables or subsampling. Some studies have identified determinants of exposure (Allayannis, 1997; Allayannis & Ihrig, 2001; Bodnar et al., 2002; Chiao & Hung, 2000), but some of these failed to establish the presence of TVE (Bodnar et al., 2002). Some studies have employed suitable multivariate GARCH family models to estimate time-varying second moments to compute TVE (Fu et al., 2011; Hunter, 2005; Lim, 2005; Tai, 2008). Kiani (2013) explored the possible existence of time-varying risk premia in ten selected currencies using non-Gaussian state space models. Most of the studies, however, focus on developed markets. There is thus a pressing need to model the relationship in the context of emerging markets.

2.2 Literature on Markov Switching Model in Foreign Exchange Market

Markov switching models have often been used to describe exchange rate movements. Engel and Hamilton (1990) were the first to deem the model fit to describe movements in dollar/mark, dollar/pound and dollar/French franc exchange rates for the period of 1973–1986. Similar results were found by Engel (1994), Engel and Hakkio (1994) and Marsh (2000). Engel (1994) explored whether the Markov switching model is useful for describing behaviour of eighteen floating exchange rates in the post-Bretton Woods era (1973–1986), including 11 non-US dollar exchange rates. Quarterly movements in US dollar were considered against that in Japanese yen, pound sterling, Canadian dollar, Italian lira, French franc, Swiss franc and German mark. The movements in yen and pound were further analysed against the remaining currencies. Engel and Hakkio (1994) explored the behaviour of weekly changes in the French franc/DM and Italian lira/DM exchange rates to the behaviour of the US dollar/DM and the Japanese yen/DM exchange rates. They showed that a single normal distribution was inadequate to describe movements in these exchange rates. Marsh (2000) considered movements in the deutschemark, pound sterling and Japanese yen against US dollar for the period of 1980–1996.

Bollen et al. (2000) found a regime switching model with shifts in mean and variance to be better fit with more accurate forecasts than a range of other GARCH family models. They considered movements in weekly spot rates for the British pound, Japanese yen and deutschemark against the US dollars (USD) for a period from 1973 to 1996.

Bergman and Hansson (2005) found the Markov switching model to be good to describe the movements in quarterly exchange rates of six industrialized countries, namely UK, France, Germany, Switzerland, Canada and Japan against the US dollar from the second quarter of 1973 to the fourth quarter of 1997. Similar results were obtained by Cheung and Erlandsson (2005). They, however, pointed out that the frequency of data, apart from the sample size, is crucial for identifying the number of regimes. Ismail and Isa (2007), Saxena (2002) and Warjiyo (2013) employed the Markov switching model to analyse the nature of exchange rate movements in emerging markets. Saxena (2002) explored equilibrium real exchange rate in Indonesia to estimate the extent of overvaluation of the currency during the Asian currency crisis of 1997. Ismail and Isa (2007) employed regime switching model to analyse movements in Malaysian ringgit against pound sterling, Australian dollar, Singapore dollar and Japanese yen from 1990 to 2005. They found regime switching models to be best fit to describe such movements. Warjiyo (2013) considered movements in Indonesian currency against US dollar in 2011–2012. Use of the model to describe time-varying currency exposure, however, is not available in the literature. This is exactly where the present study intervenes.

2.3 Literature on Threshold Regression Model in Foreign Exchange Market

There is a dearth of the literature on using threshold regression model in foreign exchange market. Studies by Bec et al. (2004), Leon and Najarian (2005), Michael et al. (1997) and Taylor et al. (2001) show that a three-regime threshold autoregressive model can better describe the stochastic process followed by several real exchange rates. In the presence of transaction costs, Michael et al. (1997) found the equilibrium models of real exchange rate determination to be essentially a nonlinear adjustment process towards purchasing power parity. They used monthly data on wholesale price indices for the UK, France, Germany and USA. Monthly data on spot exchange rate for pound sterling against these currencies was used from 1921 to 1925 (for German data) and from 1921 to 1923 (for non-German data). Taylor et al. (2001) used monthly data on consumer price indices in USA, UK, Germany, France and Japan. The exchange rate of all four non-USD currencies was considered against the US dollar. For the period of 1973–1996, the real exchange rates were indeed found to be characterized by nonlinear, regime switching movements. Using a multi-regime logistic smooth transition auto-regression technique, Bec et al. (2004) detected the presence of mean reversion in the monthly real exchange rates for different currency pairs involving US dollar, deutschmark, pound sterling, French franc, Belgian franc and Finnish markka for the period from 1973 to 2009. Leon and Najarian (2005) checked whether deviations from purchasing power parity under nonlinearity are stationary for twenty-six countries such as Canada, France, Germany, Italy, Japan, UK, USA (G7); Australia, Belgium, Israel, Korea, New Zealand, Spain; Asia: India, Indonesia, Malaysia, Philippines, Thailand (developing countries) and Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Paraguay, Uruguay (Western Hemisphere). Henry et al. (2001) followed a two-regime threshold autoregressive approach to model exchange rate instability in the trade-weighted Australian real exchange rate from 1970 to 1999. Chong and Yan (2018) employed multi-factor threshold models to successfully forecast currency crises in Argentina, Brazil, Chile, Colombia, Mexico, Uruguay, Venezuela, China, Hong Kong, Indonesia, South Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand over a period of 1982–2001. Most of the available literature however considers movements in exchange rates alone. Literature on using threshold models to explore either the behaviour of time-varying exposure or the impact of movements in financial markets on time-varying exposure is indeed lacking. This is where the present study intervenes and contributes to the literature. The study contributes further in its attempt to explore the impact of the recent COVID-19 pandemic on the movements of dynamic foreign exchange exposure in Indian context. No study has thus far made an attempt to model such behaviour.

3 Data and Methodology

3.1 Data

The study period extends from January 1999 to July 2020. The study collects monthly data on thirty-six countries' real effective exchange rate (REER) for India from the website of Census and Economic Information Center (CEIC). Since 1992, this database provides detailed and accurate data for 200 countries. The real effective exchange rate (REER) of a country is the weighted average of its currency in relation to a basket of currencies of its major trading partners. The weights are calculated on the basis of relative importance of each of the trading partners in total trade of the country concerned. REER is used to estimate value of a given currency in relation to an average group of other major currencies. Reserve Bank of India publishes data on six currency and thirty-six currency indices of REER. The six countries represent the USA, the Eurozone, UK, Japan, China and Hong Kong. The thirty-six countries' index is based on broad criteria such as (i) share in India's exports and trade, (ii) regional representation and (iii) regular availability of data on a monthly basis. The countries included are Australia, Bangladesh, Brazil, Canada, China, Denmark, Egypt, Eurozone, Hong Kong, Indonesia, Iran, Israel, Japan, Kenya, Korea, Kuwait, Malaysia, Myanmar, Mexico, Nigeria, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, South Africa, Sri Lanka, Sweden, Switzerland, Thailand, Turkey, UAE, UK and USA. This group accounts for 77 per cent and 89 per cent of India's total foreign trade and exports, respectively (www.rbi.org.in). Monthly data on Bombay Stock Exchange (BSE) SENSEX, the benchmark free-float market capitalization weighted index of thirty stocks for the Indian market, has been collected from the official website of Bombay Stock Exchange.

3.2 Calculation of Time-Varying Exposure Diagonal VECH Model

The literature on calculation of time-varying exposure is scarce. Hence, the study follows the available literature on calculation of time-varying beta, which is, by nature, similar to the time-varying exposure. Following the available literature, one might employ suitable GARCH family of models (Bollerslev et al., 1988; Koutmos et al., 1994; Ng, 1991; Yun, 2002). Alternatively, Kalman filter may be used (Black et al., 1992; Faff et al., 2000), but the gain in efficiency achieved by using it is negligible (Faff et al., 2000). This study follows the first approach and uses a suitably lagged diagonal VECH model to calculate time-varying exposures.

Following Bollerslev et al. (1988) and Bollerslev (1990), a bivariate specification of a suitably lagged diagonal VECH model may be described as follows:

$$\mathrm{VECH}(H_t) = C + A.\mathrm{VECH}(\in_{t-1}\in'_{t-1}) + B.\mathrm{VECH}(H_{t-1})$$

$$\in_t |\varphi_{t-1} \sim N(0, H_t) \tag{1}$$

VECH is a vector half operator that stacks the lower triangle of the symmetric $N \times N$ time-varying conditional variance–covariance matrix H_t

$$H_t = \begin{bmatrix} h_{11t} & \ldots & h_{1Nt} \\ \ldots & \ldots & \ldots \\ h_{N1t} & \ldots & h_{NNt} \end{bmatrix}$$

For $N = 2$, a VECH(1,1) can be written as:

$$\begin{bmatrix} h_{11,t} \\ h_{21,t} \\ h_{22,t} \end{bmatrix} = \begin{bmatrix} c_{11} \\ c_{21} \\ c_{22} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} \end{bmatrix} \begin{bmatrix} \varepsilon^2_{1,t-1} \\ \varepsilon_{1,t-1}, \varepsilon_{2.t-1} \\ \varepsilon^2_{2,t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \end{bmatrix} \begin{bmatrix} h_{11,t-1} \\ h_{21,t-1} \\ h_{22,t-1} \end{bmatrix}$$

α_{ii}, the diagonal elements, show the impact of own past innovations on present volatility. The cross-diagonal terms (α_{ij}, $i \neq j$) show the impact of past innovation in one asset return on the present volatility of others' returns. Similarly, β_{ii} measures the own past volatility spillover and β_{ij} ($i \neq j$) measures the cross-volatility spillover.

φ_{t-1} is the information set at time $t - 1$, C is a $\{N(N + 1)/2\} \times 1$ parameter vector, and A and B are $\{N(N + 1)/2\} \times \{N(N + 1)/2\}$ parameter matrices. As the off-diagonal terms of the coefficient matrices A and B are set to zero, the conditional variances become

$$h_{11,t} = c_{11} + \alpha_{11}\varepsilon^2_{1,t-1} + \beta_{11}h_{11,t-1} \tag{2}$$

$$h_{22,t} = c_{22} + \alpha_{33}\varepsilon^2_{2,t-1} + \beta_{33}h_{22,t-1} \tag{3}$$

and by assuming the correlations between the conditional variance constant,

$$h_{12,t} = \rho_{12} + \left(h_{11,t} \times h_{22,t}\right)^{1/2} \tag{4}$$

With further assumptions of all $\alpha_{ii} \geq 0$, all $\beta_{ii} \geq 0$ and all $c_{ii} > 0$, the time-varying exposure is calculated as

$$\text{TVEt} = \frac{\text{Conditional Covariance}(R_{\text{stock}}, R_{\text{REER}})}{\text{Conditional Variance}(R_{\text{REER}})} \tag{5}$$

Conditional variance for stock market return or R_{stock} is estimated from $h_{22,t}$, and conditional covariance between stock market return (R_{stock}) and changes in REER (R_{REER}) is estimated from $h_{12,t}$. The time-varying exposures thus calculated (henceforth TVE) show the sensitivity of the Indian stock market to changes in real effective exchange rates.

3.3 *Regime Switching Behaviour of Time-Varying Exposure*

The study employs the Markov switching model to depict the movements in the TVE over different regimes.

Let us assume that a random variable y_t follows a process that depends on values of an unobserved discrete state variable s_t. There are, say, M possible regimes, and we are in regime m in period t when $s_t = m$ for $m = 1, 2, \ldots, M$. The switching model assumes different regression models to be associated with each regime. Given regressors x_t and z_t, the conditional mean of y_t in regime m follows the linear specification

$$\mu_t(m) = x_t'\beta_m + z_t'\gamma \tag{6}$$

β_m and γ are vectors of coefficients. While β_m varies over regimes, γ is regime invariant. The regression errors are normally distributed with variance that may depend on the regime.

Thus, we have

$$y_t = \mu_t(m) + \sigma(m)e_t \tag{7}$$

The standard deviation of the error term may, however, be regime dependent.

The likelihood contribution for a given observation is found by weighting the density function in each of the regimes by the one-step ahead probability of being in that regime:

$$l_t(\beta, \gamma, \sigma, \delta) = \sum_{m=1}^{M} \frac{1}{\sigma_m} \emptyset\left(\frac{y_t - \mu_t(m)}{\sigma(m)}\right).P(s_t = m | I_{t-1}, \delta) \tag{8}$$

$\beta = (\beta_1, \beta_2, \ldots, \beta_M)$, $\sigma = (\sigma_1, \sigma_2, \ldots, \sigma_M)$ and δ are parameters determining the regimes. I_{t-1} is the information set in period $t - 1$. In simplest possible cases, δ shows regime probabilities.

The log-likelihood function

$$L_t(\beta, \gamma, \sigma, \delta) = \sum_{t=1}^{T} \log\left\{\frac{1}{\sigma_m}\emptyset\left(\frac{y_t - \mu_t(m)}{\sigma(m)}\right).P(s_t = m|I_{t-1}, \delta)\right\}$$

is maximized with respect to β, γ, σ and δ.

The first-order Markov assumption requires that the probability of being in a regime depends on the previous state, so that $P(s_t = j|\, s_{t-1} = i) = p_{ij}(t)$. The probabilities are assumed to be time-invariant. The assumption, however, may be relaxed. The probabilities may be written in a transition matrix as:

$$p(t) = \begin{bmatrix} p_{11}(t) & \ldots & p_{1M}(t) \\ \ldots & \ldots & \ldots \\ p_{M1}(t) & \ldots & p_{MM}(t) \end{bmatrix} \tag{9}$$

The (i, j)th element shows the probability of moving from regime i in period $t - 1$ to regime j in period t. The probabilities may be parameterized in terms of a multinomial logit. A multinomial specification for each row in the transition matrix may be made so that

$$p_{ij}\left(G_{t-1,}\delta_i\right) = \frac{\exp\left(G'_{t-1}\delta_{ij}\right)}{\sum_{s=1}^{M}\exp\left(G'_{t-1}\delta_{ij}\right)}$$

for $j = 1, 2, \ldots, M$ and $i = 1, 2, \ldots, M$ with normalization $\delta_{iM} = 0$.

3.4 TVE and Movements in Stock Market and Foreign Exchange Rates

The relationship between TVE and movements in stock and foreign exchange markets, respectively, is modelled using a discrete threshold regression model. In general, a threshold regression model starts as a multiple regression model with n observations. There are k thresholds that define $(k + 1)$ regimes. For observations in any regime i, we have

$$Y_t = x_t^{'}\beta + z_t^{'}\gamma_j + \varepsilon_t, \quad i = 0, 1, 2, \ldots, k \tag{10}$$

The x variables do not vary across regimes, but the z variables are regime-specific. There exists an observable threshold variable (St) with strictly increasing threshold values $(s_1 < s_2 < \cdots < s_k)$ such that we are in regime r if and only if $s_r \leq \text{St} < s_{(r+1)}$ where $s_0 = -\infty$ and $s_{(k+1)} = \infty$. Thus,

Regime 1:

$$Y_t = x_t'\beta + z_t'\gamma_1 + \varepsilon_t, \quad \text{if} - \infty < \text{St} < s_1$$

Regime 2:

$$Y_t = x_t'\beta + z_t'\gamma_2 + \varepsilon_t, \quad \text{if } s_1 \leq \text{St} < s_2$$

Regime $(k + 1)$:

$$Y_t = x_t'\beta + z_t'\gamma_{k+1} + \varepsilon_t, \quad \text{if } s_k \leq \text{St} < \infty$$

We define an indicator function $I(.)$ such that $I_i(S_t, s) = I_i(s_i \leq \text{St} < s_{i+1})$. It assumes the value 1 if the expression is true and zero otherwise. All regime-specific equations are now combined as:

$$Y_t = x_t'\beta + \sum_{i=0}^{k} I_i(S_t, s).z_t'\gamma_2 + \varepsilon_t \tag{11}$$

The sum-of-square objective function

$$F(\beta, \gamma, s) = \sum_{t=1}^{n} \left(Y_t - x_t'\beta - \sum_{i=0}^{k} I_i(S_t, s).z_t'\gamma_2 \right)^2$$

is minimized with respect to the parameters.

Two specifications of the threshold regression model have been used to describe the relationship between TVE and movements in stock and foreign exchange market.

Specification 1: TVE is regressed on threshold varying variables like (i) lagged values of TVE and (ii) current and lagged values of SENSEX return. The SENSEX return is the proportionate change in historical prices of SENSEX. The thresholds are determined in terms of current and lagged values of SENSEX return. This specification explores, firstly, whether the time-varying exposure is influenced by movements in the stock market and, secondly, whether such relationship modifies over different phases of the stock market.

Specification 2: TVE is regressed on threshold varying variables like (i) lagged values of TVE and (ii) current and lagged values of changes in REER. Changes in REER are the proportionate changes in historical values of REER. The thresholds are determined in terms of current and lagged values of changes in REER. This specification explores, firstly, whether the time-varying exposure is influenced by movements in the foreign exchange market and, secondly, whether such relationship modifies over different phases of the foreign exchange market.

For each specification, the appropriate model is selected on the basis of minimum AIC criterion.

4 Results and Discussion

4.1 Descriptive Statistics and Unit Root Testing

As given in Table 1, the average appreciation or depreciation, given by R_{REER}, is lower than the average stock market changes. Exposure, however, has been quite high on average and volatile too. All the three series are non-normal and skewed and have fat tails. Perron points out that structural change and unit roots are closely related, and conventional unit root tests are biased towards a false unit root null when the data is trend stationary with a structural break. The results for unit root testing with structural break, trend and intercept show all the series to be stationary with break. Foreign exchange market had a break in August 2013 in terms of return, while the stock market returns had the most significant break during global financial meltdown of 2007–08 (Fig. 1). The time-varying exposure, on the other hand, has a significant break in March 2020 during the period of pandemic (Fig. 2). This method, however, could identify a single break, namely the most significant one in the data. Mere visual inspection of Fig. 1 however makes it difficult to identify other breaks in these two markets. Figure 2 plots the movements in Indian foreign exchange market as well as in stock market over the period of study. It clearly shows that the markets pass through different regimes.

The movements in TVE are depicted in Fig. 3. The exposure itself has been quite volatile, and it seems to pass through regimes. The exposure was quite high during the period of Internet bubble in 1999–2000. It fell thereafter to reach a volatile phase of high exposure. During 2008–09, the exposure attained a significantly high level. A phase of low volatility followed until the exposure reached its all-time high during the recent pandemic. The nature of risk, however, may be better analysed if the movements in exposure can be related to changes in market movements.

Table 1 Descriptive statistics and unit root testing

	R_{REER} (changes in REER)	R_{SENSEX} (changes in SENSEX)	TVE
Mean	0.001	0.009	1.223
Std. dev	0.015	0.068	0.640
Skewness	−0.32	−0.61	0.25
Kurtosis	3.69	5.16	5.43
Jarque–Bera	9.69 *	65.89 *	65.93
ADF test statistic with trend, intercept and break	−14.70 * (August, 2013)	−16.27 * (October, 2008)	−6.27 * (March, 2020)
Observations	257	257	257

Source Author's own computation
* implies significance at 1% level of significance

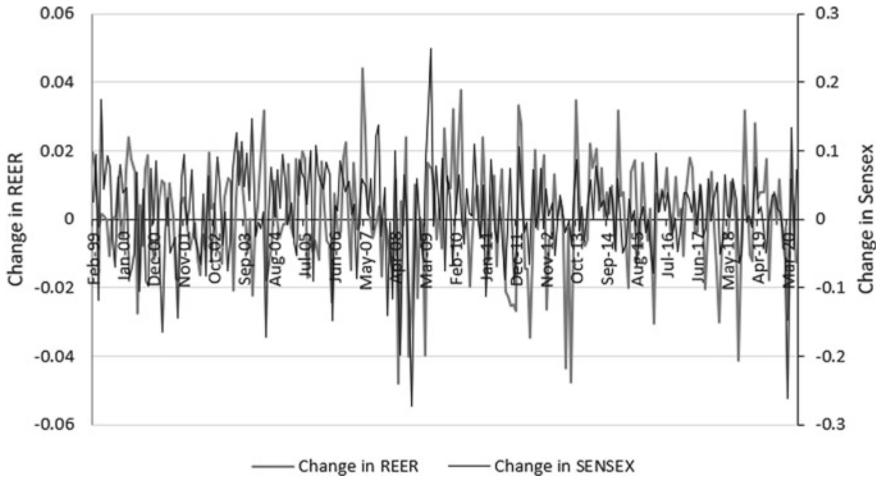

Fig. 1 Movements in changes in REER and SENSEX return (1999–2020)

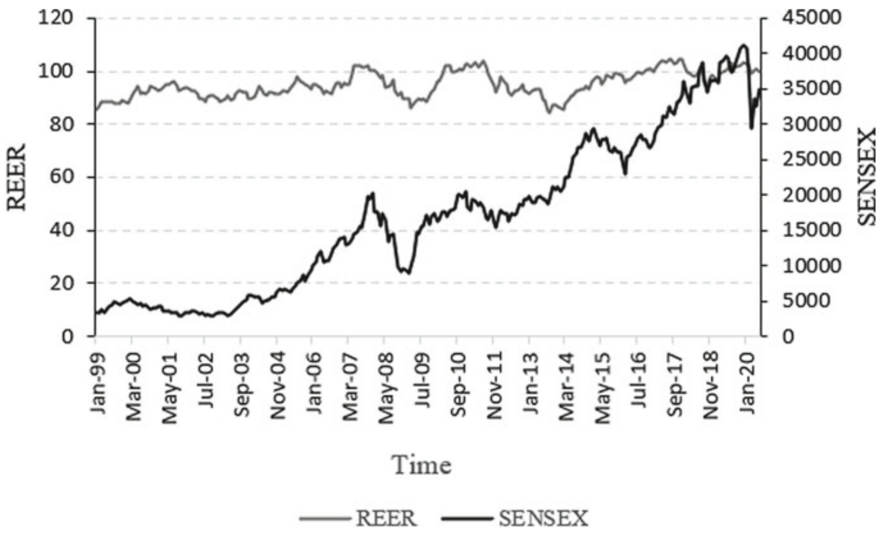

Fig. 2 Movements in REER and SENSEX (1999–2020)

4.2 *Movements in TVE, Stock Market and Foreign Exchange Market: Frequency Band-Pass Filter and Conditional Correlation*

While relating the movements in TVE to changes in financial markets, it would be better to compare the relevant cycles instead of a direct comparison of exposure

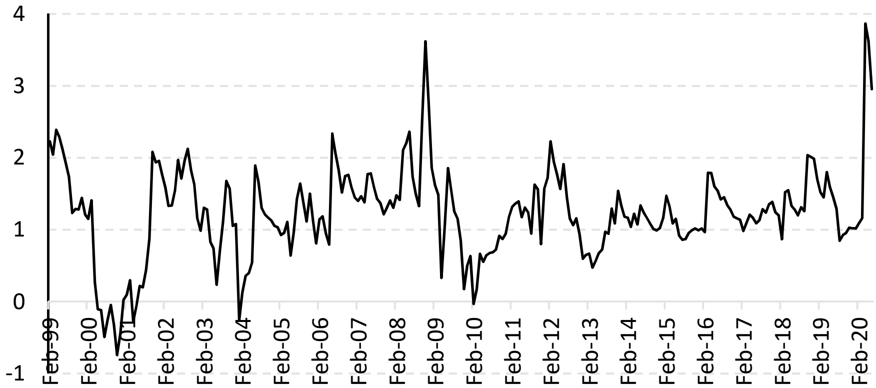

Fig. 3 Time-varying exposure of Indian stock market. *Source* Author's own computation

with *R*(REER) and *R*(SENSEX). Cycles depict long-term movements that are free of short-term fluctuations and, thus, would reveal the nature of co-movement, if any, in a better way. The cycles in the three series are extracted using the frequency band-pass filter following the full sample asymmetric method of Christiano and Fitzgerald (2003). This is the most general filter, where the weights on the leads and lags can differ. The asymmetric filter varies over time. The weights depend on the data and change for each observation.

The stock and the foreign exchange market cycles move in tandem, particularly during the periods of crises (Fig. 4). This has been true during the financial meltdown of 2008–09, during the foreign exchange market crisis of 2013 and during the recent pandemic. The dot-com bubble of 2000, however, had a serious impact on the stock market with almost no impact on the foreign exchange market. The exposure was quite high in 1999, when the dot-com bubble was in full swing. As the stock market crashed, the exposure fell significantly even though the foreign exchange

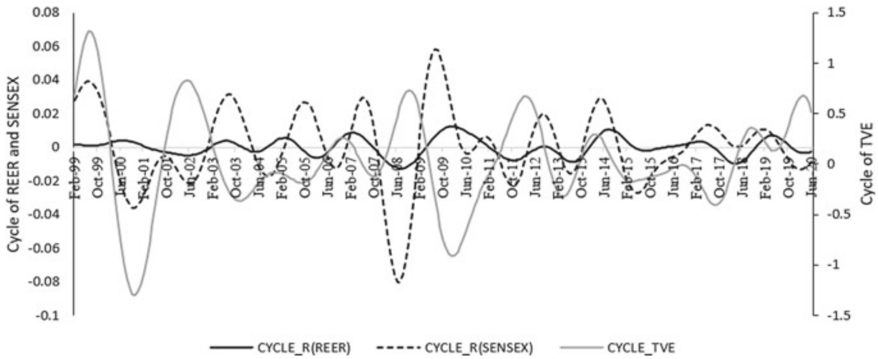

Fig. 4 Cycles in TVE, stock market and foreign exchange market. *Source* Author's own computation

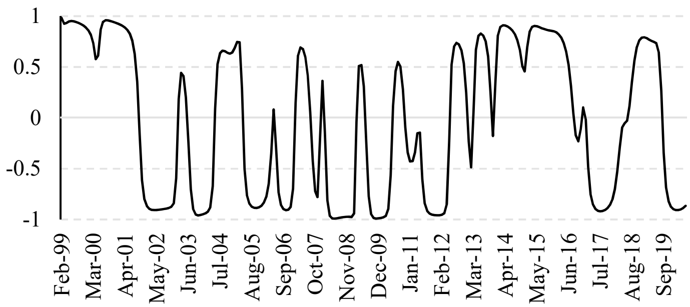

Fig. 5 Conditional correlation between TVE and *R*(SENSEX). *Source* Author's own computation

market remained stable. Significant surge in exposure was seen in 2001–02, when the markets fell once again in the aftermath of the crisis. Exposure increased significantly during the financial meltdown of 2007–08 and in 2011–12 when both the markets were sluggish. The recent days of pandemic have witnessed similar escalation. Thus, exposures seem to be related to the movements in the stock and the foreign exchange markets with the relationship varying over different phases of market regime. This preliminary analysis is extended further to consider the conditional or time-varying correlation between exposure and the two market movements. Conditional correlations are computed by estimating a suitably lagged diagonal VECH model as described in Eq. (1) taking all the three series as a system.

During the dot-com bubble, exposures were strongly and positively correlated with stock market movements. The correlation fell in March 2000 when the crisis began. Thus, the fall in market was generally associated with a fall in exposure, but the extent of association fell during crisis. During the two other periods of crises, however, exposures were significantly negatively related to market changes. A fall in market was associated with significant escalation in exposure. The conditional correlation however fluctuates significantly hinting towards a regime switching behaviour in the relationship (Fig. 5).

The conditional correlation between TVE and changes in REER pass through different phases (Fig. 6). The correlations were negative from 2008 to 2013. This was the period when foreign exchange market plunged in crisis, once during 2008–09 and then in 2012–13. After a period of fluctuations, the correlation has become negative once again during the recent pandemic. Thus, periods of foreign exchange market crises have always been characterized by increases in exposure. The nature of change in exposure in response to changes in stock market and foreign exchange market, however, may be better understood in terms of the Markov switching model. And, that is where we move next.

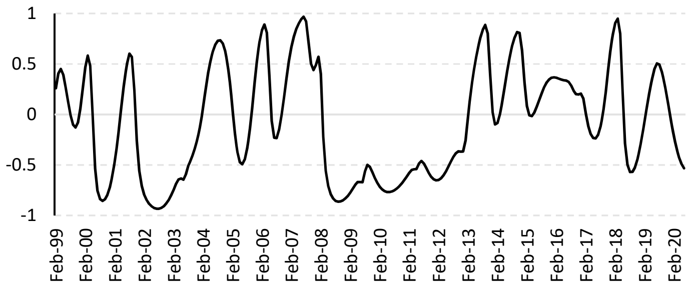

Fig. 6 Conditional correlation between TVE and *R*(REER). *Source* Author's own computation

4.3 Regime Switching Behaviour in Time-Varying Exposure

The estimation results for a two-period Markov switching model are shown in Table 2. The variances in time-varying exposure are assumed to vary over regimes. This is a sensible assumption given the volatile nature of exposure over time (Fig. 3). While TVE is taken as the dependent variable, the constant term varies over regimes. The

Table 2 Results of Markov switching regression

Dependent variable: time-varying exposure			
Regime switching variables			
	Regime 1	Regime 2	
Constant	0.19 *	0.30 *	
Log(σ)	−2.33 *	−0.54 *	
Common variables			
TVE(-1)	0.86 *		
TVE(-2)	0.13 *		
TVE(-3)	0.07 *		
Parameters of transition matrix			
P_{11}-constant	0.9 *		
P_{21}-constant	−0.19		
Mean dep variance	1.21	S.D. dep variance	0.63
Standard error of regression	0.38	Sum squared residual	35.52
Durbin–Watson statistic	1.97	Log-likelihood	−27.74
Akaike information criterion	0.29	Schwarz criterion	0.41
HQ criterion	0.34	Observations	254

[#] Convergence achieved after 21 observations
* implies significance at 1% level
Author's own computation

lagged values of TVE up to three lags are taken as non-switching regressor. The model is chosen on the basis of minimum AIC criterion.

The first regime is characterized by low average exposure with low variability. The standard deviation stands at 0.09. The second regime is a high exposure one with higher variability. The standard deviation is at 0.58. The lagged values of TVE are all significant. Therefore, past values of exposure affect the current exposures significantly. The effect, however, dwindles over time. The constant Markov probabilities are given in Table 3. If initially the market is in low-exposure regime, then it will remain there with seventy-one per cent chance. In only twenty-nine per cent cases would it move into a high-exposure regime. However, starting from a high-exposure regime, there is a higher chance of the situation to persist. In only 45% cases, the market would enter a low-exposure regime.

Figure 7 plots the probability of remaining in the high-exposure regime against the cycle in the stock market. The falling markets are always associated with a higher probability of experiencing a higher exposure. This has been true during all the three crises that the study has considered.

Figure 8 plots the probability of remaining in the high-exposure regime against the cycle in the foreign exchange market. The probability of the stock market to remain in the high-risk regime increased during the periods when the REER fell and Indian currency appreciated. Such sharp appreciations were witnessed in 2001–03, in 2008–09, in 2012–13 and once again during the recent pandemic. Other phases of

Table 3 Constant Markov probabilities

		Phase 1	Phase 2
All periods	Phase 1	0.71	0.29
	Phase 2	0.45	0.55

Probability $[i, j]$ = Probability $[(s(t)$ is in j, given that $s(t-1)$ is in $i)$ [i denotes row, while j denotes column]
Observations: 254

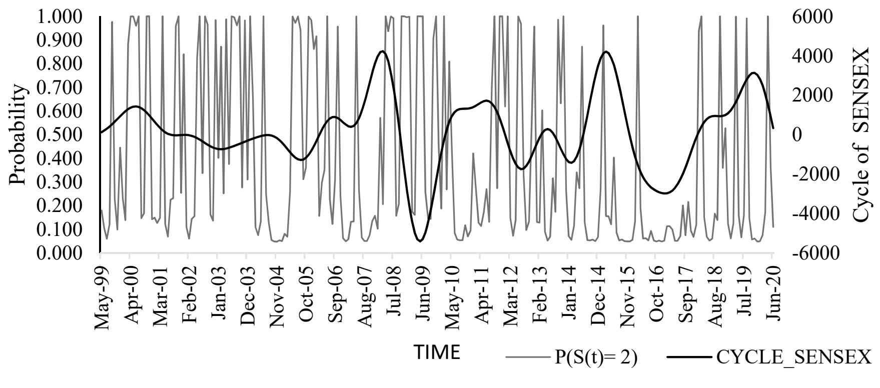

Fig. 7 Cycle in SENSEX and probability of TVE to remain in high regime. *Source* Author's own computation

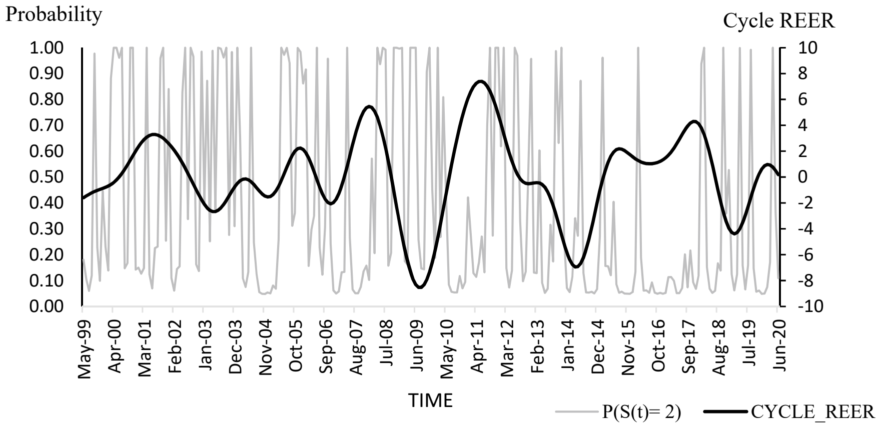

Fig. 8 Cycle in foreign exchange market and probability of TVE to remain in high regime. *Source* Author's own computation

appreciation experienced a similar hike in probabilities of being in a high-exposure state.

Thus, there is a clear indication that exposure of Indian stock market passes through different regimes and the probabilities being in a high-exposure regime depend crucially on the phases in the foreign exchange market and stock market itself. The Markov switching model, however, cannot reveal the nature of such relationship to its full extent. We, for example, could not find out how the movements in one market could affect the transaction exposure and how do such relationships vary over different regimes in market. To explore such issues, the study makes use of the threshold regression models.

4.4 *Time-Varying Exposure and the Markets*

4.4.1 Time-Varying Exposure and the Stock Market

The TVE is regressed on threshold varying variables, namely (i) lagged values of TVE and (ii) current and lagged values of SENSEX return. The thresholds are assumed to be determined in terms of current and lagged values of SENSEX return. The best fit model is chosen on the basis of minimum AIC criterion. The thresholds are selected on the basis of Bai–Perron tests of *1* to *M* globally determined thresholds. The threshold variable is the first lag of SENSEX return that defines only two regimes. The first regime is associated with extremely negative values of return. This regime therefore describes periods of crisis in Indian stock market. The estimation results show that in regime 1, as the market plunges into crisis, TVE increases significantly. However, the impact is felt with a lag of one period. Regime 2 is associated with negative as well as positive returns. Stock market movements, in this phase, have no impact on the time-varying exposures. Thus, it is only the crisis periods that have significant impacts on exposure. The exposure itself however is persistent. Higher values of exposure in a month lead to escalation in risk in the following months (Table 4).

Table 4 Discrete threshold regression estimation (specification 1)

Dependent variable TVE	Regime 1		Regime 2
Threshold variable *R*(SENSEX(-1))	<−0.05		≥−0.05
Observations	38		217
Threshold varying regressors	Coefficient		
Constant	−0.80 *		0.25 *
R(SENSEX)	−0.30		0.14
R(SENSEX)(−1)	−9.46 *		0.27
R(SENSEX)(−2)	0.85		0.32
TVE(−1)	0.54 *		0.87 *
TVE(−2)	0.49 *		0.11 **
R-squared	0.75		
Adjusted *R*-squared	0.74		
Standard error of regression	0.33		
Sum squared residual	25.81		
Log-likelihood	-69.78		
F-statistic	66.30*		
Mean dep variance	1.22		
S.D. dep variance	0.64		
Akaike information criterion	0.64		
HQ criterion	0.81		
Schwarz criterion	0.71		
Durbin–Watson statistic	1.97		
Residual tests			
Breusch–Godfrey serial correlation LM test	*F*-statistic	1.26	
	R-squared	38.81	
Heteroskedasticity test: ARCH	*F*-statistic	0.25	
	R-squared	0.25	

Source Author's own computation
*, **, *** imply significance at 1, 5, 10% level
Threshold variables considered:
R(SENSEX) *R*(SENSEX)(−1) *R*(SENSEX)(−2) R(SENSEX)(−3)
HAC standard errors and covariance (Bartlett kernel, Newey–West fixed bandwidth)
Allow heterogeneous error distributions across breaks

4.4.2 Time-Varying Exposure and the Foreign Exchange Market

The TVE is regressed on threshold varying variables, namely (i) lagged values of TVE and (ii) current and lagged values of changes in REER. The thresholds are assumed to be determined in terms of current and lagged values of REER changes. The best fit model is chosen on the basis of minimum AIC criterion. The thresholds are selected on the basis of Bai–Perron tests of *1* to *M* globally determined thresholds. There are five break points implying the presence of six regimes in the foreign exchange market. The first two regimes show negative and low values in proportionate changes in REER. A negative proportionate change implies a fall in REER or appreciation of the Indian currency. In regime 1, when Indian currency appreciates sharply, exposure escalates in response to such changes in REER with lag. A unit increase in appreciation in tth month enhances exposure by 14.36 units in $(t + 1)$th month and by 10.71 units in $(t + 2)$th month. Other lags are insignificant and hence have not been included in the model. Indian currency continues to appreciate in regime 2, but the extent of appreciation is less than the previous regime. Exposure increases with further appreciation with a lag of one month. The escalation, however, is less than what it was in regime 1. Appreciation of domestic currency pushes an economy in a disadvantageous position in international market. This has been particularly true during the periods of crises that the study has considered. The third regime is characterized by mild appreciations and depreciations in currency. This characterizes normal movements in the market, and the exposure is not at all affected by such movements. Similar situations prevail in regime 4 when Indian currency depreciates, but only mildly. In regime 5, which is a moderate depreciation regime, increased depreciation reduces exposure. However, although depreciating currencies render competitiveness and reduce risks, there is a limit. Continuous depreciation would ultimately increase exposure, and this is what is seen in the sixth regime (Table 5).

5 Conclusion

The chapter attempts to make the currency exposure of the Indian stock market vary over time to understand the nature and dynamics of market risk for investors. Given the adversity of the effects of the financial market crises, such an analysis of exposure seems relevant. The currency exposures are found to be significantly volatile and to vary across regimes in financial market. Moreover, the exposure is found to be quite persistent in nature. A low-exposure regime is most likely to be followed by a low-exposure regime. This, however, is not enough to comfort the risk-averse investors. The high-exposure regime has a higher chance to enter another high-exposure regime. Thus, risks continue to escalate once the market enters a high-risk regime. The study attempts further to locate the channels through which such risk might escalate. The crises in the stock market have always affected the exposure. The periods of dot-com bubble, the financial meltdown of 2007–08 and the recent pandemic situation have all witnessed significant increases in currency risk of Indian stock market. The

Table 5 Discrete threshold regression estimation (specification 2)

Dependent variable TVE	Regime 1	Regime 2	Regime 3	Regime 4	Regime 5	Regime 6
Threshold variable *R*(REER)	<−0.01	≥−0.011 and <−0.005	≥−0.005 and <0.0009	≥0.0009 and <0.007	≥0.007 and <0.014	≥0.014
Observations	46	39	47	39	38	46
Threshold varying regressors	Coefficient					
Constant	0.08	0.01	0.07	0.10	0.79	0.09
R(REER)	−7.11	−20.28	−38.14	14.27	−51.00	6.22
R(REER)(−1)	−14.36 *	−8.19 *	3.54	1.13	−28.40 *	9.24 *
R(REER)(−2)	−10.71 **	−2.36	2.58	−4.81	−4.63	−4.83
TVE(−1)	0.76 *	0.80 *	0.81 *	0.92 *	0.89 *	0.76 *
R-squared		0.78	Mean dep variance			1.22
Adjusted R-squared		0.75	S.D. dep variance			0.64
Standard error of regression		0.32	Akaike information criterion			0.67
Sum squared residual		23.09	HQ criterion			0.84
Log-likelihood		−55.61	Schwarz criterion			1.09
F-statistic		26.93 *	Durbin–Watson statistic			1.99
Residual tests						
Breusch–Godfrey serial correlation LM test		F-statistic	1.16			
		Obs*R-squared	48.84			
Heteroskedasticity test: ARCH		F-statistic	0.23			
		Obs*R-squared	0.23			

Source Author's own computation
*, **, *** implies significance at 1, 5, 10% level
Threshold variables considered:
R(REER) *R*(REER)(−1) *R*(REER)(−2)
HAC standard errors and covariance (Bartlett kernel, Newey–West fixed bandwidth)
Allow heterogeneous error distributions across breaks

periods of currency appreciation have also been associated with significant increases in exposure. Appreciation of domestic currency threatens the competitive advantage of the nation concerned and leads to escalated currency risk. This is particularly true during the periods of foreign exchange market crises. This brings about a point of concern for the risk-averse investors who seek to hedge against the non-diversifiable market risk. Currency exposure adds to non-idiosyncratic risks of investment. And, the nature of its movements, as is revealed by the study, suggests that risks would increase significantly and persist particularly during the periods of crisis.

Impact of the foreign exchange market on currency exposure is perhaps more alarming. Appreciation of currencies may not always be associated with crises; rather, such movements might be geared, albeit indirectly, by government policies. Thus, even a tranquil period may be associated with significant and persistent escalation in currency exposure. The impact of the stock market, however, is not that unpredictable. Fluctuations in stock prices around the trend are least likely to increase exposure. It escalates and persists only if the market plunges into crisis. This makes hedging difficult for investors operating globally. Challenges open up for the policy-makers, too. In the absence of any concern about the potential risk of currency appreciation, policies geared to changing money supply and interest rate would not only erode the competitiveness of the country in the international market, but affect the investors' confidence also. The recent pandemic situation is already witnessing significant increases in exposure. In fact, the exposure has reached, if not surpassed, the level that it attained during the global financial meltdown of 2007–08. This calls for adopting suitable monetary policy and providing stimulus to boost up financial markets. The IMF, in its recent blogs, has already praised central banks like the Federal Reserve for providing stimulus to help shore up financial markets, but warned that much of the economic recovery next year will depend on that ongoing support. IMF is further concerned about the current monetary policy challenges in the low interest rate environment. The central banks might find it difficult to best support the economy once they have exhausted the conventional policy space. The issues have significant bearing for an emerging market such as India.

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Measuring the Relationship Among Corporate Environmental Expenditure, Performance and Disclosure

Abhijit Roy

1 Introduction

The concept of sustainability emphasizes a fair distribution of resources between present and future generations (Gray & Milne, 2002). Majority of the studies on corporate environmental responsibility have tried to figure out the relationship between corporate environmental responsibility and economic performance of firms (Margolis & Walsh, 2003), but failed to establish a conclusive relationship due to varied outcomes (Cormier & Magnan, 2007; Hassel et al., 2005; Moneva & Cuellar, 2009). In this regard, we must mention that there is a definite measurement bias of firms' economic performance towards published financial information; i.e. economic performance is conceived through either accounting-based measures of profitability or stock market-based measures of returns. These are financial measures of firm performance which are simply not equivalent to the economic performance of firms (Zadek & Tuppen, 2000). Any social investment by the company in the form of community development or towards better labour practice and decent work or even for improvement of environmental efficiency is immediately treated as a charge against profit. That is the main limiting factor for taking financial measures to establish the relationship between corporate sustainability practices and economic performance as such investments are seen as a misappropriation of resources by managers by way of diversion from their actual claimants (Margolis & Walsh, 2003). Moreover, disclosure studies are predominately biased towards larger firms leaving fewer clues about the poor performers in the industry. In this chapter, we have tried to establish an objective relationship among environmental expenditure, performance and disclosure. The study aggregates firms that fail to attain a benchmark level of sustainability performance in the industry and thus represents the scenario at the bottom of the pyramid.

A. Roy (✉)
Dr. Bhupendra Nath Dutta Smriti Mahavidyalaya, Burdwan, West Bengal, India

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1.1 The Relation Between Environmental and Economic Performances

The central idea of sustainability in the perspective of sustainable environmental management is to move closer towards environmental–economic sustainability (Wagner, 2005). Figure 1 explains the link or the rationale behind corporate environmental performance and its impact on the economic performance. The "Type-1" curve represents the cost-concerned school of thought or traditionalists' view, where improvement of environmental performance increases costs and thus reduces profits. The strategic environmental management approach or the revisionists' view can be explained in "Type-2" or inverted U-shaped curve. It points to an optimum level of environmental performance for which the economic performance of the firm is maximum; below that level, there is a positive relation, and above that level, there is a negative relation. Wagner (2005) has further introduced the regulatory aspects in the model. If the regulatory requirement is weak and the obligatory level of environmental performance falls below the optimum level, then the firm with traditionalists' view will comply up to the level of regulatory requirements. On the other hand, firms with revisionists' view will go for voluntary performance over the regulatory requirements to attain higher-order economic benefits. Of course, in case of strict legal regime if the requirements of environmental performance fall below the optimum level then both traditionalists and revisionists will comply the obligatory performance only as any voluntary performance beyond the obligatory level is economically not viable.

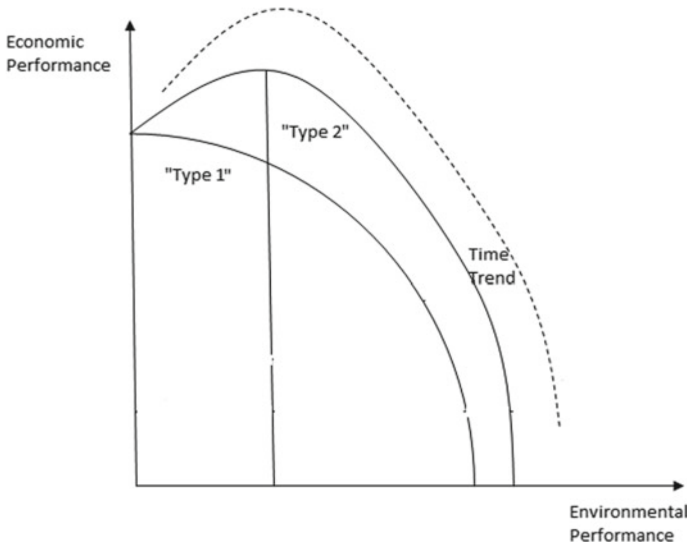

Fig. 1 Model of environmental economic sustainability. *Source* Based on Lankoski (2000), Schaltegger and Figge (2000), Wagner (2005)

Management philosophy is a key factor as to how a firm finds itself in corporate citizenship. In our model, we have introduced the disclosure with prominent importance. Disclosure, both regulatory and voluntary, is a communicative action that reduces information asymmetry. As stakeholders' engagements are getting more prominence day by day, disclosures are no more a mere regulatory requirement as there is growing demand from the stakeholders to disclose over and above the regulatory level.

Environmental performance is a material fact like emission of chemical, sulphur dioxide, nitrogen dioxide, energy input, water input and others that are measurable. We can assess disclosures of such performance with the help of certain standard guidelines like Global Reporting Initiative (GRI). In this bottom line, the key is management philosophy which decides how much cost to be incurred for environmental performance and how much of such performance to be disclosed to the stakeholders. Isolating the returns for the specific sustainability practices is difficult or may be erroneous, but we can directly assess how much costs the company has incurred for sustainability practices. A large number of earlier studies have measured the association between environmental performance, disclosures and financial performance (Margolis & Walsh, 2003) in order to address the concern whether it is economically viable to spend voluntarily for social and environmental responsibility (King & Lenox, 2001; Konar & Cohen, 2001). Studies have used measures of environmental footprints (Clarkson et al., 2006), costs incurred for environmental responsibility (Ashcroft & Smith, 2008) and level of environmental disclosures (Al-Tuwaijri et al., 2004; Cormier et al., 2005) as the proxy for corporate environmental performance. To provide an objective measurement of our model, we have used the costs incurred for environmental sustainability performance as the basis to understand whether a firm is following sustainability measures or falls short. This forms the basis of our analytical model.

2 Minimum Sufficiency Approach of Environmental Performance

Minimum sufficiency approach has been one of the major approaches to measure absolute poverty. Here, the basic needs are identified, then those are translated into the income required to satisfy those needs and that level of income becomes the poverty line. This measure gives us the incidence of poverty in a country but does not provide any clue about the intensity of poverty. The context of the present paper is corporate sustainability practices. Following the approach of the measurement of poverty, we try to measure the incidence of failure by companies to attain industry standards for sustainability. But, this is giving us an absolute measure and not a relative measure to help us understand the intensity of failures by companies to attain sustainability standards. In the present study, we have closely followed Sen's (1976) and Kakwani's

(1980) works on poverty and proposed an aggregation of incidence and intensity in our model to construct a composite index.

This approach is based on the search for the minimum level of cost that is required to be incurred to attain a certain level of sustainable environmental practices. Any environmental practice which is for compliance or a voluntary one attracts some costs, and so, obtaining the minimum level of cost which is to be incurred to attain the required level of environmental sustainability practices along with the desired level of disclosure is important. Firms spending below that threshold line should be regarded as the poor performers in sustainability practices.

To begin with, let us assume that all the companies are similar so far as their minimum standard environmental performance and disclosures are concerned. "Standard" means obligatory as well as voluntary, as determined by the norms of the industry. Suppose the standard requirements of environmental disclosures are given by the vector $\overline{\boldsymbol{\theta}}$ and the levels of environmental performance by the vector $\overline{\boldsymbol{\Phi}}$. The vector for environmental performance $\boldsymbol{\Phi}$ is converted into $\boldsymbol{\theta}$ by some matrix of management philosophy $\mathbf{P}$. That is

$$\boldsymbol{\theta} = \mathbf{P}\,.\,\boldsymbol{\Phi} \tag{1}$$

Under the minimum sufficiency approach, we do not impose $\overline{\boldsymbol{\Phi}}$; rather, we keep on searching different levels of $\boldsymbol{\Phi}^{\mathbf{i}}$ which prompts the management philosophy to satisfy $\overline{\boldsymbol{\theta}}$. Then, we find the minimum cost associated with the array of $\boldsymbol{\Phi}^{\mathbf{i}}$ that meet the minimum disclosure standard of $\overline{\boldsymbol{\theta}}$. This minimum cost that meets $\overline{\boldsymbol{\theta}}$ becomes our threshold line for corporate sustainability practices. Here, we need to mention that for any level of costs (C_i) there may be n levels of $\boldsymbol{\Phi}^{\mathbf{i}}$ due to differences in efficiencies among companies. So, if we have total R levels of costs then for the whole industry there may be $R \times n$ number of different levels of environmental performances ($\boldsymbol{\Phi}$).

2.1 Standard Procedure

Suppose there are $\mathbf{C_i}$ ($i = 1, 2, \ldots, R$) levels of costs associated with actual levels of sustainable environmental performances $\boldsymbol{\Phi}$ that lead to environmental disclosure levels $\boldsymbol{\theta}$. Now, for a given level of environmental performance, disclosures may vary between companies due to difference in management philosophy around disclosure practices. We assume there are m different levels of disclosures for a given level of cost vis-à-vis environmental performance. So, if there are R levels of costs, then there will be $R \times m$ elements in the disclosure matrix for the whole industry. We know that the standard disclosure requirement of the industry is $\overline{\boldsymbol{\theta}}$. Now, for $\mathbf{C_i}$, if

$$\boldsymbol{\theta} = \mathbf{P}.\boldsymbol{\Phi}^{\mathbf{i}} \geq \overline{\boldsymbol{\theta}}, \quad \mathbf{i} = 1, \ldots, \mathbf{R} \tag{2}$$

Then, $\mathbf{C_{min}}$ out of $\mathbf{C_i}$ ($i = 1, \ldots, R$) becomes the desired minimum level of cost ($\mathbf{C}$*) of environmental practices.

So, this is the problem of finding the minimum cost at which the environmental performance satisfies the required standard level of environmental disclosure by the corporate. The actual procedure can be explained in the following way:

Cost of the firm	Environmental performance	Levels of env. disclosure
$\mathbf{C_1}$	$\mathbf{\Phi_1^1\ \Phi_2^1\ \Phi_n^1}$	$\boldsymbol{\theta_1^1\ \theta_2^1\ \theta_m^1}$
$\mathbf{C_2}$	$\mathbf{\Phi_1^2\ \Phi_2^2\ \Phi_n^2}$	$\boldsymbol{\theta_1^2\ \theta_2^2\ \theta_m^2}$
.	. . .	. . .
.	. . .	. . .
$\mathbf{C_i}$	$\mathbf{\Phi_1^i\ \Phi_2^i\ \Phi_n^i}$	$\boldsymbol{\theta_1^i\ \theta_2^i\ \theta_m^i}$
.	. . .	. . .
.	. . .	. . .
$\mathbf{C_R}$	$\mathbf{\Phi_1^R\ \Phi_2^R\ \Phi_n^R}$	$\boldsymbol{\theta_1^R\ \theta_2^R\ \theta_m^R}$

Performances may vary for same cost due to differences in efficiency of firms. Now, we choose the environmental disclosure vectors which satisfy our minimum requirement $\bar{\boldsymbol{\theta}}$ and finally choose the corresponding $\mathbf{C_i}$ as $\mathbf{C}$* which is minimum of all.

2.2 *Incidence Ratio for Companies with Poor Sustainability Practices*

Initially, it is popularly used by Charles Booth in his survey (1889–1901) to quantify the extent of poverty in London. The ratio can be defined

$$\mathbf{H_D} = \frac{\mathbf{n}}{\mathbf{N}} \tag{3}$$

Here, **N** is the total number of companies in the sector and **n** represents the number of companies that have failed to incur minimum threshold level of environmental cost and thus considered deprived of environmental sustainability. Thus, $\mathbf{H_D}$ is a simple index but fails to answer whether its sustainability spending vis-à-vis environmental performance is close to the minimum threshold line of environmental costs or far below.

2.3 Intensity Ratio of Poor Sustainability Practices

The intensity of the gap can be measured by aggregating the simple arithmetic gap (g) between the minimum threshold environmental cost and individual firm-specific environmental spending for those firms whose environmental costs fall below the threshold level of $\mathbf{C}^*$. The expression is as follows:

$$g = \sum_{i=1}^{n} \left(\mathbf{C}^* - \mathbf{C_i}\right), \quad \text{where } \mathbf{C_i} < \mathbf{C}^* \tag{4}$$

So, the average arithmetic gap is

$$\overline{g} = \frac{1}{n} \sum_{i=1}^{n} \left(\mathbf{C}^* - \mathbf{C_i}\right); \quad \text{where } \mathbf{C_i} < \mathbf{C}^* \tag{5}$$

This ratio is insensitive to the number of companies sharing this gap but surely helps to understand that companies just below the minimum threshold line contribute little to the aggregate value of sustainability performance and disclosure gap. So, it is the measure of the absolute value. In order to make it unit free, the sustainability gap can be defined as a normalized gap (I_{gn}). Under normalization, individual gaps put between 0 and 1 and it is defined as follows:

$$I_{\mathrm{gn}} = \sum_{i=1}^{n} \left[\frac{\mathbf{C}^* - \mathbf{C_i}}{\mathbf{C}^*}\right]; \quad \text{where } \mathbf{C_i} < \mathbf{C}^* \tag{6}$$

So from the measures above it is seen that $\mathbf{g}$ and $\overline{\mathbf{g}}$ are homogeneous of degree one and measure the gap in terms of money. On the other hand, I_{gn} normalizes the gap and it is homogeneous of degree zero. Now, both the features of average arithmetic gap and normalized gap can be combined to get the intensity ratio (I_D) of sustainability gap in the following way:

$$\begin{aligned} I_D &= \frac{1}{n\mathbf{C}^*} \sum_{i=1}^{n} \left(\mathbf{C}^* - \mathbf{C_i}\right) \\ &= 1 - \left(\frac{\overline{C}_D}{C^*}\right), \quad \text{for } \mathbf{C_i} < \mathbf{C}^* \end{aligned} \tag{7}$$

Here, $\overline{C}_D$ is the average cost of all firms spending below the threshold level.

2.4 Constructing General Index of Poor Corporate Sustainability

In construction of the index, we have extensively referred Sen's (1976) and Kakwani's (1980) index in their seminal works on poverty. An index of poor sustainability performers requires aggregation of individual gaps expressed in terms of the difference between actual environmental costs and the minimum threshold cost for sustainable environmental practices ($\mathbf{C}^* - \mathbf{C_i}$). We only take differences which are positive, that is, $\mathbf{C_i} < \mathbf{C}^*$. In axiomatic framework, for the construction of index the individual gaps should be arranged in some order and weights to be assigned to each of the individual gaps. The scheme of ordinal weighting is described here:

Environmental costs	$\mathbf{C}_1 \leq \mathbf{C}_2 \leq \cdots \leq \mathbf{C_i} \leq \cdots \leq \mathbf{C_n} < \mathbf{C}^*$
Gaps	$\mathbf{g}_1 \geq \mathbf{g}_2 \geq \cdots \geq \mathbf{g_i} \geq \cdots \geq \mathbf{g_n} > 0$
Weights	$\mathbf{n}(\mathbf{n}-1)\ldots(\mathbf{n}+1-\mathbf{i})\ldots 1$

For the purpose of the index, we formalize this axiom as rank relative axiom denoted as R (Sen, 1981). The second axiom used for the index is the normalized absolute axiom denoted as A. Using these axioms, we formulate the index of poor sustainability performers ($\mathbf{D_s}$) as the normalized weighted aggregate of the positive gaps of actual environmental costs and the cost on minimum threshold line:

$$\mathbf{D_s} = \mathbf{A}\sum_{\mathbf{i}=1}^{\mathbf{n}} \mathbf{g_i}\,\mathbf{v_i} \tag{8}$$

where $\mathbf{v_i}$ is the weight on the individual environmental expenditure gaps of firms and $\mathbf{A}$ is normalized parameter which is dependent on the number of firms $\mathbf{n}$ that are deprived of sustainability. The total size of the population (no. of firms in the sector) is $\mathbf{N}$, and minimum threshold level of environmental costs incurred on environmental performances that is translated into minimum required level of disclosure is $\mathbf{C}^*$.

2.4.1 Ranked Relative Axiom (*R*) for Sustainability Gap

The weighted ordinal ranks ($\mathbf{v_i}$) as discussed above are equal to the ranks of individual firm's environmental expenditure among the firms that fail to attain minimum sustainability requirements. So,

$$\mathbf{v_i} = \mathbf{r}(\mathbf{i}) \tag{9}$$

where $r(i)$ denotes the rank of environmental expenditure of ith firm. So as explained earlier, in a non-decreasing order of arrangement of the firms' environmental expenditures, $\mathbf{v_i}$ can be stated as

$$\mathbf{v_i} = \mathbf{n} + \mathbf{1} - \mathbf{i} \tag{10}$$

2.4.2 Normalized Absolute Axiom (A) for Sustainability Gap

If all the firms have equal environmental costs C^*, then the individual as well as the total deprivation will be zero. Then, the total costs of all the firms in the sector would have been NC^*. If the aggregate environmental expenditure gap expressed in Eq. 4 is normalized by the amount NC^*, then we get

$$\begin{aligned}\overline{D}_S &= \frac{1}{NC^*}\sum_{i=1}^{n}(\mathbf{C}^* - \mathbf{C_i}) \\ &= \frac{n}{N}\left[1 - \frac{\overline{\mathbf{C_D}}}{\mathbf{C}^*}\right]; \quad \text{for } \mathbf{C_i} < C^* \\ &= \mathbf{H_D}\cdot\mathbf{I_D}\end{aligned} \tag{11}$$

So when the deprivation defined in terms of arithmetic gap is $(\mathbf{C}^* - \mathbf{C_i})$, then normalization parameter $\mathbf{A}$ is $1/\mathbf{NC}^*$.

Here, $\overline{D}_s$ indicates a specific value. We can further simplify $\overline{D}_s$ as

$$\begin{aligned}\overline{D}_s = H_D ID &= \frac{n}{N}\left[1 - \frac{\overline{\mathbf{C_D}}}{\mathbf{C}^*}\right] \\ &= \frac{n}{N}\left[\frac{\mathbf{C}^* - \overline{\mathbf{C_D}}}{\mathbf{C}^*}\right] \\ &= \frac{n}{N}\left(\frac{\overline{g}}{\mathbf{C}^*}\right)\end{aligned} \tag{12}$$

So under the axiom A, expressed in Eqs. 11 and 12, for $g_i = \overline{g}$, and thus for $i = 1, 2, \ldots, n$, we can write that

$$\begin{aligned}\overline{D}_s &= \frac{n}{N}\left(\frac{\overline{g}}{\mathbf{C}^*}\right) = \frac{1}{\mathbf{NC}^*}\sum_{i=1}^{n}(\mathbf{C}^* - \mathbf{C_i}) = \frac{1}{\mathbf{NC}^*}(1\overline{g} + 2\overline{g} + \cdots + n\overline{g}) \\ &= \frac{1}{\mathbf{NC}^*}\overline{g}(1 + 2 + \cdots + n) = \frac{1}{\mathbf{NC}^*}\overline{g}\frac{n(n+1)}{2}\end{aligned}$$

This implies that

$$\frac{n}{N}\left(\frac{\overline{g}}{\mathbf{C}^*}\right) = \frac{1}{\mathbf{NC}^*}\overline{g}\frac{n(n+1)}{2}$$

We know that the axiomatic normalization parameter A is $1/\mathbf{NC^*}$. So,

$$\frac{n}{N}\left(\frac{\overline{g}}{\mathbf{C}^*}\right) = \mathbf{A}\overline{g}\frac{n(n+1)}{2} \tag{13}$$

Simplifying this, we get

$$\mathbf{A} = \frac{2}{\mathbf{N}(\mathbf{n}+1)\mathbf{C}^*} \tag{14}$$

2.5 Generalization of Poor Sustainability Performance Index

Now using the axioms **R** and **A**, the deprivation of environmental sustainability index of the firm is

$$\mathbf{D_s} = A\sum_{i=1}^{n} g_i\, v_i$$

and can be written in generalized form as

$$\mathbf{D_s} = \frac{2}{\mathbf{N}(\mathbf{n}+1)\mathbf{C}^*}\sum_{i=1}^{n}\left(\mathbf{C}^* - \mathbf{C_i}\right)(\mathbf{n}+1-\mathbf{i})$$

The index may be taken as a sectoral one as the minimum disclosure requirement varies in different sectors and so there will be varying minimum threshold cost C^*.

3 Application of the Index

Now, we wish to apply our model on a data set to find out the extent of sustainability disclosure gap between good performers and bad performers and whether this gap is reducing or increasing over the period. As mentioned, the index of poor sustainability performance and disclosures is essentially a sectoral index. For the present application, we have considered companies from cement industry and information technology-enabled services industry (a polluting and non-polluting industry, respectively). Sustainability practices are more prominent in larger companies. So, we have considered sufficient number of large companies from each sector as the representative sample for the respective industries. We have set a cut-off level of environmental disclosure which is regarded as the basic level of disclosure that the companies in a specific industry should attain.

In our model, we have shown that $\boldsymbol{\theta} = \mathbf{P} \,.\, \boldsymbol{\Phi}$ where $\overline{\boldsymbol{\Phi}}$ is the vector of environmental performance is converted into $\overline{\boldsymbol{\theta}}$, vector of environmental disclosures, following certain management philosophy **P**. Environmental performance is again dependent on the costs incurred by firm to attain such levels of environmental performances. The minimum cost incurred to attain a desired level of environmental performance is taken as the threshold. Firms that incur less than the threshold level of costs are regarded as the poor performers of sustainability practices. Here, we mention that we could not find reliable and consistent data for environmental expenditures of companies. So, due to the unavailability of the cost data cost-based threshold level could not be applied, and therefore, we estimated a disclosure-based threshold level for our sample. As our analysis is based on the premise that management communicates the environmental performance through disclosures, so both environmental performance and disclosures may be considered as good proxies for corporate environmental performance.

The second issue that we have to address here is the benchmark level of disclosures for the respective sectors. There can be statistical measurements and stakeholder' opinion-based measurements. This application is just to see how the model works with real disclosure dataset. So, we have used the median value of the sample as the benchmark level of disclosure. Ideally, the benchmark should be decided by engaging the experts and the stakeholders. For the purpose of this application, we have selected companies from cement industry in India being categorized as highly polluting (red category) according to the Ministry of Environment and Forest, Government of India. The second sets of companies are taken from apparently less-polluting sector information technology-enabled services (ITES). Considering data consistency, we have taken top 26 companies from the polluting sector (cement industry) and top 29 companies from the non-polluting sector (ITES industry) on the basis of their market capitalization. The study period was chosen to be 2012–13 to 2016–17, that is, five years. The data are compiled from the published annual reports and sustainability reports of sample companies. As the environmental disclosure score becomes the basis for the index construction in the absence of cost data, we consider this as the key variable. For the purpose of measurement, we have used content analysis methodology applied on the print-based published documents of the sample companies (Al-Tuwaijri et al., 2004). For the purpose of content analysis, an environmental disclosure grid is prepared closely following 4th generation (G4) guidelines of environmental reporting as laid down by Global Reporting Initiative (GRI). The disclosure grid covers area like corporate environmental strategy and analysis, external assurance, governance and engagements, regulatory aspects, risk aspects and environmental performance indicators. In the disclosure grid, the weightage of environmental performance indicators is highest with possible score of 33 out of total possible score of 60. The detailed disclosure grid used in the content analysis is shown in Annexure 1.

The calculation of the index is reported in Annexures 2 and 3. While calculating median, we have taken all the sample companies in a sector for full five years. That means if there are 30 companies in any sector for which 5 years' data are taken, then the data points considered for the calculation of median are 150. Following this way, we have considered 130 firm years for cement industry and 145 firm years for ITES industry for the calculation of sector-specific median values. Sector-specific disclosure benchmarks are necessary as the disclosure practices differ across sectors.

For cement industry, the cut-off or the benchmark environmental disclosure stands at 16.5, and for ITES sector it is 16. As our study takes into consideration the top 26 and 29 market capitalization companies from cement and ITES, respectively, so it covers the majority market share in the respective sectors. We could not include all the companies in the sectors as in that matter median would not have been regarded as an acceptable benchmark for threshold level of disclosures; rather, stakeholders and experts should be engaged in deciding the acceptable sector-specific cut-offs which is beyond the scope of the present study.

The tables in the Annexure 2 and 3 show the calculation for the construction of the index of poor sustainability performance and disclosures for the firms that fall below the industry-specific median level of disclosures in cement industry and in IT& ES industry, respectively. The index is calculated for each year separately. The index reports the state of the companies' sustainability performance at the aggregate level for any sector. Over the study period, both the incidence and the intensity of the companies falling below the industry threshold level of disclosures are reducing steadily in both polluting and non-polluting sectors. It clearly indicates the growing awareness and maturity of Indian corporate sector regarding environmental sustainability practices. Figures 2 and 3 show the movement of the index of poor sustainability performance over the period of our study for the two industries.

The figures report that at the aggregate level both polluting and non-polluting sectors are doing well in terms of environmental performances and disclosures. These results are strictly indicative but leave a scope for extensive application of the index in wider contexts to draw definite inferences.

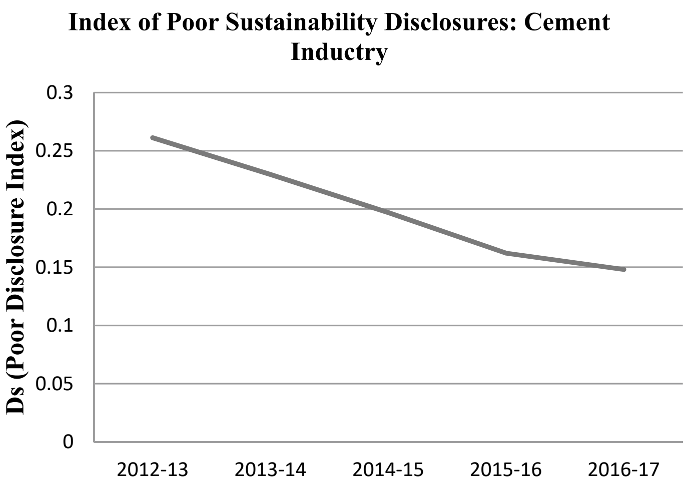

Fig. 2 Index of poor sustainability disclosures in cement industry. *Source* Author's computation

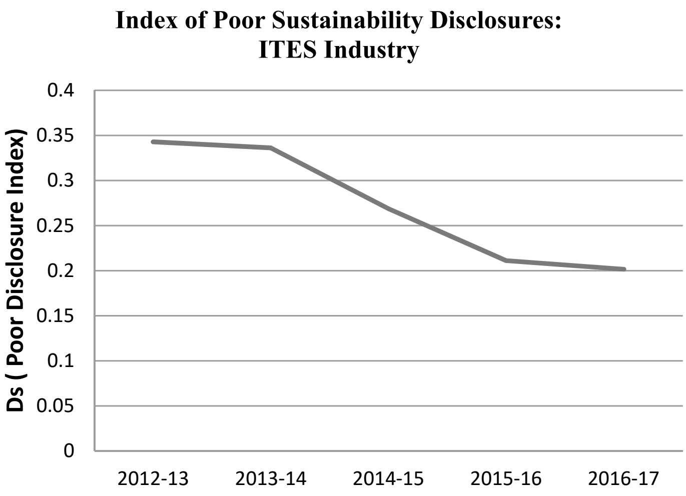

Fig. 3 Index of poor sustainability disclosures in ITES industry. *Source* Author's computation

4 Conclusion

The index as well as the functional relationship used in the index construction process is based on some axioms which are by no means unquestionable, and it can be improved by experiments. In the entire discussion, the underlying theme has been to attain minimum sustainability requirements backed by environmental spending. Here, the minimum sustainability performance does not mean the obligatory aspects only, but it means the industry requirements of environmental performances that are determined by the stakeholders. The minimum cost threshold line points to the economic efficiency of the firm in achieving required level of sustainability practices. The index should be sector specific as the standards or the minimum requirements for sustainability practices differ among sectors. The index presents a macro-view of firms that fail to attend a minimum level of sustainability performance and disclosures in comparison with its' peers within the sector. The management of an individual firm may compare their own environmental costs vis-a-vis performances and disclosures with the minimum industry threshold cost and minimum disclosure requirements. Larger firms with large number of stakeholders always draw more attention in terms of their environmental performance and disclosures but may not be a true representative of the sector. In this context, the index is able to report the overall performance of the sector over the period of time as it considers the laggards in the sector only. Finally, to use the index reliably we should test it in different sectors and in different country contexts.

Annexure 1

Environmental disclosure grid.

Sl. no.	Items	Scale of scoring	Map to GRI
(A)	**Strategy and analysis (maximum score 5)**	***Follow rating scale A**	
1	Declaration of environmental policy by senior decision-makers	0–1	GN 1.1
2	Disclosure of key environmental risks and impacts and the management system in place for that	0–1	GN 1.2
3	Disclosure of relevant achievements, event, awards and failures in the reporting period	0–1	GN 1.1
4	Mention of environmental goals and key challenges of the company in future (3–5 years)	0–1	GN 1.1
5	Involvement to environmental organization/association for improving environmental practices	0–1	GN 4.13
(B)	**Assurance (max score 1)**	***Follow rating scale A**	
1	Assurance and verification of corporate environmental performance are done by an independent organization	0–1	GN 3.13
(C)	**Governance, commitments and engagements (max score 3)**	***Follow rating scale A**	
1	Environmental committee is present in the board	0–1	GN 4.1
2	Conducts periodic environmental audits	0–1	GN 4.9
3	Adopts and follows environmental charters and principles that are developed externally	0–1	GN 4.12
(D)	**Law and regulation conformity (max score 6)**	****Follow rating scale B**	
1	Litigations, actual and potential fines	0–3	EN 28
2	Order to conform corrective actions	0–3	
(E)	**Expenditures and risk (max score 12)**	****Follow rating scale B**	
1	Investment on R&D and technologies to improve environmental efficiency and performance	0–3	EN 30
2	Environmental operating costs	0–3	
3	Disclosure of specific mechanism that is in place to identify environmental opportunities and risks	0–3	GN 1.2
4	Provisions for future expenditures	0–3	

(continued)

(continued)

Sl. no.	Items	Scale of scoring	Map to GRI
(F)	**Environmental performance indicators (maximum score 33)**	****Follow rating scale B**	
1	Energy consumption (direct and indirect)	0–3	EN 3,4
2	Materials usage and the proportion of recycled materials as inputs	0–3	EN 1,2
3	Amount of energy saved due to efficiency, conservation and usage of renewable energy	0–3	EN 5,6
4	Total usage of water and the efficiency of water usage	0–3	EN 8,9,10
5	Total quantity of greenhouse gas emission (direct and indirect)	0–3	EN 16,17
6	Total quantity of the reduction of greenhouse gas emission and the measures taken for the reduction	0–3	EN 18
7	Quantity of NO_x, SO_x and ozone-depleting substances generated	0–3	EN 19,20
8	Quantity of significant water, land and air discharges and spills	0–3	EN 21,23
9	Waste treatment, generation and disposal	0–3	EN 22,24,25
10	Process in place to reduce the environmental footprint of products and services	0–3	EN 26,27
11	Natural resources conservations	0–3	EN 11,12,13,14,15
Total maximum possible score is 60			

***Rating scale A**: 1 = Yes, the item is mentioned; 0 = No, the item is not mentioned

****Rating scale B**: 3 = item described in monetary or quantitative terms; 2 = item described specifically; 1 = item discussed in general

Annexure 2

Calculation of index of poor sustainability disclosures in cement industry (polluting sector) (Tables 1, 2, 3, 4 and 5).

Annexure 3

Calculation of index of poor sustainability disclosures in ITES industry (non-polluting sector) (Tables 6, 7, 8, 9 and 10).

Table 1 Index of poor sustainability disclosures in cement industry for 2012–13

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16.5	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* v_i}$
1	Burnpur Cement	9.5	14	133.0
2	Sourashtra Cement	8.5	13	110.5
3	Panyam Cement	8.5	12	102.0
4	Ramco Cement	7.5	11	82.5
5	Kakatiya Cement	7.5	10	75.0
6	Rain Industries	6.5	9	58.5
7	Deccan Cement	6.5	8	52.0
8	Barak Valley Cement	5.5	7	38.5
9	ACC	4.5	6	27.0
10	JK Lakshmi Cement	4.5	5	22.5
11	Sagar Cement	4.5	4	18.0
12	Anjani Portland Cement	4.5	3	13.5
13	NCL Industries	3.5	2	7.0
14	Gujarat Sidhee Cement	3.5	1	3.5
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i\, v_i$				743.5
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000351
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.261221

Source Author's computation

Table 2 Index of poor sustainability disclosures in cement industry for 2013–14

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16.5	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Keerthi Industries	9.5	14	133
2	Burnpur Cement	8.5	13	110.5
3	Ramco Cement	7.5	12	90
4	Kakatiya Cement	7.5	11	82.5
5	Rain Industries	6.5	10	65
6	Deccan Cement	6.5	9	58.5
7	Panyam Cement	6.5	8	52
8	Sourashtra Cement	5.5	7	38.5
9	Sagar Cement	4.5	6	27
10	Barak Valley Cement	4.5	5	22.5
11	Anjani Portland Cement	3.5	4	14
12	NCL Industries	3.5	3	10.5
13	Gujarat Sidhee Cement	2.5	2	5
14	JK Lakshmi Cement	1.5	1	1.5
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i\, v_i$				710.5
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000323
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.229657

Source Author's computation

Table 3 Index of poor sustainability disclosures in cement industry for 2014–15

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16.5	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Keerthi Industries	9.5	13	123.50
2	Ramco Cement	7.5	12	90.00
3	Burnpur Cement	7.5	11	82.50
4	Rain Industries	6.5	10	65.00
5	Kakatiya Cement	6.5	9	58.50
6	Sagar Cement	5.5	8	44.00
7	Deccan Cement	5.5	7	38.50
8	Panyam Cement	5.5	6	33.00
9	Sourashtra Cement	4.5	5	22.50
10	Barak Valley Cement	4.5	4	18.00
11	Anjani Portland Cement	3.5	3	10.50
12	NCL Industries	2.5	2	5.00
13	JK Lakshmi Cement	0.5	1	0.50
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i v_i$				591.50
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.00
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.19697

Source Author's computation

Table 4 Index of poor sustainability disclosures in cement industry for 2015–16

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16.5	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Keerthi Industries	8.5	11	93.50
2	Ramco Cement	7.5	10	75.00
3	Rain Industries	6.5	9	58.50
4	Burnpur Cement	6.5	8	52.00
5	Sagar Cement	5.5	7	38.50
6	Kakatiya Cement	5.5	6	33.00
7	Panyam Cement	5.5	5	27.50
8	Deccan Cement	4.5	4	18.00
9	Sourashtra Cement	4.5	3	13.50
10	Barak Valley Cement	3.5	2	7.00
11	NCL Industries	0.5	1	0.50
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i v_i$				417.00
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.00039
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.16200

Source Author's computation

Table 5 Index of poor sustainability disclosures in cement industry for 2016–17

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16.5	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Keerthi Industries	7.5	11	82.50
2	The Ramco Cement	6.5	10	65.00
3	Rain Industries	6.5	9	58.50
4	Burnpur Cement	6.5	8	52.00
5	Sagar Cement	5.5	7	38.50
6	Kakatiya Cement	5.5	6	33.00
7	Panyam Cements	4.5	5	22.50
8	Saurashtra Cement	3.5	4	14.00
9	Barak Valley Cement	3.5	3	10.50
10	Deccan Cement	1.5	2	3.00
11	NCL Industries	1.5	1	1.50
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i v_i$				381.00
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.00039
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.148019

Source Author's computation

Table 6 Index of poor sustainability disclosures in ITES industry for 2012–13

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^*}\,\mathrm{V_i}$
1	Rolta India	12	16	192
2	Hinduja Venture	12	15	180
3	NIIT Technologies	10	14	140
4	AGC Networks	10	13	130
5	Blue Star Infotech	10	12	120
6	Zensar Technologies	9	11	99
7	Financial Technologies	9	10	90
8	Saksoft	9	9	81
9	Tata Elxsi	8	8	64
10	Mastek	7	7	49
11	3i Infotech	7	6	42
12	Hinduja Global Solutions	6	5	30
13	Ramco Systems	5	4	20
14	Mindteck	5	3	15
15	Mphasis	3	2	6
16	Oracle Financial Services	1	1	1
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i\, v_i$				1259
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000272

(continued)

Table 6 (continued)

Sl. no.	Company	Gap $(\mathbf{C^*} - \mathbf{C_i})$ Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^*}\, V_i$
$\mathbf{D_s}$: Index of poor sustainability disclosure				0.342865

Source Author's computation

Table 7 Index of poor sustainability disclosures in ITES industry for 2013–14

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Infinite Computer Solutions	13	16	208
2	Rolta India	12	15	180
3	Hinduja Venture	12	14	168
4	AGC Networks	10	13	130
5	Blue Star Infotech	10	12	120
6	NIIT Technologies	9	11	99
7	Saksoft	9	10	90
8	Financial Technologies	8	9	72
9	Tata Elxsi	7	8	56
10	Zensar Technologies	7	7	49
11	Mastek	7	6	42
12	3i Infotech	7	5	35
13	Hinduja Global Solutions	4	4	16
14	Ramco Systems	3	3	9
15	Mphasis	2	2	4
16	Mindteck	2	1	2
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i\, v_i$				1280
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000263

(continued)

Table 7 (continued)

Sl. no.	Company	Gap $(\mathbf{C}^* - \mathbf{C_i})$ Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
D_S: Index of poor sustainability disclosure				0.336134

Source Author's computation

Table 8 Index of poor sustainability disclosures in ITES industry for 2014–15

Sl. no.	Company	Gap $(\mathbf{C^* - C_i})$ Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Infinite Computer Solutions	12	14	168
2	Hinduja Venture	12	13	156
3	Rolta India	11	12	132
4	AGC Networks	9	11	99
5	Blue Star Infotech	9	10	90
6	Financial Technologies	8	9	72
7	Saksoft	8	8	64
8	NIIT Technologies	7	7	49
9	Zensar Technologies	6	6	36
10	3i Infotech	6	5	30
11	Tata Elxsi	5	4	20
12	Hinduja Global Solutions	4	3	12
13	Mastek	3	2	6
14	Ramco Systems	1	1	1
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i v_i$				935
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000287
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.268678

Source Author's computation

Table 9 Index of poor sustainability disclosures in ITES industry for 2015–16

Sl. no.	Company	Gap $(\mathbf{C^*} - \mathbf{C_i})$ Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Infinite Computer Solutions	11	12	132
2	Hinduja Venture	11	11	121
3	Rolta India	10	10	100
4	AGC Networks	8	9	72
5	Financial Technologies	7	8	56
6	Saksoft	7	7	49
7	Blue Star Infotech	6	6	36
8	Zensar Technologies	5	5	25
9	NIIT Technologies	5	4	20
10	3i Infotech	5	3	15
11	Tata Elxsi	4	2	8
12	Hinduja Global Solutions	3	1	3
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i v_i$				637
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000332
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.211207

Source Author's computation

Table 10 Index of poor sustainability disclosures in ITES industry for 2016–17

Sl. no.	Company	Gap ($\mathbf{C^* - C_i}$) Cut-off = 16	$\mathbf{V_i = n + 1 - i}$	$\mathbf{g_i^* V_i}$
1	Infinite Computer Solutions	11	12	132
2	Hinduja Ventures	11	11	121
3	Rolta India	9	10	90
4	AGC Networks	8	9	72
5	Saksoft	7	8	56
6	Financial Technologies	6	7	42
7	Zensar Technologies	5	6	30
8	3i Infotech	5	5	25
9	Blue Star Infotech	5	4	20
10	NIIT Technologies	4	3	12
11	Tata Elxsi	3	2	6
12	Hinduja Global Solutions	2	1	2
Weighted average of sustainability disclosure gap: $\sum_{i=1}^{n} g_i\, v_i$				608
A: $\frac{2}{\mathbf{N(n+1)C^*}}$				0.000332
$\mathbf{D_s}$: **Index of poor sustainability disclosure**				0.201592

Source Author's computation

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Assessing the Impact of COVID-19 on Interactions Among Stock, Gold and Oil Prices in India

Paramita Mukherjee and Samaresh Bardhan

1 Introduction

The interaction within financial markets, especially between stock and commodity markets, has drawn a lot of attention among economists, policymakers and investors alike during the last two decades. There is growing evidence that there is a linkage between commodity and equity markets and that the correlations between the two markets have increased since the beginning of the decade of 2000 (Buyukşahin et al., 2008; Olson et al., 2014; Tang & Xiong, 2012). It is also argued that financial markets such as equity and bond markets offer useful information about the behaviour of commodity markets where stock price indices showed evidence of predictions for commodity price indices (Chen et al., 2010). Gorton and Rouwenhorst (2006) argued that before 2000, commodity markets were functioning in silos and rather segmented majorly from the financial markets as well as from one another. Prior to the early 2000s, in commodity markets, prices included a risk premium (for idiosyncratic risk pertaining to commodity price) and hardly showed evidence of co-movement with stocks and with each other. However, given the fact that investment in commodity markets has considerably increased with significant flow of index investment in such markets, commodity and financial markets have become more integrated and less segmented (Tang & Xiong, 2012). Since index investors are concerned typically with strategic portfolio allocation between assets like equities and bonds and commodity,

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P. Mukherjee (✉)
School of Commerce, Narsee Monjee Institute of Management Studies, Hyderabad, India

S. Bardhan
Department of Humanities and Social Sciences, Indian Institute of Technology Ropar, Rupnagar, India
e-mail: samaresh@iitrpr.ac.in

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they simultaneously tend to trade in and trade out of all commodities in a given index. An estimate of the U.S. Commodity Futures Trading Commission (CFTC 2008) reveals that there has been an increase in the estimated investment in commodity indices (and related instruments)—from \$15 billion to \$200 billion dollars during 2003 and mid-2008. This particular feature indicates less segmentation between the two markets and suggests the possibility of spillover effects from equity to commodity markets (Rossi, 2012; Tang & Xiong, 2012).

Against this background, the motivations for this chapter are drawn from a number of factors. **First**, in commodity markets, commodities are traded both as a financial instrument and as raw materials used in the production of final commodities. In the recent past, investors consider commodity markets as financial assets (see, e.g. Mensi et al., 2013; Reboredo & Uddin, 2016; Vivian & Wohar, 2012). Commodity markets are also viewed as part of a portfolio diversification strategy and also hedge against inflation (Arezki et al., 2014; Creti et al., 2013; Tadesse et al., 2014; Tang & Xiong, 2012). Spillover effects from commodity markets to the stock markets are generated by a greater investor presence in the commodity markets. Moreover, increased return correlation with oil led to higher volatility, at least partially, in individual commodities, especially indexed commodities. **Second**, commodity prices appear to be important given that these affect the general price level in the economy. For example, price of gold receives considerable attention of monetary authorities since it increases as people view gold as a hedge against expected inflation and so switch from currency to gold. Similarly, fluctuation in price of crude oil is thought to have a significant influence on economic growth and several other macroeconomic variables such as inflation, investment and output.[1] **Third**, commodity prices play an important role in the financial markets. For instance, market participants as well as policy-makers focus on the dynamics of the volatility of commodity prices as it may significantly affect economic growth as well as financial development (Cevik & Saadi Sedik, 2014). Increase in commodity prices, in general, follows from an increase in demand and expansion of economic activities (Kilian, 2009). With the increased cost of production following an increase in prices of commodities such as crude oil, gold and silver, used as inputs in production, firms' profit is also adversely affected (Lombardi & Ravazzolo, 2016). This, in turn, is likely to adversely affect stock prices.

Fourth, there is a general agreement that the recent global pandemic, COVID-19, which started in Wuhan, China, in December 2019, led to serious disruptions in global financial and economic systems and the governments as well as businesses had to react (Phan & Narayan, 2020). Global financial markets experienced severe adverse shocks following repercussions in commodity markets, with fall in oil price in particular. Two months after the COVID-19 outbreak set in, global crude oil price significantly fell by around 30%, the largest decline since the Gulf War. This happened after the Saudi authorities unexpectedly decided to offer discounts in price to the tune

[1] A rise in oil price results in an increased energy bill of consumers and higher production cost. It also indicates the reduction of its availability as a primary input in production following rising costs, thereby implying a reduced potential output. All of these, in turn, exert adverse effect on employment, profits, investment and inflation.

of 6 to 8 dollars to their prime customers in Asia, Europe and the USA (Schneider & Domonoske, 2020; Sharif et al., 2020).[2] Financial markets have reacted with large drops, e.g. stock markets across the globe experienced significant downslide, as a consequence of the war concerning oil price and also the fears about the spread of the pandemic and patient death caused by it in France, Italy and Spain. Salisu et al. (2020) observed that in 2020 between February and March, with the spread of the COVID-19 outbreak being rapid and declared a global pandemic by World Health Organization (WHO), most of the developed equity markets experienced severe downfall. While stock prices in US market dropped by 32%, it declined by 27.9% in UK and 39.3% in Italy. Emerging market economies also had similar experiences with prices of stocks in Brazil, Russia and China falling by 40.5%, 24.2% and 10.1%, respectively. Global stock markets also experienced significant volatility during January to May 2020.

On the other hand, with the outbreak of COVID-19, gold prices globally recorded a relatively smaller decline, followed by an upside trend, commencing from the middle of March 2020 (Gharib et al., 2020). Obviously, the uncertainty surrounding the COVID-19 pandemic globally has disconcerted, to a significant extent, the dynamics of the commodity prices like crude oil and gold and made investors more risk-averse who went for safe haven assets such as gold (Gharib et al., 2020; Mensi et al., 2020). External shocks also might lead to expectations of official gold purchases, leading to an increase in the expected future price of gold. As gold and oil are the commodities traded most commonly in the derivatives markets, the entire market dynamics and movements in prices of these two commodities are supposed to have important ramifications for the financial markets during the current pandemic of COVID-19. **Finally**, we observe a large body of literature that looks into the linkages among gold price, oil price and stock price (Bedoui et al., 2019; Ewing & Malik, 2013; Narayan et al., 2010; Soytas et al., 2009; Zhang & Wei, 2010). However, the nexus between commodity markets and financial markets, in particular, is not much explored, specifically in the emerging market context like India, in the face of the recent pandemic. However, along with the rest of world, Indian markets are equally impacted, since the outbreak of COVID-19 pandemic in January 2020. We come across couple of studies, in Indian context, that examine how the pandemic impacted financial markets and their volatility. However, we hardly find any study focusing on the interrelations of commodity and equity markets following the pandemic in India.

The chapter aims to assess the impact of COVID-19 pandemic on the interaction between commodity and stock markets in the Indian context. A scrutiny of the behaviour of the linkage between these two markets, following the pandemic, seems to be crucial from the point of view of both policymakers and investors. For investors who seek to minimize their risks and eventually aim to maximize returns while diversifying their portfolio and hedging risks, such relations are likely to impart valuable guidance.

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[2] The severe collapse in oil price in international markets seems to be the outcome of an economic slowdown-induced fall in demand, generated by COVID-19 pandemic as well as unfruitful negotiations concerning the reduction of daily barrel production between Organization of the Petroleum Exporting Countries (OPEC) and Russia.

We analyse the co-movement and causality of commodity prices and stock prices. While the causality between fluctuations in oil price and equity price relates to the financialization of the commodity markets, it happened even before the outbreak of COVID-19. We hypothesize that the pandemic may exert a short-term economic impact on the commodity financial market linkage through oil price–stock linkage or through gold price–stock linkage (Gharib et al., 2020; Salisu & Isah, 2017; Salisu et al., 2019, 2020; Swaray & Salisu, 2018; Wang et al., 2013).

For this purpose, we segregate our analysis into two periods, viz. the pre-COVID-19 period and COVID-19 period. Then, a comparative analysis of the co-movement and causality of commodity and stock prices is conducted. Given the disturbances in markets created by the pandemic, one may hypothesize that the onset of the pandemic is likely to aggravate the spillover effects among the financial and commodity markets; moreover, the response of the relevant agencies (e.g. participants, regulators, etc.) to the pandemic is going to determine the nature and extent of these spillovers in the long run. For instance, generally there is a sharp rise in the volatility in financial markets and spillover across markets during crises (Diebold & Yilmaz, 2012). Therefore, analysis of the probable spillovers from shocks owing to COVID-19 is definitely going to throw light on the possible early signs of warning regarding the severity and the consequences of the crisis. Specifically, this information is helpful to investors as their objective is to maximize returns even in the presence of risks. Moreover, it is of considerable interest to assess the extent to which gold is considered as a safe haven or hedge and/or a diversifier (at the face of the volatile movements in oil price) during the COVID-19 pandemic.

This chapter makes an attempt to analyse the above issues by estimating ARDL model on daily data in the recent past for the Indian financial market. The contribution of the chapter lies not only in considering the impact of COVID-19 by comparing the relationship with pre-COVID period, but also to throw light on the linkage between Indian stock and commodity derivatives markets with the high-frequency data in the recent past. Few existing studies on this in the Indian context are either dated or have not considered such kind of assessment of a crisis on the relationship.

The organization of the rest of the chapter is as follows: a brief overview of the state of Indian stock market as well as commodity markets is given in Sect. 2. A brief survey of literature is presented in Sect. 3. Section 4 provides details on data and methodology, and Sect. 5 presents results and discussion. Section 6 concludes the chapter.

2 Indian Scenario

There has been a phenomenal growth and expansion of Indian equity market that is reflected in the substantial growth in the volume of investment, with the introduction of financial sector reforms in the decade of the 1990s. Therefore, perturbations in domestic macroeconomic factors as well as external factors are likely to affect the level and volatility of stock returns significantly. Previous studies in the Indian context reveal that Indian stock market is significantly influenced by movements in commodity markets by three important factors, viz. international price of crude oil, price of gold and exchange rates. Jain and Biswal (2016) explore the relationship between global gold price, global price of crude oil, exchange rate and the stock prices in India. Findings reveal that a fall in the value of stock price index is influenced by a fall in prices of crude oil and gold, and these relationships appeared to be more pronounced in post-global financial crisis period, 2008–2013. In this study, gold is considered as an asset class of investment.

India is the major importer of both oil and gold in international markets. India was the fourth largest among countries with regard to the consumption of crude oil and petroleum products. In terms of net imports also, it is the fourth largest country after USA, China and Japan in 2015 (US Energy Information Administration, 2016).[3] Since India is heavily dependent on imports of crude oil, to the extent of more than 80% of total consumption, any significant change in price of crude oil is likely to exert an impact on inflation and hence the equity market (Ghosh & Kanjilal, 2016). Change in oil price influences the macroeconomic fundamentals, and this affects the financial market liquidity and stock prices. Consequently, the expected earnings get impacted and this affects stock market returns (Jones et al., 2004).

Considering the supply side, increase in crude oil prices causes higher production costs, thereby adversely affecting cash flow and hence stock prices (Kapusuzoglu, 2011). This happens because of adverse impact on firms' profits. On the demand side, oil price rise may cause inflation to rise, which may further result in the increase in interest in bond market, and thereby discourage investment in the equity market (Ghosh & Kanjilal, 2016). Gold, on the other hand, is considered as a 'safe haven' to avoid risk in financial markets. Gold appeared to be a strong 'safe haven' during the 2008 global financial crisis for most of the developed countries in the USA and Europe, but not for large emerging economies such as India (Baur & McDermott, 2010).

3 Literature Survey

Studies have found that gold is considered as a safe haven as well as a hedge against other financial assets like stocks or bonds in countries like the USA, UK and Germany (Baur & Lucey, 2010; Baur & McDermott, 2010). Sadorsky (1999), in a VAR framework, studies the relationship between oil and stock prices; the model incorporated industrial production and a short-term interest rate, and findings indicate oil price and other variables are linked. Chiou and Lee (2009), based on data from 1992 to 2006, examined how daily oil prices (viz. West Texas Intermediate (WTI)) drive S&P 500 stock returns and observed that oil price fluctuations exert some influence on stock returns. In another study, Choi and Hammoudeh (2010) observed that portfolios in stock markets are explained by commodity prices, where the study incorporated

[3] https://www.eia.gov/international/overview/country/IND, accessed on 26 August 2020.

S&P 500 index and prices of WTI oil, Brent oil, gold, copper and silver. Rossi (2012) explores whether less segmentation of commodity markets led to volatility in commodity prices during the late 2000s and found that equity market is capable of predicting[4] global commodity price index. This implies that market segmentation was weak and that there might have been spillover effects in the direction from the stock market to the commodity markets during that period.

However, Bhunia (2013) observed bidirectional causality between stock price return and domestic gold price. Gokmenoglu and Fazlollahi (2015) studied the US markets during January 2013 to November 2015. The results indicate that the long-run equilibrium relationships exist and the convergence to the long-run equilibrium level of stock price index occurs through adjustments in both levels and volatilities of gold and oil price. Iscan (2015) studied the interactions between stock and commodity prices in the context of Turkish markets during 2002–2014 and hardly found any evidence of the relations between two markets. Bondia et al. (2016) studied the relationship between oil and stock prices of energy firms. By applying threshold cointegration tests for long-run relationship, authors observe that oil price and interest rates exert influence on energy stock prices.

As far as the recent literature on commodity markets–stock market nexus during the post-pandemic period is concerned, we observe few studies which scrutinize the effects of COVID-19 pandemic. Among others, Sharif et al. (2020) examine the linkage among the recent spread of the pandemic, shock in oil price volatility, the stock prices, geopolitical risk and policy uncertainty with respect to economic policies in the context of the US economy based on daily data; they unveil the unprecedented adverse impact of the pandemic coupled with the shocks in oil price on the volatility of stock market, as well as other effects, in terms of perceived risks of the US investors. Mensi et al. (2020) investigate the effects of the pandemic on oil and gold prices based on intra-day data and applying an approach called Asymmetric Multifractal Detrended Fluctuation Analysis (A-MF-DFA). The findings point to the inefficiency of both the markets, especially after the outbreak of COVID-19. Salisu et al. (2020) estimate the relationship between oil prices and equity prices during COVID-19 pandemic by applying panel vector autoregressive (pVAR) model on daily data from a cross section of 15 worst COVID-affected countries including India.[5] Findings suggest that during the pandemic, both the markets have been impacted to a greater extent, compared to the effects observed in pre-COVID period, and this is true for initial as well as prolonged impacts of both own shock and shocks from the other markets. Gharib et al. (2020) examine the causal relationship between crude oil and gold spot prices based on data for the period of January 2010 to May 2020 that incorporates post-COVID period. Findings suggest the bubbles in the two markets have a contagion effect during the recent pandemic and the contagion is bilateral. Mishra et al. (2020) estimate the effect of COVID-19 on the Indian financial market and also make a comparison of the effects with those of two other important

[4] Out-of-sample predictions.

[5] Other countries include developed and developing countries, viz. Belgium, Canada, UK, USA, Germany, Italy, France, Netherlands, Spain, Turkey, India, China, Brazil, Mexico and Russia.

and recent changes in India, viz. demonetization and implementation of Goods and Services Tax (GST), the unified tax regime. Based on the analysis of daily data for the period of January 2003 to April 2020 concerning variables like net foreign institutional investment, return on stock market and exchange rate they observe that unlike the other two events, during the pandemic stock returns were negative for all the stock indexes considered. Dev and Sengupta (2020), however, argue that accurate prediction of the extent of economic loss following COVID-19 is difficult.

Most of the existing studies discussed above focus on developed countries, and for developing countries such as India, we find very few studies that looks into the nexus between commodity markets and stock markets. This chapter's contribution to the existing literature lies in dealing with this issue in depth and with rigour, and in presenting a pre- and post-pandemic comparison of the linkages.

4 Data and Methodology

4.1 Data

In order to explore how the equity price is influenced by commodity prices and volatilities of commodity prices in the Indian context, and whether such relationship has changed during the COVID-19 pandemic, we take into account the daily data from the key stock markets of the country and the commodity derivatives market. For stock prices, two benchmark stock indices, viz. SENSEX of Bombay Stock Exchange denoted henceforth as BSE and the NIFTY 50 of National Stock Exchange denoted as NSE henceforth, are taken. Out of total turnover across all exchanges in India, more than 50% are accounted for by BSE (Ghosh & Kanjilal, 2016). We consider S&P BSE SENSEX consisting of 30 stocks of companies that are well established, listed on Bombay Stock Exchange and financially sound. SENSEX is calculated on the basis of free-float methodology of market-weighted index. Stocks of the 30 constituent companies in S&P BSE SENSEX are the largest and most actively traded stocks and represent an array of industrial sectors. Both are sourced from the respective websites of the stock exchanges. Daily closing prices of both the indices are taken in logarithmic form and denoted as LBSE and LNSE, respectively. Their returns (i.e. the difference between the logarithm of price index on consecutive days, e.g. $\text{LBSE}_t - \text{LBSE}_{t-1}$), in turn, are denoted by RBSE and RNSE, respectively.

For commodity prices, the data is sourced from the Multi Commodity Exchange of India Limited (MCX), the exchange where commodity derivatives are traded online. It is India's first listed exchange (https://www.mcxindia.com). In the previous sections, the linkage between stock market and commodities like gold and oil has been discussed. In MCX, gold and oil are among the top ten commodities traded most actively in terms of value. From MCX, per unit daily spot prices of crude oil and gold are taken.[6] Prices are taken in logarithmic form and denoted as LPCRUDE and LPGOLD, respectively.

In the empirical models, we also consider volatility of prices of crude oil and gold. The 5-day annualized actual volatility (AAV)[7] of oil and gold price as provided by MCX is taken as measures of volatility. Here as a measure of asset volatility, annualized volatility is calculated on the basis of (daily) closing prices of front month (spot month) future contract.[8] Since this is measured as the standard deviation of spot prices, it is taken in raw form and the volatilities are denoted as VOLCRUDE and VOLGOLD, respectively. The regulatory framework under which both stock exchanges (BSE and NSE) and commodity exchange (MCX) operate is decided by the Securities and Exchange Board of India (SEBI).

The daily data is taken from 1 June 2017 to 10 August 2020 leading to 783 observations. The sample is chosen on the basis of the following factors: first, since we are interested to figure out whether the relationship has changed during the COVID-19 pandemic, we have incorporated latest data available, till August 2020. This period encompasses the periods of both pre-COVID-19 and post-COVID-19 in India. Second, for examining the relationships of financial variables, we have focused on high-frequency data, viz. daily data. Third, we have taken the data from 2017, as from 16 June 2017, and dynamic fuel pricing was implemented under which prices were to be revised every morning at 6 a.m. The companies in oil marketing are permitted to fix the retail price on the basis of exchange rate movements and fluctuations in global oil prices.[9] During the same period, gold prices also have recorded significant fluctuations. Out of the total sample, the period from 31 January 2020 onwards has been considered as the period of COVID-19 pandemic as on that date the first case of coronavirus disease in India was reported. In Appendix, Table 5 presents the descriptive statistics for the data.

[6] Unit of measurement of crude oil is one barrel (BBL). Spot price of gold is measured per 10 g per unit, and prices of crude oil and gold are provided in rupees (mcxindia.com). The average price of the two sessions is taken for both the variables.

[7] This represents the weekly volatility trends in the underlying commodities. The standard deviation (annualized) of the continuously compounded daily returns of an asset is called the annualized actual volatility (AAV). The asset volatilities are annualized. The formula for calculating the AAV is as follows:

$\mathrm{AAV} = 100 \times \sqrt{\left(\frac{252}{D}\right)\sum_{t=1}^{D}\left(\ln\frac{P_t}{P_{t-1}}\right)^2}$ where P_t = closing prices on day 't' (of underlying futures) and P_{t-1} = closing prices on the day $t-1$, i.e. previous business day of day 't'; D depicts the number of business days while computing the (historical) volatility. Then, the volatility is multiplied by 100 and expressed in percentage terms (mcxindia.com).

[8] Front month refers to the nearest expiration date of a future contract and is also named as 'spot' or 'near' month.

[9] The objective of the dynamic pricing was to ensure that they can put into effect the benefit of the slightest international oil price change and thereby would prevent huge leaps in prices at the end of the fortnight. For details, see https://www.businesstoday.in/current/economy-politics/how-petrol-diesel-prices-are-fixed-why-they-change-every-day/story/281961.html#:~:text=As%20for%20the%20everyday%20change,and%2016th%20of%20every%20month.

Figures 1 and 2 present the movements of prices and the volatilities of prices of crude oil and gold. It is observed that crude oil price exhibits periods of fluctuations with changing trends, while gold price exhibits a rising trend with fluctuations. During the pandemic, crude oil price fell in March, but from the end of April it started moving up. On the contrary, gold price kept on moving up during the pandemic, possibly owing to its safe haven status. Both the prices record significant volatility, while the volatility of crude oil prices during the third week of April was extraordinary.

As far as the movement of stock prices during the period of COVID-19 is concerned, it is observed that on March 2, BSE SENSEX witnessed a collapse (www.moneycontrol.com). On March 9, the close of BSE SENSEX was lower by 1942

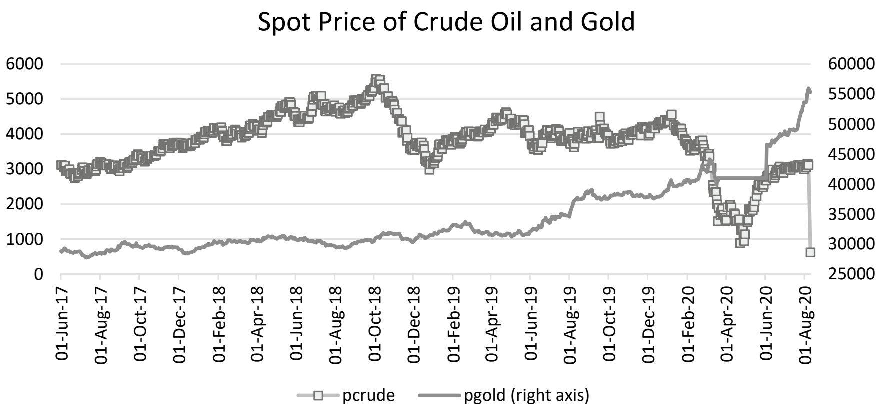

Fig. 1 Spot price of crude oil and gold

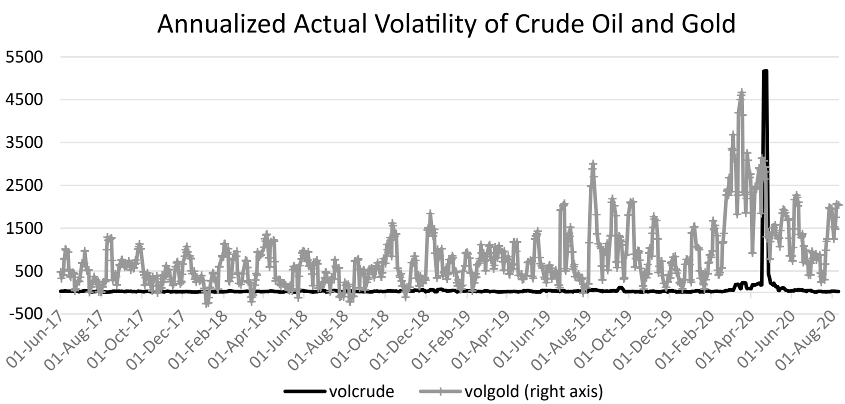

Fig. 2 Annualized actual volatility of crude oil and gold

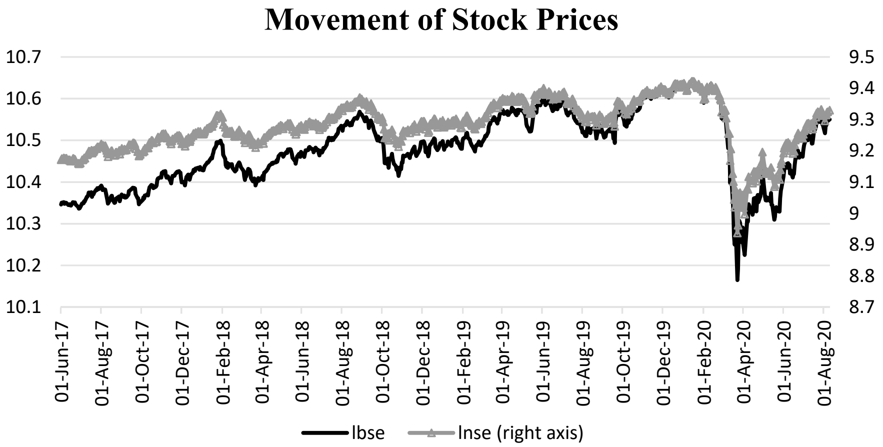

Fig. 3 Movement of stock prices

points, while the NSE NIFTY 50 close dropped by 538 points.[10] On March 12, the collapse of the prices in Indian stock markets was unprecedented, at least in last three years, attributable to the declaration of WHO of the COVID-19 outbreak as a pandemic. The BSE SENSEX recorded sharpest decline of around 8.18% (2919 points), reached its lowest level in about last two years' time, while the NIFTY 50 fell by 9% (950 points).[11] The time plots of both LBSE and LNSE are presented in Fig. 3 for the entire sample.

All the variables are tested for stationarity by unit root test (augmented Dickey–Fuller), and it was observed that LBSE, LNSE, LPCRUDE and LPGOLD were integrated of order 1, whereas VOLCRUDE and VOLGOLD are stationary at level. The correlation between the stock return and the price of gold is positive and moderately high. Also, there is positive and considerable correlation between stock return and price of crude oil (Table 1). Other correlations are quite low.

4.2 Methodology

The relationship that we would like to estimate is:

$$\begin{aligned} \text{LBSE}_t = \alpha &+ \beta_1 \text{LPCRUDE}_t + \beta_2 \text{LPGOLD}_t + \beta_3 \text{VOLCRUDE}_t \\ &+ \beta_4 \text{VOLGOLD}_t + \epsilon_t \end{aligned} \tag{1}$$

[10] https://economictimes.indiatimes.com/markets/stocks/news/monday-mayhem-may-mark-worst-day-for-sensex-5-factors-causing-this-crash/articleshow/74547106.cms, accessed on 28 August 2020.

[11] https://www.ndtv.com/business/bse-sensex-today-live-market-news-sensex-ends-2919-points-lower-nifty-at-9590-amid-coronavirus-fear-2193751, accessed on 28 August 2020.

Table 1 Correlation

	LNSE	LBSE	LPCRUDE	LPGOLD	VOLCRUDE	VOLGOLD
LNSE	1					
LBSE	0.99	1				
LPCRUDE	0.50	0.50	1			
LPGOLD	0.70	0.76	0.22	1		
VOLCRUDE	0.02	0.07	-0.04	0.15	1	
VOLGOLD	0.10	0.14	0.00	0.32	0.29	1

Source Authors' computation

$$\begin{aligned} \mathrm{LNSE}_t &= \alpha + \beta_1 \mathrm{LPCRUDE}_t + \beta_2 \mathrm{LPGOLD}_t + \beta_3 \mathrm{VOLCRUDE}_t \\ &\quad + \beta_4 \mathrm{VOLGOLD}_t + \epsilon_t \end{aligned} \tag{2}$$

Since the variables are integrated of different orders (0 and 1), the long-term relationship may be estimated by applying autoregressive distributed lag (ARDL) bound test approach of cointegration (Pesaran & Shin, 1999; Pesaran et al., 2001). The ARDL(l, m, n, p, q) model in our context is estimated in the following conditional ECM form:

$$\begin{aligned} \Delta \mathrm{LBSE}_t &= \beta_0 + \sum_{i=1}^{l} \beta_i \Delta \mathrm{LBSE}_{t-i} + \sum_{j=0}^{m} \gamma_j \Delta \mathrm{LPCRUDE}_{t-j} \\ &\quad + \sum_{k=0}^{n} \delta_k \Delta \mathrm{LPGOLD}_{t-k} + \sum_{i=0}^{p} \alpha_i \Delta \mathrm{LVOLCRUDE}_{t-i} \\ &\quad + \sum_{j=0}^{q} \varphi_j \Delta \mathrm{VOLGOLD}_{t-j} + \theta_0 \mathrm{LBSE}_{t-1} \\ &\quad + \theta_1 \mathrm{LPCRUDE}_{t-1} + \theta_2 \mathrm{LPGOLD}_{t-1} \\ &\quad + \theta_3 \mathrm{VOLCRUDE}_{t-1} + \theta_4 \mathrm{VOLGOLD}_{t-1} + \epsilon_t \end{aligned} \tag{3}$$

$$\begin{aligned} \Delta \mathrm{LNSE}_t &= \beta_0 + \sum_{i=1}^{l} \beta_i \Delta \mathrm{LNSE}_{t-i} + \sum_{j=0}^{m} \gamma_j \Delta \mathrm{LPCRUDE}_{t-j} \\ &\quad + \sum_{k=0}^{n} \delta_k \Delta \mathrm{LPGOLD}_{t-k} + \sum_{i=0}^{p} \alpha_i \Delta \mathrm{LVOLCRUDE}_{t-i} \\ &\quad + \sum_{j=0}^{q} \varphi_j \Delta \mathrm{VOLGOLD}_{t-j} + \theta_0 \mathrm{LNSE}_{t-1} \\ &\quad + \theta_1 \mathrm{LPCRUDE}_{t-1} + \theta_2 \mathrm{LPGOLD}_{t-1} \end{aligned}$$

$$+ \theta_3 \text{VOLCRUDE}_{t-1} + \theta_4 \text{VOLGOLD}_{t-1} + \epsilon_t \quad (4)$$

There are wide applications of such models that examine the existence of long-run linkages among economic or financial variables. Bound test is based on an F-test for which the null hypothesis is of no cointegration: H_0: $\theta_0 = \theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$, against the alternative hypothesis that H_0 is not true. A rejection of the null hypothesis indicates that a long-run equilibrium relationship exists among the four variables. If long-run relationship is obtained from the bound test, the dynamics of the short-run relationship is estimated by an error correction model (ECM). If long-term relationship is not there, we report the conditional ECM only.

In order to find out the optimum lags in the model, optimal lag structure test is applied; the test is based on information criteria, viz. Akaike (AIC) and Schwartz information criterion (SIC) and the appropriate ARDL(l, m, n, p, q) model is obtained. Since the objective is to find out whether the relationship has changed during a crisis like the COVID-19 pandemic, models are estimated separately for the pre-COVID and COVID period. For that, the sample is split into two s—the period from 1 June 2017 to 30 January 2020 is considered as pre-COVID period (653 observations), and the rest of the sample is called the COVID period (130 observations).

We have also tested the relationship between the stock returns and the volatilities and levels of spot prices in the commodity futures market by pairwise Granger causality test for up to 5 lags. The same is applied for both RBSE and RNSE, and all other variables are taken in their stationary form. This causality test also is applied separately for pre-COVID and COVID periods. The results are reported in the next section.

5 Results

The ARDL bound tests are conducted for pre-COVID and COVID period for both BSE and NSE, with a specification of a model with no trend and restricted intercept. The bound test results are reported in Table 2.[12] From the table, it is evident that during the pre-COVID period, there is no cointegration for both SENSEX and NIFTY with the commodity prices and their volatilities. But, during the post-COVID period, bound tests indicate that variables are cointegrated (for both SENSEX and NIFTY) and the error correction models are estimated for the COVID period. It should be noted that during the pre-COVID period, the long-term relation suggests that only the price of gold is having a statistically significant and positive impact on SENSEX and NIFTY; viz. an increase of 1% in price of gold makes BSE move up by 0.72% and NIFTY by 0.53%, respectively. It seems that investors invested in both gold and stock markets, in general. This probably speaks of the intent of diversification on the part of investors. This is also in synchronization with Jain and Biswal (2016). But in

[12] The model with no trend and unrestricted intercept was also estimated, and the bound test results are similar.

Table 2 ARDL long-run parameter estimation and bound test

Dependent variable	LBSE (pre-COVID)			LNSE (pre-COVID)			LBSE (COVID)			LNSE (COVID)		
Regressors	Selected model	Coefficient	Std. error	Selected model	Coefficient	Std. error	Selected model	Coefficient	Std. error	Selected model	Coefficient	Std. error
Constant	(4,5,5,5,0)	3.04	3.30	(4,5,5,5,0)	3.90	2.56	(2,4,0,4,2)	8.40	1.79	(2,4,0,4,2)	7.02	1.77
LPCRUDE		0.01	0.23		−0.01	0.18		0.28***	0.06		0.28**	0.06
LPGOLD		0.72**	0.34		0.53**	0.25		−0.003	0.17		0.015	0.17
VOLCRUDE		0.003	0.003		0.002	0.003		0.00009***	0.00003		0.00008***	0.00003
VOLGOLD		−0.01	0.01		−0.01	0.01		−0.0095***	0.003		−0.0098***	0.003
Bound test												
F Wald test statistic		1.31			1.35			5.12***			5.09***	

Source Author's computation
Note ***, **, * indicate $p < 0.01$, $p < 0.05$, $p < 0.10$, respectively

the COVID period, the relationship has changed. Gold price no longer influences the stock indices. Rather, the price of oil seems to affect the stock price indices positively. This again might be owing to the diversification motive. Moreover, with increase in last 5 day's volatility in crude oil prices, there has been a significant increase in the stock prices. This is quite expected during a crisis as investors move away from crude oil owing to increased volatility to purchase stocks. But, interestingly, with more volatility in gold prices, stock price indices have declined. This is possibly due to the status of gold as safe haven, and during an unprecedented crisis like a pandemic, investors did not shift to stock markets despite the volatility in gold prices. Moreover, it seems that with more fluctuations in gold prices, they reduced investment in stock markets to purchase other assets and/or gold. This observation is in conformity with few global evidence of gold price increase and decline of oil price and the corresponding decline of global stock market during January–March 2020 (Gharib et al., 2020; World Economic Forum, 2020).

The regressions are estimated taking cue from the results presented in Table 2. Hence for the COVID period, the error correction models are reported in Table 3 to understand the short-run dynamics. It is found that the sign of the error correction coefficient (denoted as ecm(−1)) in determination of LBSE and LNSE is negative (−0.16 and −0.15) and significant at 1% level of significance. This indicates that the speed of the convergence on a daily basis of BSE (NSE) to its long-run level is

Table 3 ARDL error correction representation for pre-COVID and COVID periods

Dependent variable				
	ΔLBSE (COVID)		ΔLNSE (COVID)	
	Model: (2,4,0,4,2)		Model: (2,4,0,4,2)	
Regressors	Coefficient	Standard error	Coefficient	Standard error
Δlbse(−1)	−0.20**	0.08		
Δlnse(−1)			−0.21**	0.08
Δlpcrude	0.01	0.01	0.01	0.01
Δlpcrude(−1)	−0.09***	0.03	−0.09***	0.03
Δlpcrude(−2)	0.03	0.03	0.03	0.03
Δlpcrude(−3)	0.04	0.03	0.04*	0.03
Δvolcrude	0.000001	0.000004	0.0000003	0.000004
Δvolcrude(−1)	−0.000008	0.000004	−0.000008**	0.000004
Δvolcrude(−2)	−0.000004	0.000004	−0.000003	0.000004
Δvolcrude(−3)	−0.00001***	0.000004	−0.00001***	0.000004
Δvolgold	0.001*	0.000520	0.0001*	0.000510
Δvolgold(−1)	0.001	0.001	0.001*	0.001
ecm(−1)	−0.16***	0.03	−0.15***	0.03

Source Authors' computation
Note ***, **, * indicate 1%, 5%, 10% levels of significance, respectively

16% (15%), and the convergence is achieved through the contribution of the levels and volatilities of oil and gold prices. A significant short-run effect of lags of some independent variables is observed on the equity market return, and the variables are crude oil price and the volatility of both crude oil and gold prices.

Table 4 reports the results of pairwise Granger causality test. Since the results for BSE and NSE are identical, results for BSE only are reported for pre-COVID and COVID period. During the pre-COVID period, evidence shows one-way causality from crude oil price to BSE return and from price of gold to BSE return. However, while the causality runs from BSE return to crude oil price volatility, evidence shows that for one lag causality runs from crude oil price volatility to BSE return, too. There is no causality between BSE return and gold price volatility. While comparing these observations with the causality of the variables during the COVID period, the causality from crude oil price to BSE return is still observed. However, other relationships have completely changed as is indicated in Tables 3 and 4. In this period, for each lag, there is evidence of one-way causality from volatility in gold prices in the past 5–10 days (volatility being the AAV of last 5 days, the lag of 5 indicates the volatility of approximately 10 days) to BSE return. This largely corroborates to the findings in Tables 3 and 4.

6 Conclusions

The chapter focuses on finding out whether during the pandemic, the linkage between the equity market and the commodity derivatives market (gold and crude oil, in particular) has changed compared to the previous era in India. The chapter is based on daily data on the prices of stocks and prices as well as volatilities of gold and crude oil (spot) prices for the last 3 years in the Indian equity markets and the commodity derivatives market. Estimating the long-run linkages among these variables by ARDL cointegration approach and pairwise Granger causality tests, the chapter provides a number of useful insights to the investors and policymakers alike.

First, it was observed that the relationship has changed during COVID-19 pandemic. For example, during the pre-pandemic period, stock prices are only positively influenced by contemporary gold prices and the long-term trends of these variables are not related. However, during the pandemic, the relationship has changed and evidently the stock price and prices as well as volatilities of prices of gold and crude oil exhibit a long-term linkage. The long-term relationship shows that the contemporary crude oil price and volatilities of both crude oil and gold are the drivers of stock prices during the COVID period. *Second*, given a shock in the long-term relationship during the COVID period, short-term adjustment takes place through the adjustments of the three variables, viz. crude oil price, volatility of crude oil price and that of gold price. *Third*, given a shock, BSE and NSE converge to their respective long-run levels, with a daily speed of adjustment of 16% and 15%, respectively. *Fourth*, the change in relationship is also evident from the change in causality among the variables. While the one-way causality running from oil price to stock returns

Table 4 Pairwise granger causality test

	Pre-COVID period					COVID period				
Lag	1	2	3	4	5	1	2	3	4	5
Null hypothesis	*F*-Statistic					*F*-Statistic				
ΔLPCRUDE does not Granger cause RBSE	0.002	0.827	4.678***	4.38***	4.09***	1.13	2.75	2.85***	2.45	2.30**
RBSE does not Granger cause ΔLPCRUDE	0.321	0.241	0.158	0.576	0.388	0.33	0.13	0.13	0.44	1.01
ΔLPGOLD does not Granger cause RBSE	1.212	0.674	0.642	4.89***	5.72***	0.09	1.05	0.62	0.44	0.36
RBSE does not Granger cause ΔLPGOLD	3.259	1.736	1.269	2.202	1.613	2.02	1.91	1.86	1.54	1.63
VOLCRUDE does not Granger cause RBSE	2.568	1.380	1.028	2.058	3.41***	0.00	0.90	0.59	0.48	0.52
RBSE does not Granger cause VOLCRUDE	11.82***	5.62***	4.18***	3.43***	3.51***	1.37	0.73	0.92	0.67	0.89
VOLGOLD does not Granger cause RBSE	0.156	0.127	1.268	1.061	1.899	12.96***	7.09***	4.51***	3.44**	4.48***
RBSE does not Granger cause VOLGOLD	3.619	2.037	1.412	1.023 ara>	0.795	0.06	1.20	0.91	0.75	1.75

Source Author's computation
Note ***, ** indicate $p < 0.01$, $p < 0.05$, respectively

Table 5 Descriptive statistics

	LBSE	LNSE	LPCRUDE	LPGOLD	VOLCRUDE	VOLGOLD
Mean	10.5	9.3	8.2	10.4	68.6	10.8
Median	10.5	9.3	8.3	10.4	26.3	9.4
Maximum	10.6	9.4	8.6	10.9	5176.2	43.1
Minimum	10.2	8.9	6.4	10.2	3.5	2.0
Std. dev.	0.1	0.1	0.3	0.2	411.1	5.9
Skewness	−0.2	−0.6	−2.2	1.1	12.2	1.9
Kurtosis	2.5	3.8	10.8	3.3	151.9	8.2
Jarque–Bera	13.0	77.2	2613.0	156.5	742,542.6	1378.3
Probability	0.0	0.0	0.0	0.0	0.0	0.0
Observations	783	783	783	783	783	783

remains the same during both the periods, BSE and NSE returns, in the pre-COVID period, were caused by past values of gold price. But in the COVID period, there is evidence that the causality runs from the gold price volatility of past five to ten days to the stock returns. *Fifth*, the stock returns being negatively influenced by gold price volatility indicate status of gold as the safe haven during the crisis. *Sixth*, the results clearly indicate that in the Indian financial market equity and commodity markets exert influence on each other in the pre-COVID period; e.g. levels of oil and gold price in the immediate past had significant effects on the stock returns, and also stock returns influenced oil price volatility. But after the COVID outbreak, through the influence of crude oil price and volatility of gold price on stock returns, the spillover effect seems to be running from commodity market to the equity market and not the other way round.

The change in the relationship during COVID throws light on the behaviour of the investors as a whole. However, the study may further be extended by incorporating some more commodities which are traded heavily, e.g. silver. The chapter suffers from lack of data during the COVID period, and a longer time after COVID may provide some more insights in future.

Appendix

See Table 5.

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