Monetary Policy Transmission in India: Some Issues and New Evidence

A thesis submitted to the University of Hyderabad

in partial fulfillment of the requirements for the award of

DOCTOR OF PHILOSOPHY
IN
ECONOMICS

By
ACV SUBRAHMANYAM
Registration No. 16SEPH03

SCHOOL OF ECONOMICS

UNIVERSITY OF HYDERABAD

HYDERABAD-500046 (INDIA)

November 2022

Monetary Policy Transmission in India: Some Issues and New Evidence

A thesis submitted to the University of Hyderabad

in partial fulfillment of the requirements for the award of

DOCTOR OF PHILOSOPHY
IN
ECONOMICS

By
ACV SUBRAHMANYAM
Registration No. 16SEPH03

Thesis Supervisor
Prof. S. Raja Sethu Durai

SCHOOL OF ECONOMICS

UNIVERSITY OF HYDERABAD

HYDERABAD-500046 (INDIA)

November 2022

श्री गुरुभ्यो नमः

Dedicated to my gurus (RNV),
Andhra Bank, and
my Family

School of Economics
University of Hyderabad
Hyderabad-500046, India

DECLARATION

I, ACV Subrahmanyam, hereby declare that this thesis entitled "**Monetary Policy Transmission in India: Some Issues and New Evidence**" submitted by me under the guidance and supervision of Prof. S. Raja Sethu Durai of University of Hyderabad, is a *bonafide* research work, which is also free from plagiarism. I also declare that it has not been submitted previously in part or full to this University or any other University or Institution for the award of any degree or diploma. I hereby agree that my thesis can be deposited in Shodganga/INFLIBNET.

A report on plagiarism statistics from the University Librarian is enclosed.

Name: ACV Subrahmanyam

ACVSManyam

Signature of the scholar

Registration No. 16SEPH03

Date: 11-11-2022

Place: Hyderabad

School of Economics
University of Hyderabad, Hyderabad-500046 (India)

CERTIFICATE

This is to certify that the thesis entitled "Monetary Policy Transmission in India: Some Issues and New Evidence" submitted by ACV Subrahmanyam bearing registration number 16SEPH03 in partial fulfilment of the requirements for award of Doctor of Philosophy in the School of Economics is a bonafide work carried out by him under my supervision and guidance. The thesis is free from plagiarism and has not been submitted previously in part or in full to this or any other University or Institution for award of any degree or diploma. The candidate has satisfied the UGC Regulations of publications and conference presentations before the submission of his thesis. Details are given below.

A. Publications:

1. Subrahmanyam, A. C. V., and Raja Sethu Durai, S. (2022). Does ownership matter in bank herding behavior? Evidence from India. Journal of Social and Economic Development, 1-23. https://doi.org/10.1007/s40847-022-00195-z

B. Presentations in conferences:

1. Presented a paper: "Effect of Bank Ownership on Transmission of Monetary Policy and Credit Growth in the Post Reform Period" in: 56th Annual conference of The Indian Econometric Society, at Madurai Kamaraj University, Madurai, 8-10 January 2020.

2. Presented a paper: "Amalgamation of Public Sector Banks – An Overview and Assessment", in: National Symposium on Big-Bang Economic Reforms: Opportunities & Challenges, at Department of Economics, Loyola College, Chennai, 19th February 2020.

Further, the student has passed the following courses towards fulfillment of coursework requirement for Ph.D. during August – December 2016.

Course Code	Course Title	Credits	Pass/Fail
EC-801	Advanced Economic Theory	4	Pass
EC-802	Social Accounting and Data Base	4	Pass
EC-803	Research Methodology	4	Pass

Signature of PhD Supervisor

S. Raja Sethu Durai 11/11/2022

Prof. S. Raja Sethu Durai

PROFESSOR
SCHOOL OF ECONOMICS
UNIVERSITY OF HYDERABAD
Hyderabad-500 046. (INDIA)

Dean

DEAN
SCHOOL OF ECONOMICS
UNIVERSITY OF HYDERABAD
Hyderabad-500 046. (INDIA)

Acknowledgements

"When you want something, all the universe conspires in helping you to achieve it."
Paulo Coelho- The Alchemist

Achievements are often ascribed in personal name; nothing can be far from truth. That's the touchstone, I bear when I acknowledge people, intentions, and forces beyond that nurtured, guided, and helped me in this tumultuous journey of rediscovering my pitfalls and potentials.

Foremost, I am indebted to my gurus, from my integrated master's programme Late. Prof. A V Raja, Prof. Naresh Sharma, and Prof. Vathsala Narasimhan. For they personally nurtured my thinking and have instilled the zeal to solve problems analytically, they continue to inspire me. I cannot express my gratitude in words to Prof. Bandi Kamaiah who stood by me in fulfilling my goal to get a PhD. He has reposed immense faith in my abilities and helped me pass many hurdles in my academic journey.

I could complete this PhD because of the support and encouragement given by entire Top Management team of my ex-employer Andhra Bank. The then Chairman Sri Suresh N Patel, Executive Directors Sri Satish Kumar Kalra, Sri Ajit Kumar Rath have supported me to fulfil the obligations of the academic course. Besides, the entire genesis of my thesis is in the banking domain, and I owe this to the numerous interactions I had with wonderful people across length and breadth of Andhra Bank. These interactions be it in Board / Business Review Meetings, Credit/ Investor Committees and through arguments with my esteemed colleagues have provided me with innumerable questions and handful of tools to analytically answer them. My insights about banking are attributable solely to the happenstance of me being part of such vibrant discussions. I am particularly thankful to Smt. Anjana Dube, ISS (Indian Statistical Service) – Deputy Director General, Government of India for posing a very inquisitive question, in her capacity as Government Nominee Director for Andhra Bank on spatial variability of NPAs, which spurred the fundamental thinking behind this thesis. In the same spirit, I am grateful to Sri JS Sudhakarudu, who is my banking guru, and has painstakingly explained the interface between economics & banking helping me cement my understanding of economics behind the banking processes. Many elder colleagues at Andhra Bank personally taught me the intricacies of banking over the years Sri MS Chalapathi Rao, Sri Atma Ram, Sri TD Dilip Kumar, Sri T Appa Rao, Sri SSR Prasad, Sri MB Rajendra Prasad and many others. It would be a miss if I fail to mention the deep intellectual impact, I had due to my interactions with Sri CVR Rajendran (Ex-CMD); Sri J Packirisamy (Ex-MD); Sri R Srinivasan (Ex-CRO); Late Sri Y Amarnath (Ex-CFO) of Andhra Bank who helped me to appreciate the nexus between regulatory expectations & business demands and objective of maintaining the fine balance. Besides the professional environment, Andhra Bank has also offered me with wonderful friends and camaraderie keeping the fire of inquisitiveness alive with their lively debates and discussions beyond office. I owe a special thanks to the business analytics team with Chandra Mohan, Balaji SR, Anitha, Tarun Bi, Shashank Reddy, and Arun, who supported my work both academically and professionally.

In this journey I was lucky to have steadfast support from my friends who withstood with my volatilities and endured my troubles as theirs. I can only reminiscence their help and will be

forever thankful to them. Ms. Deepika Sharma who endured arduous workload and facilitated me to fulfil my academic obligations. Ms. Chinmayee Kar, who not only managed the official engagements, but also provided me with moral & intellectual guidance on both personal and professional matters. Ms. Deepali Advani, who ensured my spirits are positive and provided me with sane counsel & technical guidance for completing my PhD. Dr. Pranesh Bhargava played the role of a caring senior guiding me through ups and downs of pursuing research with intellectual honesty and commitment. Mr Ujjwal Gaur and Mr PSSSR Murthy for their insights and critical questions helping me to sharpen my thinking on many aspects. I specially thank Mr. Prakash Babu, a family friend, a colleague more than anything else a beacon hope for guiding me throughout this journey. Finally, I am thankful to Dr. YV Jayasurya, Dr. P Vijay and Dr. R Vennela for reposing faith in my abilities and serving as my intellectual guideposts.

As mentioned in the adage at the beginning that world conspires to make you achieve your goals cannot be truer than what I experienced in this voyage. Enduring many a storm both personally and professionally I often drifted. Like a light house that guides stranded ships, my thesis supervisor Prof. S Raja Sethu Durai has truly guided me through the chaos and clutter ensuring that I reach the destination. His insights on every aspect of life, including research were very sharp and practical reflecting the value system he carries. On a similar note, a rocking boat needs a strong anchor to stabilize and set things in order. I am lucky to have two such anchors Dr. Thota Nagaraju and Mr Vamsi Mithra who prevailed as anchors for sanity and stability in my life. If not for them, I would have wrecked this enterprise yielding to the forces, which wanted me to fail. I remain in their debt.

I am thankful to Prof Naresh Sharma and Prof. Debasish Acharya, who as part of my doctoral committee gave valuable insights on my thesis, with a personal warmth that I always cherish. I am also grateful to Prof. RV Ramana Murthy, Prof. Lakshmi Narayana, Prof. R Vijay, Prof. G Omkar Nath, Dr. G Vijay and all other faculty members of School of Economics, who over the years have engendered many a young mind moulding astute researchers and professionals out of them. Further, the support rendered by the Office Staff of School of Economics, particularly Shri Adi Narayana is invaluable. I also thank the Office of the controller of examinations, e-governance cell, IGML library for supporting my academic journey. My co-research scholars Hafsal, Anand, Shameer have always supported me by providing me timely assistance to complete the thesis. I am thankful to them.

I also take this opportunity to thank my present employer, Reserve Bank of India and the Research and Modelling Group at the Department of Supervision. I thank Shri R Ravi Kumar (Ex-CGM) for posting me to the research group. I am grateful to Dr. Pallavi Chavan, Dr. Ajit Kumar, Dr. Richa Saraf, Dr. Avdhesh Kumar Shukla, and Abhishek Singh who have ensured that I had a congenial environment to pursue my academic ambitions and helped me to build technical skills to address the analytical challenges.

Karl Marx's depicts that value of labour power is not entirely attributable to the individual, but also to the family that sustains and supports his ambitions, at times much to their inconveniences and frustrations. I am propelled by the constant energy supplied by my parents, my sister, brother-in-law, and my nieces who drove this enterprise. Finally, I am indebted to the Almighty God, who has conspired with the unknown forces in fructifying this mission.

Contents

List of Tables

List of Figures

List of Abbreviations

ADF	Augmented Dicky Fuller
ASCB	All Scheduled Commercial Banks
BPLR	Benchmark Prime Lending Rates
BSR	Basic Statistical Returns
CIRF	Cumulative Impulse Response Function
CMIE	Centre for Monitoring Indian Economy
CPI	Consumer Price Index
CR3	Concentration Ratio (top 3)
CR5	Concentration Ratio (top 5)
CRAR	Capital to Risk Adjusted assets Ratio
DBIE	Data Base on Indian Economy
DW	Durbin Watson
EBLR	External benchmark liked rates
FEVD	Forecast Error Variance Decomposition
FMOLS	Fully Modified Ordinary Least Squares
FSB	Foreign Sector Banks
GDP	Gross Domestic Product
GFSR	Global Financial Stability Report
HHI	Hirschman-Herfindahl Index
IMF	International Monetary Fund
IRF	Impulse Response Function
LAF	Liquidity Adjustment Facility
LSV	Lakonishok, Shleifer, and Vishny
MCI	Monetary Conditions Index
MCLR	Marginal Cost of Funds Linked Lending Rates
MFI	Micro Finance Institutions
MFIN	Micro Finance Institutions Network
NBFC	Non-Banking Financial Company
NDP	National Domestic Product

NPA	Non-Performing Assets
OLS	Ordinary Least Squares
PLR	Prime Lending Rate
PSB	Public Sector Banks
PVB	Private Sector Banks
RBI	Reserve Bank of India
REPO	Repurchase Operations
ROA	Return on Assets
ROE	Return on Equity
SAR	Spatial Autoregression
SCB	Scheduled Commercial Banks
SVAR	Structural Vector Autoregression
T-bill	Treasury Bills
VAR	Vector Autoregression
WALR	Weighted Average Lending Rate

Monetary Policy Transmission in India: Some Issues and New Evidence

Abstract

The present thesis leverages IMF's perspective of analysing 'transmission of monetary policy through the reaction of financial intermediaries' and examines monetary policy transmission through the bank lending channel in India. By pivoting analytical framework on factors shaping the reaction of banks to monetary impulses by using long term and granular bank credit data, the study highlights some issues and provides new evidence on monetary transmission in the post-liberalization period. The study has set the following objectives (a) Analysing structural changes in distribution of bank credit across size, sector, spatial, and ownership dimensions, (b) Examining plausible herding behavior as a credit growth strategy conditioned by relevant macro, monetary, and bank characteristics, (c) Exploring spatial differences in monetary transmission across Indian States, and (d) Assessing factors influencing 'Spatial Differences and Spill-overs' from the policy shocks across sectoral and bank ownership dimensions. The main findings of the study are (I) the stylized facts characterizing banks' credit strategies and their implications for monetary transmission, (II) the evidence suggesting herding behavior of banks to concentrate branch networks inducing spatial variability in responsiveness of credit growth to monetary impulses, (III) confirming the presence of spatial variability of monetary transmission among Indian States with negative spill-overs, and (IV) estimating the impact of factors influencing spatial variability and depicting the prominent role played by bank level features viz. branch concentration, per capita bank and NBFC credit on spatial variability. Further, the use of novel spatial weight matrices (viz., branch network affinity) explains the negative spatial spill-overs as plausible response of the banks to rationalize managerial resources resulting in selective focus on certain States/ sectors. Overall, the thesis extends literature on spatial aspects of monetary transmission in India and provides policy insights on herding tendencies, divergent business strategies of bank groups impacting monetary transmission at large.

JEL Classification: E51, E52, G21, R21

Key Words: Monetary Policy Transmission, Bank Lending, Herding Behavior, Spatial Matrices, Spill-overs, Credit Strategy.

Chapter 1: Introduction

1.1. Introduction

Globally ensuring low and stable inflation has emerged as the key objective of central banks.[1] Accordingly, in 2015, the Reserve Bank of India (RBI) has adopted a flexible inflation targeting framework. Achieving the objective of low and stable inflation requires efficient transmission of the monetary impulses to broader economic variables viz. interest rates, credit growth, output etc., Further, literature identifies, four major channels for transmitting monetary impulses viz. Interest Rate Channel, Bank Lending Channel, Asset Price Channel and Exchange Rate Channel (Mishkin, 1996); (GFSR, 2016). In India, though interest rate channel has a prominent role, like other emerging economies, the transmission of monetary policy is dominated by the bank lending channel (Mishra et al., 2012). While asset price, exchange rate channels are found to have a limited impact (Aleem, 2010); (B. Singh and Pattanaik, 2012).

Notwithstanding the relative importance of other channels of monetary transmission, in the Indian context, the bank lending channel assumes a significant role. This is attributable to the bank centric nature of the economy, with banks remaining the main stay of financial intermediation facilitating flow resources to commercial sectors (Subbarao 2013).[2] Thus, analysing the nuances of bank lending channel enables a better understanding of the overall monetary transmission process and aids in improving its efficiency. In this backdrop, several studies have analyzed the functioning of bank lending channel in India (**Table 1.1**). Further, a comprehensive view on the monetary transmission in India is detailed in the report of the

[1] Gill Hammond, 2012 "State of the Art of Inflation Targeting", CCBS, Handbook No.29, Bank of England.
[2] Between 2011 to 2020, on average, the non-food credit and investment from banks accounted for 55 % of the flow of resources to the commercial sector excluding foreign direct investment. (Source: Database on Indian Economy, Reserve Bank of India).

Expert Committee to Revise and Strengthen the Monetary Policy Framework, which underscored the role and significance of bank lending channel in the overall monetary transmission in India (RBI 2014). However, the report highlights the less than proportionate and delayed transmission of monetary impulses through the bank lending channel, affecting the overall efficacy of transmission (*ibid)*. While emphasizing the role of financial and credit market frictions, the report also hinted at the possible role of banks' behavior in impeding the transmission through the bank lending channel.

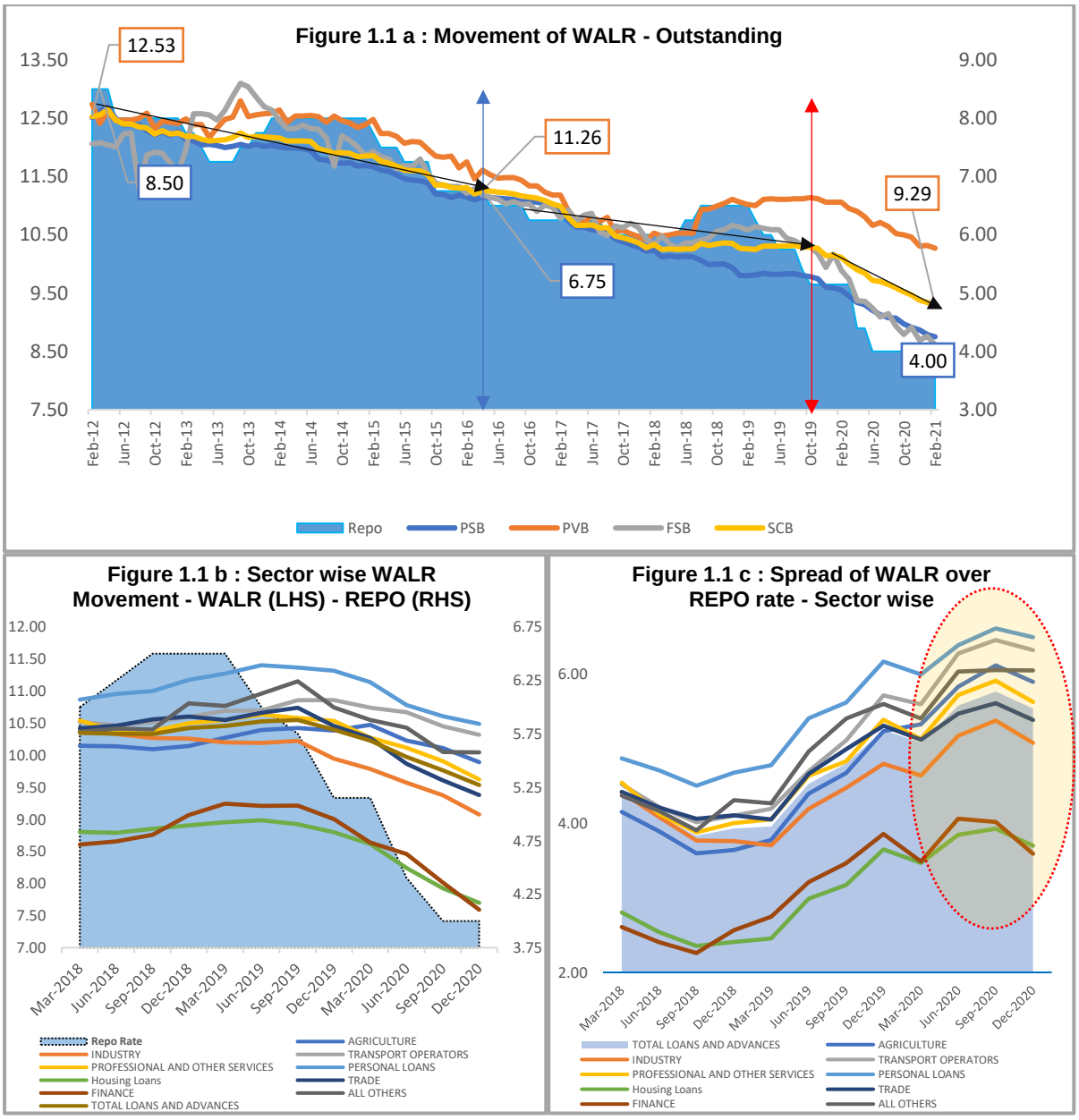
The disjunction between expected and actual transmission through the bank lending channel, can be contextualized by analysing the pricing and credit growth behavior of the banks. Post-liberalization, Indian banks were given freedom to price their assets and liabilities in line with the market conditions. Further, to align the transmission of monetary impulses and to ensure transparency in the credit pricing process, the RBI prescribed the broad contours of the pricing formulas to be adopted by the banks. Furthermore, reckoning the delays and to ensure proportionate & timely transmission of policy rates, the RBI has mandated banks to price their loans linked to approved external benchmarks like policy REPO rate from 1st October 2019.

However, leveraging the operational freedom to set interest rates, the banks have been passing on less than proportionate changes in the policy rates to lending rates (**Figure 1.1a**). The pass through (spread) can be approximated as the difference between Weighted Average Lending Rates (WALR) and the Policy REPO rates i.e, actual cost faced by the borrower. The spread between WALR and REPO was around 400 bps (Feb-2012) which increased to 450 bps (Apr-16) and to 500 bps (Oct-19).[3] Also, there is a wide sectoral variation in the spreads charged to borrowers by banks (**Figure 1.1b**). Thus, the banks are in effect blocking or impeding

[3] These dates coincide with the prescription of change in pricing formulas viz. benchmark prime lending rates to base rates (2012), base rates to marginal cost of funds linked lending rates (MCLR) (2016), and MCLR to External benchmark liked rates (EBLR) (2019) and also with falling policy rates, and statutory liquidity ratios.

proportionate transfer of monetary signals to lending rates, limiting the benefits due changes in the pricing formulas and the fall in policy rates.

Figure 1.1: Movement in Weighted Average Lending Rates (WALR) and Spread of WALR over Policy Rate (REPO) across bank groups and sectors



Source: Database on Indian Economy and authors' estimates

Further, the transmission to interest rates is an intermediary step, it is more important to understand the responsiveness of the credit growth as it has direct bearing on output and inflation Khundrakpam (2011); Kapur and Behera, (2012). This pegs an important question

about the behavior of the banks in attuning their pricing to monetary signals and the consequent impacts evidenced through the credit growth across sectors.

This also entails that a bank strategically responds to monetary shocks by limiting the transfer of monetary impulses and calibrates the responsiveness of its credit growth. Notwithstanding the role of systemic factors like general economic conditions, external environment, financial conditions etc., the factors influencing the banks credit growth strategy thus become pivotal in analysing the effectiveness of monetary transmission through the bank lending channel.

However, majority of the studies analysing the bank lending channel in the Indian context have treated banks as passive agents responding to monetary signals. Whilst there are notable exceptions which analyze the role of bank specific factors that influence the transmission to lending rates, or the responsiveness of credit growth, they do not present a comprehensive framework centred on the banks' response to the monetary signals in terms of its credit growth strategy. The present thesis aims to address this gap in the literature by analysing the factors shaping the banks' credit growth strategy and its impact on monetary transmission through the bank lending channel.[4]

In this background, chapter 1 introduces the study area of the thesis (section 1). The rest of the chapter 1 is structured as follows. In section 2, the relevant literature is reviewed, and the gaps are identified. In section 3 the analytical framework and scope of the thesis are discussed. The objectives of the thesis are listed in section 4, and the organization of thesis is detailed in section 5.

[4] The credit growth is pivotal for banks in India, as banks garner 80 to 90 per cent of their revenues from interest income earned through advances and investments. Further, the credit risk is the major risk faced by banks.

1.2.Literature Review

In this section a comprehensive and focused review of the literature is presented based on the studies analysing bank lending channel and its features in India (**Table 1.1**).

Table 1.1: Studies on the Bank Lending Channel of Monetary Transmission in India

Sl.	Title	Findings
1	*Transmission of monetary policy and the bank lending channel: Analysis and evidence for India* (Pandit and Roy, 2004)	Study finds the existence of bank lending channel in India using a VAR (Vector Autoregression) framework. Evidence from the study also suggests differential response to monetary shocks between large and small banks. Further, ownership is also having an impact with government owned (majority) public sector banks showing greater response to monetary shocks.
2	*Transmission mechanism of monetary policy in India* (Aleem, 2010)	Using VAR framework and imposing external constrains to account for exogenous features, the study establishes the importance of bank lending channel in India. This study also underscores the minimal impact of asset price and exchange rate channel on the monetary transmission in India
3	*Credit Channel of Monetary Transmission in India - How Effective and Long is the Lag?* *(Khundrakpam, 2011)*	The study establishes that credit channel is significant and robust in the Indian case. Further, the study notes a lag of 7 months for the policy rate to impact real credit growth. Also, in the post global financial crisis period, the study indicates there is a decline in impact of policy changes on bank credit growth.
4	*The bank lending channel of monetary policy transmission: evidence from an emerging market, India* (Saumitra and Toto, 2012)	The study finds evidence for bank lending channel and identifies that, small banks with liquidity constraints are more affected by monetary shocks especially in the non-priority sector lending segments.
5	*Changes in Transmission Channels of Monetary Policy in India* (Sengupta, 2014)	The study identifies the changes to channels of monetary transmission in the post-LAF (Liquidity Adjustment Facility) period and observes that the bank lending channel has weakened in the post LAF period, whilst other channels like the asset price and exchange rate channels have become more prominent.

Sl.	Title	Findings
6	*Monetary transmission in developing countries: Evidence from India.* (Mishra et al., 2016)	The study identifies bank lending channel as the foremost albeit with structural impediments like high cost of intermediation, low competition affecting transmission. Further, using VAR methodology the study establishes the partial pass through of changes in policy rates to bank lending rates.
7	*Financial frictions and Monetary Policy Transmission in India* (Kletzer, 2012)	The study highlights role played by the institutional features that characterize bank borrower interactions, which determines the scope for the working of the bank lending channel in India. Specifically, the paper indicates the possibility of credit rationing by the banks amongst borrower groups.
8	*Role of Financial Frictions in Monetary Policy Transmission in India* (Banerjee et al., 2018)	The study analyses the role of financial frictions in the monetary transmission using Structural VAR methodology and finds that there is a weak transmission both through the interest rate and bank lending channel with incomplete pass through. The study also observes differential response between retail and whole bank branches, owing to the different level of financial frictions experienced by household versus firm/ corporate borrowers.
9	*Does Monetary Policy Have Differential State-Level Effects? An Empirical Evaluation*[5] (Nachane et al., 2002)	Using Structural Vector Autoregression (SVAR) framework, this novel study finds the regional differences in the transmission of monetary impulses across Indian States. Further, the study indicates the variations in the banking and industrial development of States might be resulting in these differences.
10	*Bank lending channel in India: Evidence from state-level analysis* (Bhatt and Kishor, 2013)	The study finds the existence of bank lending channel at the State level in India. First it establishes the impact of monetary shocks on the bank lending. Further, the study also finds the impact of bank lending on the real economy activity, underscoring the bank dependence in the economy.
11	*The Sectoral Impact of Monetary Policy Transmission in India: A Panel VAR Approach* (Ghosh, 2019)	Building on the framework of Nachane et al. (2002), this study also uses a SVAR approach and finds the differential impact of monetary policy across sectors and States. The differential response is attributed to the extent of financial integration of the States and sectors with the formal banking sector.

[5] Nachane et al., (2002), per se does not elucidate the working of bank lending channel directly but underscore a very important feature of regional disparities in monetary transmission being dependent on financial deepening across Indian States.

Sl.	Title	Findings
12	*Bank Lending Channel – A Literature Review* (Sood, 2018)	The study presents a succinct review of the literature on bank lending channel and portrays the role of competition, concentration, efficiency, asset quality and customer relationships of banks in bank lending channel. Further, it highlights studies in the Indian context focusing on the role of bank ownership, response and lag in transmission, role of bank liquidity, type of borrowers, sectoral responses etc.,
13	*Distributional Impact Of Monetary Policy Through The Commercial Banks' Borrower Preferences: The Empirical Evidence for India* (Bajaj and Suresh, 2020)	The study finds asymmetric impact of monetary transmission in the bank lending channel to the borrowers of different sizes. The small borrowers with a few alternative sources of credit, witness greater contraction in credit than the large borrowers. Due to risk averse behaviour, the banks prefer large borrowers because of the lower transaction costs leading to asymmetric transmission of monetary impulses.
14	*Implications of bank ownership for the credit channel of monetary policy transmission: Evidence from India.* (Bhaumik et al., 2011)	The study finds the impact of bank ownership on monetary policy transmission in India during the various phases of monetary policy. The impacts are more pronounced during the tightening phase of monetary policy. Besides, the study also highlights the role of relationship lending as bank counter informational asymmetries.
15	*Testing the Presence and Efficacy of the Bank Lending Channel in India: The Role of Ownership, Economic Period and Size* (Sarkar, 2020)	Using long term data, this study establishes the bank lending channel and confirms the role of bank ownership on monetary transmission, controlling for bank size, economic period, bank liquidity, capitalisation etc., It observes that banks of all ownership types reduce loan supply to in response to a monetary contractionary, the response is higher in case of foreign banks followed by public and private banks.
16	*Asset quality and credit channel of monetary policy transmission in india: Some evidence from bank-level data* (Raj et al., 2020)	The study while establishing the robustness of credit channel of monetary transmission underscores the role of poor bank asset quality in dampening the monetary impulses and transmission in the Indian context. Further the study finds that stronger capital position of the banks improves the efficacy of monetary transmission
17	*Monetary Policy Pass-through, Ownership and*	The study finds bank lending channel is sluggish compared to interest rate channel in responding to

Sl.	Title	Findings
	Crisis: How Robust is the Indian Evidence? (Ansari and Ghosh, 2021)	monetary signals. Further, the bank ownership conditions the bank response to monetary shocks, with public sector banks showing higher response under the bank lending channel and curtailing credit during crises.
18	*Bank capital and monetary policy transmission in India* (Muduli and Behera, 2021)	This study observes that banks with greater capital cushion effectively transmit monetary impulses as compared to capital constrained banks in the bank lending channel. Further, the level of stressed assets acts as a drag on the banks' ability to be more responsive.

Source: Authors' compilation

From literature, it is evident that bank lending channel plays a crucial role in the monetary transmission mechanism in India[6]. Further, most studies indicate that the transmission through the bank lending channel occurs with a lag and is often less than proportionate compared to the changes in the policy rates (**Figure 1.1**). Furthermore, the transmission is attuned with spatial, sectorial variability, often influenced by the bank ownership category and relationship with different borrower categories.

However, in most studies, the focus is only on analysing the responsiveness of final outcome variable i.e., bank interest rates or credit growth, to the changes in the monetary policy variables. Such frameworks consider the banks as passive agents passing on monetary signals to the broader economic variables. As a result, they only offer a partial explanation for the less than proportionate transmission of monetary signals. While some studies do factor the bank level variables and factors in their analytical frameworks and highlight the role of size, ownership, liquidity, asset quality and capital adequacy etc., as the key bank level features influencing the monetary transmission.

[6] Though other channels of monetary transmission are gaining prominence, besides the interest rate channel, the bank lending channel remains the main course through which monetary variables impact real economic output/ inflation etc., (RBI 2014). Hence, in this thesis the attention is limited only to the bank lending channel.

Even though, such studies incorporate the bank level variables/ factors, they are only explaining the plausible constraining role played by a particular factor like capital adequacy or asset quality in dampening/ accentuating the transmission of policy signals. In other words, they also consider banks to be passive agents in reacting to the exogenous monetary shocks constrained by these features. Furthermore, the bank ownership is found to be a key variable influencing the bank's reaction to monetary shocks. Similarly, the sectoral variability in monetary transmission has a crucial role. Only a few studies reckon these features in their analysis often limiting to a particular dimension viz. ownership or sector but not both.[7] Hence, these studies fall short of giving a comprehensive explanation for the spatial, sectoral and ownership wise variability of the banks' responses to monetary shocks. The present thesis aims to address these gaps in the literature.

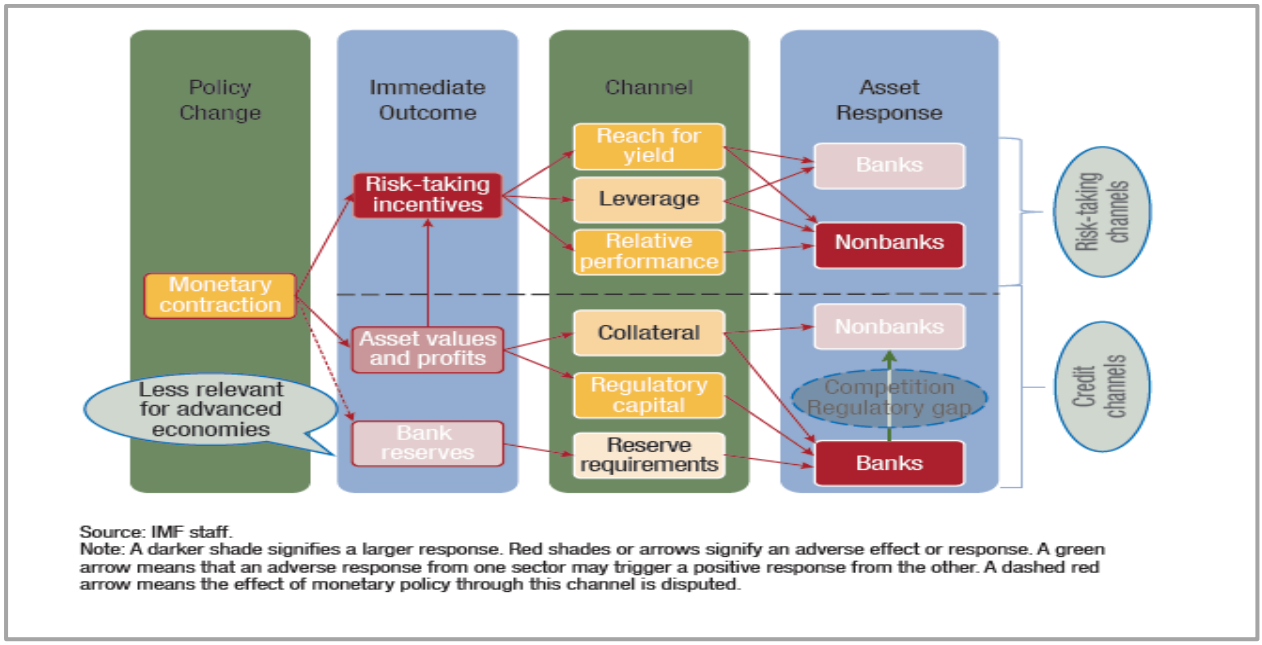
1.3. Analytical Framework

Notwithstanding the interesting evidence put forth by the earlier studies in the Indian context, there is a possibility to improve and extend their analytical frameworks for examining the bank lending channel of monetary transmission. A methodological framework suggested by the International Monetary Fund (IMF) (**Figure 1.2**) underscores the need to consider the reactions of the financial intermediaries (banks) to the monetary shocks to build a comprehensive view of the monetary policy transmission process (GFSR, 2016). Leveraging the same, the present thesis attempts to build a comprehensive framework to put forth new evidence on monetary transmission through the bank lending channel in India, by analysing the banks reactions to the monetary impulses/ shocks. The analytical framework of this thesis shifts the focus to analyse the outcome variable (credit growth) in terms of banks' reactions to monetary shocks and the same is detailed in this section.

[7] Bhaumik et al., 2011; Bajaj and Suresh (2020) are notable exceptions in this case. While the former focused on the influence of ownership, the latter focused on the size category of the borrower. Both studies do not analyze sectoral or spatial variability.

From a banks' standpoint, credit growth is the most crucial factor accounting for more than 80 percent of its revenues and risk weighted assets. [8] For a bank, the monetary shocks are exogenous changes which influence its profitability, growth etc., Therefore, given monetary shocks (policy changes), tracking the responsiveness of credit growth reveals the underlying strategy adopted by the bank. Besides the bank ownership, competition, sectoral and spatial credit composition, branch distribution, general economic factors etc., condition the credit growth strategy of the banks (Kumar and Gulati, 2014).

Figure 1.2: Transmission of Monetary Policy through the Reaction of Financial Intermediaries



Source: Reproduced from Global Financial Stability Report, October 2016. IMF [9]

Therefore, the factors conditioning the credit growth strategy of the bank, indirectly influence the banks response to monetary shocks. It is this nexus between factors conditioning the banks credit growth strategy and the exogenous monetary shocks, that determine final responsiveness

[8] For a typical bank, the credit growth determines the deposit/ funding requirements. Further, a proportion of deposits are then parked as investments and reserve requirements. Also, the riskiness of credit and consequent asset quality determine the capital requirements. Thus, one can dove tail the growth in other balance sheet components to credit growth.

[9] Accessed from: https://www.imf.org/en/Publications/GFSR/Issues/2016/12/31/Fostering-Stability-in-a-Low-Growth-Low-Rate-Era

of the banks. Further, focussing on the factors conditioning banks' credit growth strategy and its impact on monetary transmission is also justified in the backdrop of liberalisation policies and banking sector reforms adopted in India in the late 1990s. These reforms gave banks the operational autonomy to banks to price their assets/ liabilities in line with market conditions. Further, the competitive landscape has also undergone a change in the last three decades with the advent of new generation private and foreign banks, displacing the dominant position of the public sector banks. These structural shifts coupled with the implementation of BASEL capital adequacy norms, listing of banks on stock bourses increased the integration of banks with the broader market conditions, necessitating them to reorient their business models to focus on growth and profitability.

Therefore, the analytical framework of this thesis adopts an approach pivoted on banks' reactions (responsiveness of credit growth) to the changes in the monetary policy duly considering the factors that condition the credit growth strategy of the banks. However, to capture such effects the analysis should be over a long period as strategic orientation of banks or entities changes over time. Hence, for the present thesis, the sample period is taken from 1990 to 2020.[10] The sample period of the study coincides with the implementation of liberalisation and bank reform policies in India over the last three decades. The long-term and granular data provides ample scope to test the impact of factors conditioning bank credit growth strategy in response to monetary shocks. Hence, in this background, the present study has set out its objectives to analyse the response of banks to monetary shocks, while factoring the variables conditioning their credit growth strategy. The same is detailed in the next section.

[10] The main data source for the present study is the Basic Statistical Returns (BSR) published by the Reserve Bank of India (RBI). While BSR data is available from 1972, the reporting period has changed from 1990 onwards. Hence, to have a consistent data, the sample period is taken from 1990 to 2020. Post 2020 data is avoided to prevent the distortions on account of covid-19 pandemic induced lockdowns and the loan moratoriums announced by RBI etc.,

1.4. Objectives of the Thesis

The following four objectives are set out for examination in the present thesis. Further, the successive objectives were fine-tuned reckoning the results from preceding objectives to present a comprehensive and cogent explanation on the role of banks in attenuating monetary policy responses factoring the impact of ownership, sectoral, and spatial factors.

1. The first objective aims to bring out the "Stylized" facts on credit trends in Indian banking system in the post-liberalization period on following dimensions viz., Sectoral composition, Size (borrower category), Bank Group (ownership), States (spatial). The aim is to analyse the changes in the orientation/ focus of the banks' credit growth strategies as reflected from the changes in the credit distribution trends.
2. Taking cue from the first objective, in the second objective the plausibility of herding behaviour amongst banks is explored. Specifically, it addresses the question whether banks adopt herding as a credit growth strategy conditioned by monetary impulses and relevant bank characteristics viz. ownership, sectoral composition of advances etc.,
3. Reckoning the observations from objective 1 and 2, in objective 3 the spatial features of monetary policy transmission through the bank lending channel are explored. More specifically, the objective explores whether there are any spatial differences in the transmission of monetary policy shocks across States, reflected in the responsiveness of credit growth conditioned by macro-economic factors and bank specific features.
4. In objective 4, the reasons for Spatial Differences and Spill-overs among States in transmission of monetary impulses is explored. The aim is to analyze the factors causing spatial differences and also explore the possibility of spill-overs between States in response to monetary shocks affecting their credit growth.

1.5. Organization of the Thesis

The thesis is organized into six chapters including the present Introduction chapter. In chapter 2, the stylized facts on changes in the credit distribution and its implications on banks are discussed. Further taking cue from distributional trends, the herding behavior among banks and the influence of monetary, macro and bank specific features on the same is explored in Chapter 3. Reckoning the importance of spatial features of credit distribution in chapter 4, the variability in spatial transmission of monetary impulses is analyzed and in chapter 5 the reasons for spatial variability and spill-overs are explored. Chapter 6 provides the concluding observations and the policy implications. It also details the limitations and the scope for future research.

Chapter 2: Stylized facts on Credit Trends of Indian Banking Sector in the Post Liberalization Period

2.1.Introduction

Indian economy continues to be a bank led economy despite the activation of capital, insurance, and mutual fund markets in the post-liberalization period. Further, given the crucial role played by the bank lending channel in the Indian context, as a prelude, this chapter details the stylized facts on bank credit distribution trends across *Sector, Size, Spatial, and Ownership* dimensions. The market-oriented policies and regulations adopted in the post-liberalization period increased competition among banks necessitating them to strategically re-orient their business models to capture growth opportunities and improve profitability. Consequently, banks re-orientated their business models factoring the concentration and composition of risks across products and geographies reflecting the underlying diversities in the economic development across Indian States/ sectors (Bapat and Mazumdar, 2015).

The stylized facts presented in this chapter provide a framework for analyzing the role of strategic orientations & business models of the banks in the post liberalization period. These strategic re-orientations are further nuanced by ownership categories of the Indian banks with the dominant public sector banks (PSBs) striving to protect their turf, and the *de novo* Private Sector Banks (PVBs) and Foreign Sector Banks (FSBs) trying to establish a foothold (Kumar and Gulati, 2014). The strategic interplay between business models of different bank ownership types led to structural shifts in the banking sector in post-liberalization period, impacting key macro-economic variables like growth Gross Domestic Product (GDP), inflation, and interest rates etc., This underscores the crucial role of banks and specifically the bank credit play in overall macro and monetary management of the economy (Singh et al.,

2016). In this background, the aim is to bring out the structural shifts in Indian banking sector in the post-liberalization period through the stylized facts on the credit distribution trends. Accordingly, in the present chapter, the analysis of the stylized facts is presented. The chapter has four sections, including the introduction (Section 2.1). The data and methodology are specified in section 2.2. The credit distribution trends on various dimensions are presented in section 2.3. The time trends in credit distribution are detailed in section 2.4 and section 2.5 concludes.

2.2. Data and Methodology

The sample period for the analysis coincides with the post-liberalization period of the Indian economy i.e., from 1990 to 2020. The requisite data is sourced from the BSR data available in the Database on Indian Economy (DBIE) hosted by RBI. The BSR data published by RBI is the mainstay of this analysis which captures the data on credit and deposits annually across bank ownership types *viz.* ***PSBs, PVBs****, and* ***FSBs***. [11] While the data on deposits is also available, the focus of this study is on the composition of credit/ advances as it represents the primary source of risk and revenue for the banks. Using BSR returns, the annual data on bank credit from 1990 to 2020 is consolidated, representing the post-liberalization period of the Indian economy. The cross-tabulations of credit data across product, geographical, and size dimensions are exploited to bring out the trends in credit portfolios across bank groups (ownership types) is detailed below. [12]

- Bank group-wise - Total credit.
- Bank group-wise - Sector-wise credit.
- Bank group-wise - Size wise credit, and
- Bank group-wise - State-wise credit

11 Besides commercial banks, in India there are regional rural, small finance and local area banks, however their organization and operations are quite different from commercial banks. Given their limited share in overall credit (amount and accounts), they have been excluded from the present analysis.

12 The data on size and sector wise distribution is available consistently only from 1999 onwards. Hence, the calculations are based on the data from 1999 -2020.

2.3. Bank Credit Distribution Trends across Various Dimensions

2.3.1. Trends in Bank group-wise distribution of credit

In the post -liberalization period, market-oriented policies have led to increased private participation in the banking sector. The share of PVBs in total credit amount rose from 4% in 1990 to 34% by 2020 and the share of PSBs though still significant fell from 87% to 58%.[13] Despite their falling share, the PSBs still command a significant market share in terms of credit amount. Interestingly, in terms of share in the number of credit accounts, which represents the number of borrowers catered by various banking groups, the dominance of PSBs has given away to the PVBs. Between 1990 to 2020, the share of PSBs in the total number of credit accounts has fallen from 74% to 34%, with the share of PVBs rising from 4% to 47%. This indicates that PVBs now cater to more borrowers than PSBs (**Table 2.1**). Another interesting feature of this structural shift is that between 1990 and 2020, the relative account size of PSBs has increased from 1.17 to 1.70, while it has fallen for PVBs from 0.93 to 0.74.[14] The lower relative account size of PVBs coupled with their increasing share in total number of credit accounts, indicates that PVBs have increasingly focused on smaller ticket accounts, while PSBs have focused on relatively larger ticket accounts (**Table 2.1**).

Stylized fact 1*:* Trends in distribution of total credit among various bank groups in the post-liberalization period clearly indicates that PSBs have increasingly focused on the large borrowers/ corporates while PVBs catered to relatively small value borrowers/ retail clients. These trends underscore divergence in the strategic approaches adopted by these two dominant bank groups in the post-liberalization period.

[13] Given the limited share of FSBs, the discussion on stylized facts is limited to trends in PSBs and PVBs.

[14] Relative account size is computed as the average size of the credit account for a bank group relative to the average size of the credit accounts for All Scheduled Commercial Banks (ASCBs).

$$\text{Relative size} = \frac{[\text{outstanding credit for a bank group}/\text{number of credit accounts for a bank group}]}{[\text{outstanding credit for all bank groups}/\text{number of credit accounts for all bank groups}]}$$

Table 2.1: Bank group-wise share in total credit (amount and accounts) in per cent

Bank Group	Credit Accounts		Credit Amount		Relative Ticket Size (ratio)**	
	1990	2020	1990	2020	1990	2020
PSB	74	34	87	58	1.17	1.70
PVB	4	47	4	34	0.93	0.74
FSB	0	3	6	4	32.22	1.67
Others*	21	17	3	4	1.00	1.00

Source: BSR data and authors' calculation

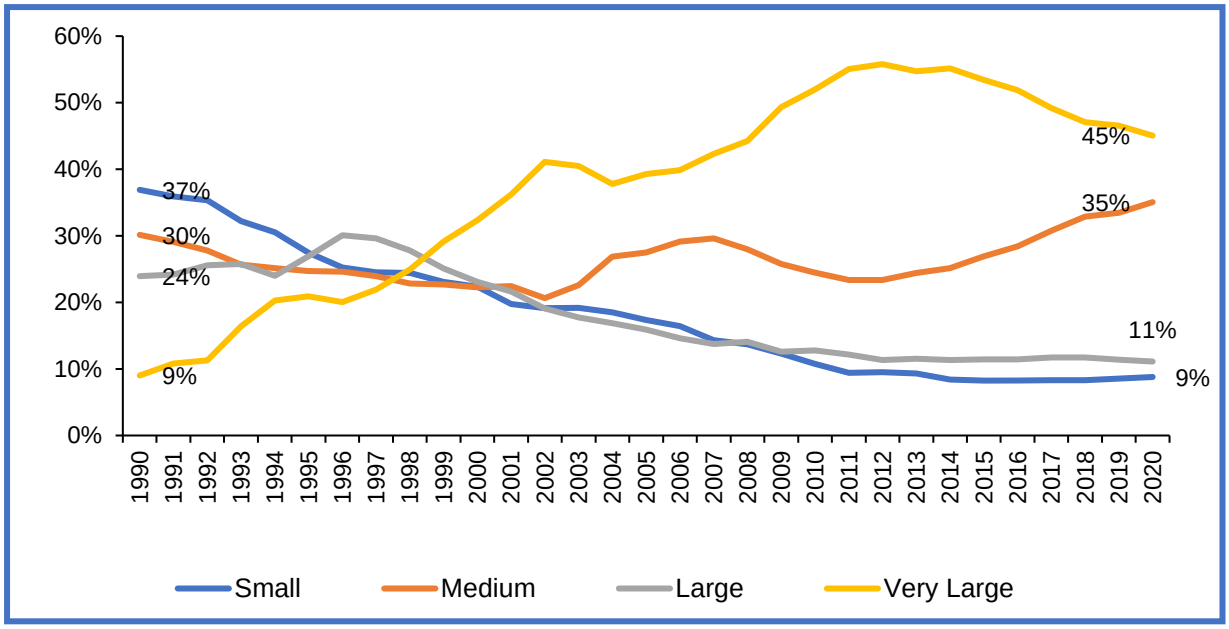
Notes: *Owing to their regional focus, Regional Rural Banks, Local Area Banks, Small Finance Banks etc., are excluded from the current analysis.

2.3.2. Trends in Bank group and size-wise distribution of credit

Based on the size of the credit limit, the BSR classifies credit into eleven size buckets. However, for a comprehensive analysis, these eleven size buckets are clubbed into four categories: *small, medium, large, and very large*[15]. Between 1990 to 2020, at the aggregate level the size wise distribution of total credit skewed towards *very large value* accounts accompanied with the fall in the share of *small value* accounts (**Figure 2.1**). This structural shift is in line with the growing size of the economy in the post-liberalization period leading to increase in average size of credit accounts over time. Further, the movement of credit shares (i.e., in total credit amount) of different size buckets within a bank group throws interesting insights (**Table 2.2**). As observed at the aggregate level, the share of *very large value* accounts in total credit amount has increased for all banking groups, accompanied by the fall in share of *small value* accounts. In case of PSBs and FSBs between 1999 to 2020, the share of *very large* value accounts to total credit increased substantially from 30% to 52% and 42% to 65% respectively. As opposed the share of *very large value accounts* for PVBs has increased moderately from 22% to 36%.

[15] The *small value accounts* have credit limits less than INR 2 lakh, *medium value accounts* have credit limits between INR 2 Lakh to INR 1 Crore. The *large value accounts* have credit limits above INR 1 Crore to INR 10 Crore, and the *very large value* accounts have credit limits above INR 10 Crore.

Figure 2.1: Size bucket wise share in Total Credit (Amount) in per cent



Source: BSR data and authors' calculation

This indicates that PSBs and FSBs have a stronger preference towards *very large value* accounts. Further, the PVBs have relatively focused more on *medium* and *small value accounts* while significantly reducing the share of their *large value* accounts. These observations corroborate trends observed at the level of total credit.

Table 2.2: Bank group / size-wise Distribution of Credit- Amount in per cent[16]

Bank group	PSBs		PVBs		FSBs	
	1999	2020	1999	2020	1999	2020
Small	24	7	13	8	9	2
Medium	23	34	28	39	16	13
Large	23	7	37	17	33	20
Very Large	30	52	22	36	42	65
Total	100	100	100	100	100	100

Source: BSR data and authors' calculation

Stylized fact 2*:* Across banking groups, there is a clear structural shift towards accounts in the *medium* and *very large value* buckets compared to the *small* and *large value* buckets. However, the strategic orientation varied for different banking groups, with divergent preferences for various size buckets reflects the underlying risk preferences in their business models.

[16] Consistent data on bank group and size wise distribution of credit is available only from 1999 onwards.

2.3.3. Trends in Bank group and sector-wise distribution of credit

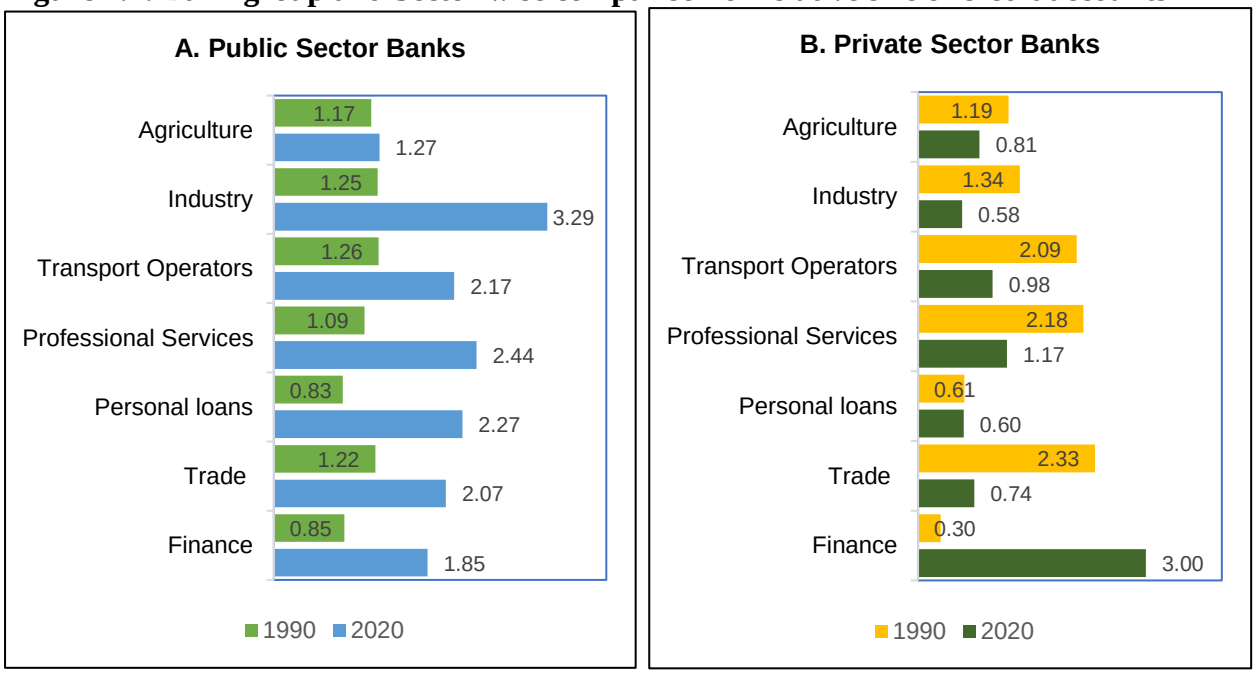
The BSR classifies the credit into eight broad sectors *viz*. *Agriculture, Industry, Transport Operators, Professional & Other Services, Personal Loans, Trade, Finance, and All Others*. As observed at the aggregate level, across all sectors between 1990 to 2020, the PVBs improved shares both in credit amount and accounts reducing dominance of PSBs (**Table 2.3– Panel A**). Besides, in this period, PVBs have comparatively gained a higher share in credit accounts than in credit amount thus resulting in a lower relative size of credit account. Also, in the post-liberalization period, reflecting the changing composition of GDP towards services sectors, the bank credit too gravitated towards service sectors and retail loans (**Table 2.3– Panel B**). Further, it is interesting to note that, while both the bank groups had similar focus sectors like personal loans, professional services, finance in the post-liberalization period, the relative size of credit accounts for PSBs has risen both over time and in comparison, to PVBs in all sectors expect in finance (**Figure 2.2**). *Ceteris Paribus*, this implies that PVBs are contracting lower risk (i.e., quantum of exposure per account) than PSBs across all sectors, excepting finance.

Table 2.3: Sector / Bank group-wise distribution of credit amount in per cent

Year	**A: Share in credit amount "across" bank groups**				**B: Share in credit amount "within" bank groups**			
Bank Group	**PSB**		**PVB**		**PSB**		**PVB**	
Sector	**1990**	**2020**	**1990**	**2020**	**1990**	**2020**	**1990**	**2020**
Agriculture	97	74	3	26	16	14	10	8
Industry	89	62	3	32	50	33	34	29
Transport Operators	93	35	6	61	3	1	5	4
Professional Services	89	45	7	46	3	6	5	10
Personal loans	89	57	6	41	6	23	10	28
Trade	89	57	6	39	14	10	20	11
Finance	65	68	5	25	2	11	3	7
All others	88	50	8	46	7	2	13	3
Total	90	60	4	36	100	100	100	100

Source: BSR data and authors' calculation

Figure 2.2: Bank group and Sector wise comparison of relative size of credit accounts



Source: BSR data and authors' calculation

Stylized fact 3: In the post-liberalization, though the different banking groups had similar focus sectors viz. personal loans, finance, services etc., there was a strategic divergence in terms of preference to relative ticket size (risk), while the PSBs preferred large ticket advances across sectors compared to PVBs, which inclined towards small ticket advances.

2.3.4. Trends in Bank group and State-wise distribution of credit

Indian States exhibit diversity in geographical features, social, industrial, and infrastructural development, banking networks, etc. Further, from a banks' standpoint, the spatial-sectoral distribution of advances brings diversification effects and helps in better risk management and revenue stabilization. However, banking is a unique industry where geographical diversity may act adversely as the domain knowledge about the local economic and social characteristics plays a crucial role in developing a stable credit portfolio with low delinquency. Therefore, bank managements must choose between entering a well-known turf versus facing competition in new areas. However, in the post-liberalization period, the spatial – sectoral distribution of

total credit (State and Bank group-wise) reveals that credit concentration has increased between 1990 to 2020. The share of the Top 10 States in terms of share in total credit has increased from 82% (1990) to 85% (2020). At the sectoral level too, the concentration of credit in the top-10 States has increased across all sectors, except for trade, reflecting banks' preference to deepen credit only in select States with higher banking penetration in terms of existing credit networks. At the bank group level too, the concentration of credit in top-10 States has increased in case of PSBs while it has fallen for PVBs (except for finance) (**Table 2.4**). This coupled with the observations from sector and size wise analysis of credit indicates that in the post-liberalization period, PSBs consolidated their credit portfolios by preferring large value accounts in a few States, while PVBs have diversified their credit across States by contracting relatively small value accounts across sectors.

Table 2.4: Sector/Bank Group-wise Share of Top 10 States in Credit amount in per cent

Bank Group	**PSBs**		**PVBs**		**FSBs**		**ASCBs**	
Sector / Year	**1990**	**2020**	**1990**	**2020**	**1990**	**2020**	**1990**	**2020**
Agriculture	80	85	99	79	100	100	81	85
Industry	85	91	94	90	96	98	85	91
Transport Operators	73	90	97	81	99	94	71	82
Professional Services	83	86	96	91	99	100	84	88
Personal loans	82	85	96	86	96	98	94	95
Trade	74	78	95	81	99	97	82	81
Finance	92	99	95	98	100	100	95	98
All others	81	86	98	86	100	99	82	83
Total	82	85	96	86	96	98	82	85

Source: BSR data and authors' calculation

Stylized fact 4: During the post-liberalization period, structurally, credit concentration has increased across States and Sectors. At the bank group level, the Strategic focus was varied across Sectors and States, with PSBs consolidating and PVBs diversifying the credit portfolios, reflecting differences in the geographical and sectoral diversification benefits factored by respective banks managements**.**

2.4. Time trends in the Credit Distribution

To present a holistic analysis of the structural shifts in credit distribution, the point in time comparison is complemented with a time trend analysis. Interestingly the high growth period of the Indian economy between 2000 to 2010 is likely to have resulted in structural shifts evidenced across credit dimensions and bank groups. At an aggregate level, the relative size of credit accounts of PVBs shifted towards lower end while that of PSBs has increased during this period. This is accompanied by a trend shift with PVBs emerging as the dominant group in terms of share in number of credit accounts (**Figure 2.3**). The trend shifts observed at the aggregate level also resonate over time and across size, sector, and space credit dimensions.

Figure 2.3: Bank group wise movement over time in relative size of credit accounts (Panel-A) and share in number of accounts (Panel-B)

Source: BSR data and authors' calculation

As observed earlier, across size buckets the relative size of credit accounts has fallen for PVBs, while it increased for PSBs, with the changes in the trends becoming more evident during the high growth years between 2000 to 2010. However, the relative size of *very large value* credit accounts, of PVBs always remained lower than that of PSBs reflecting the inherent preference for *very large value* credit accounts in the latter category of banks (**Figure 2.4**). Similar trend changes in relative size of account are observed in the spatial distribution of credit too. Besides,

at sector level too, trend changes were observed during the period between 2000 to 2010. In the post liberalization period, service sector and personal consumption emerged as key focus sectors with rise in their share in total credit (**Table 2.3 – Panel B**). Also, in terms of relative size of credit accounts, these sectors witnessed trend changes earlier than other sectors like agriculture and trade which witnessed trend changes later (**Figure 2.5**).

Figure 2.4: Bank group and size wise time trends in relative size of credit accounts

Source: BSR data and authors' calculation

Stylized fact 5: The time trends in credit distribution across size, sector and spatial dimensions indicate that the two major dominant bank groups viz. PSBs and PVBs had strategically positioned their business models differently during the high growth years of Indian economy, resulting in structural changes in the bank credit in the post-liberalization period.

Figure 2.5: Bank group and Sector wise time trends in relative size of credit accounts

Source: BSR data and authors' calculation

2.5. Conclusion

Leveraging the BSR data, the stylized facts on credit distribution presented in this chapter unravel structural changes in banking sector across size, sector, and spatial credit dimensions resonating the impact of varied strategic choices of bank managements in the post-liberalization period. The following features stand out in the transformation of credit trends. In case of emerging private sector banks, there is a marked focus towards smaller ticket size borrowers in the personal loan and service sectors combined with spatial diversification of credit. As opposed to this, in case of dominant public sector banks, the focus shifted towards large value corporate borrowers across credit sectors with increasing spatial concentration. Contextualizing the results from the earlier studies the stylized facts have implications for building the analytical framework to assess the monetary transmission through the bank lending channel in India. Bajaj and Kumar (2020) indicate tight monetary conditions result in stronger affects for smaller borrowers than for the large borrowers. Bhaumik et al., (2011) and Sarkar (2020) observe the impact of ownership on monetary transmission. Ghosh (2019), observes responsiveness of credit growth only in a few sectors in a few States. Therefore, one can expect the geographical, sectoral, and size wise risk diversification benefits factored by the banks influence its reaction to monetary impulses, there by impacting the overall transmission process. Furthermore, the interesting feature of the stylized facts is that between the two dominant banking groups there is stark difference in the focus areas viz. small vs large, personal vs industry, spatial concentration vs diversification etc., Such trends may be suggestive of plausible herd behavior among banks within one ownership category. If banks exhibit such herding tendencies, they may either impede or accentuate transmission of monetary signals across credit segments, as they follow leader banks in the ownership/ credit category. Thus, taking cue from the results observed in the present chapter, the impact of bank ownership and other macro-economic and monetary factors on bank herding is explored in the next chapter.

Chapter 3: Bank Herding Behavior as a Credit Growth Strategy and the Role of Monetary Policy

3.1. Introduction

Stylized facts from the chapter 2 posit that in the post-liberalization era, banks strategically re-oriented their business models to face increased competition, capture growth opportunities, and improve the return to their stakeholders (Kumar and Gulati, 2014). Further, the strategic re-orientation of banks' business models to face competitive pressures was conditioned by the ownership of the banks. Consequently, to garner new growth opportunities, banks across ownership types pursued massive branch expansion strategies leveraging liberalized branch licensing guidelines of the RBI. However, as banks forayed into new domains, they faced increased operational and informational costs in terms of branch expansion, monitoring, staff costs, entry barriers due to local factors like language, culture, and market structure (Berger et al., 2000; Miller and Parkhe, 2002). In pursuing such growth and profitability objectives, given the information asymmetries in extending loans to new customers across sectors and States, the banks could follow the decisions made by leader banks with better information to optimize their information costs. Such tendencies give scope for herding behavior amongst banks. The literature has well established (Haveman, 1993; Uchida and Nakagawa, 2007; Nakagawa, 2022) that following the liberalization or deregulation policies, the banks follow 'herd behavior' in pursuing high growth strategies, especially in the face of informational asymmetries. The herd behavior can also be observed in banks opening branches in similar areas, imitating competitors' products to garner higher market share (Persons and Warther, 1997). Also, herding can lead to sub-optimal risk taking often resulting in asset quality issues for the banks (Banerjee, 1992; Bikhchandani et al., 1992; Tran et al., 2017; Fang et al., 2021).

In the context of transmission through the bank lending channel in India, studies like Bhaumik et al., (2011) underscore the role of relationship lending resulting muted response to monetary signals by banks belonging to different ownership categories (specifically old generation private banks) as they optimize informational costs. Similarly, Kletzer, (2012); Banerjee et al., (2017), highlight the role of financial frictions in conditioning banks response to monetary signals, both the studies indicate differential responses between small (retail) / households and large (corporate) borrowers as banks optimize informational costs. Bajaj and Suresh (2020) also indicate optimization of operational and information costs by banks results in differential response of large and small borrowers to monetary shocks.

Further, from a monetary transmission standpoint, the banks that follow herding behavior can either accentuate or impede the transmission of monetary signals. To illustrate, in a tight monetary phase, which generally signifies uncertain macro-economic environment, the banks may deviate from the optimal path of supplying credit by following the decisions of leader banks in the local areas or in specific sectors.[17] Juxtaposing the stylized facts from chapter 2, wherein banks within an ownership category exhibited similar focus areas in the post-liberalization period, indicates the possibility of Indian banks opting herding as a credit growth strategy. Hence, the responsiveness of credit growth to a monetary impulse/ shock may plausibly be influenced by the nature and extent of herding adopted by these banks.[18]

Therefore, in this chapter the nexus between monetary impulses/ shocks and banks herding behavior is explored. As a first step, leveraging the Lakonishok, Shleifer, and Vishny (henceforth LSV) herding measure and a unique bank-level data set, the plausibility of 'herding

[17] Optimality in this context can refer to both reducing or increasing credit depending on the geographical and sectoral risk diversification benefits factored by the banks.
[18] Despite its potential to impact bank performance and financial stability, a few studies have analyzed bank herding in the Indian context (Pal, 2020)

behavior' among Indian banks in the post-liberalization is examined (Lakonishok et al., 1992). Second, the role of macro, monetary, and bank specific factors on the herding behavior of Indian banks is analyzed. Third, the impact of bank herding on asset quality is carried out to understand the role of herding on bank credit strategy. The rest of the chapter is organized as follows. Section 2 provides the review of relevant literature. Section 3 discusses the data and methodology and presents the empirical strategy. Section 4 presents the results and a discussion, and the final section concludes and sets the context for the third objective.

3.2. Literature Review

Unlike the abundant literature on the herding behavior in the capital markets, only a limited number of studies examined the herding behavior in the banking industry. When banks possess uncertain (or lack of) information about the borrowers, they are likely to follow the decision of other banks in their lending decisions. In this process termed informational cascading, the herding banks are essentially free-riding on the information possessed by other banks, ignoring their private information (Banerjee, 1992; Bikhchandani et al., 1992, 1998; Avery and Zemsky, 1998; Barron and Valev, 2000). Further, in the case of emerging markets, the borrower information is not complete and is often costly, leading to informational cascading type herding behavior. Bank herding is observed in case of US banks (Jain and Gupta, 1987)), Japaneese Banks (Uchida and Nakagawa, 2007; Nakagawa, 2022), Australian Banks (Tran et al., 2017). Studies identify the drivers of herding behavior like the principal-agent problems or information learning (Devenow and Welch, 1996); the role of competitors' lending decisions (Rötheli, 2001); reckoning peer lending decisions and public information to assess the creditworthiness of the borrowers, especially in the case of small banks, declining bank performance leads to herding behavior (Zhang and Liu, 2012).

Notwithstanding the bank specific features, evidence suggests the role of macro-economic and monetary factors impacting bank herding behavior. Mondschean and Pecchenino, (1995) observe that herd behavior leads to cyclical fluctuations in bank lending due to aggregate shocks such as changes in the monetary regime, tax, or regulatory policy. Further, studies also observe that the herding behavior varied across loan categories and bank ownership types. In the case of Australian banks, Tran et al., (2017) found that herding in the case of housing and credit card loan segments impacts bank asset quality. Likewise, Heo, (2019) observed that in the case of US banks, herding by the big banks is higher for real estate loans than commercial, industrial, or consumer loans during the boom period. Furthermore, studies like Fang et al., (2021) assessed the role of bank ownership on herding behavior and observed that loan herding in the Taiwanese banks, except in the case of government-owned banks.

The informational cascading hypothesis of bank herding finds ample support in the literature, with evidence indicating herding behavior by banks in major economies with implications for bank asset quality. Besides the macroeconomic factors, the bank-specific factors drive the herding behavior with varied impacts across sectors and bank ownership types. Further, in the Indian context, the trends in the banking sector in the post-liberalization period with banks facing heightened competition and undertaking massive branch expansion suggest the possibility of bank adopting herding as a credit growth strategy across sectors/ bank ownership types. Hence, there is a need to examine the herding behavior among the Indian banks across the ownership groups and loan segments, reckoning the role of macroeconomic, monetary and bank-specific factors.

3.3. Data and Methodology

3.3.1. Data

For this analysis the bank-level annual data (such as total credit, profits (return on assets), capital adequacy, non-performing assets, number of branches, the cost to income ratio, and ownership details) of 28 public sector, 34 private sector, and 45 foreign sector banks[19] and the macro-economic data (such as GDP, inflation, broad money (M3), monetary policy rates, and deposit rate) is collected from the RBIs' Data Base on Indian Economy. Unemployment rates have been extracted from the world bank database. Based on the data availability, sample period spans between 1995 to 2020, covering the post-liberalization period.

3.3.2. Herd Measure

Following literature (Uchida and Nakagawa, 2007; Tran et al., 2017), using LSV methodology herding among Indian banks is estimated. The LSV herd measure is defined as below:

$$LSV_{it} = |p_{it} - p_t| - E|p_{it} - p_t| \qquad (1)$$

where i denotes a particular credit sub-segment (*i= 1,..k)* and p_{it} denotes the proportion of banks that are registering growth in year *t*.[20] Further p_t denotes the average proportion of banks registering growth across *k* credit sub-segments in the year *t*. The average proportion of banks can be considered as the expected credit behavior of all the banks in year *t*, reflecting the overall lending policy reckoning the macroeconomic and sector-specific conditions. Therefore, the absolute difference $|p_{it} - p_t|$ denotes the share of banks extending loans over and above the expected levels to a particular credit sub-segment *k* quantifying the 'herding portion.' In the second term $E|p_{it} - p_t|$ is subtracted to normalize the LSV herding measure to zero under the

[19] Following Uchida and Nakagawa, (2007), in a given year only the banks with defined growth rate are considered. Thus, in a given year, the banks that are newly established or acquired are excluded.
[20] Considered credit sub-segments than industry sectors to generalize the use of LSV 'herd measure'.

null hypothesis of no herding [21]. The mean of LSV_{it} across *k* credit sub-segments give the herding measure for the credit segment in the year *t.* Further, the significance of the 'herding measures' is tested using a chi-square test and the Zi scores defined below (Uchida and Nakagawa, 2007).

$$Z_{it} = \frac{p_{it} - p_t}{\sqrt{\frac{p_t(1-p_t)}{N_i}}}$$

Where N_i is the number of banks in the k^{th} credit sub-segment for the year *t*.

The LSV herd measure captures the herding exhibited by banks in lending to a particular industry/ sector over and above the expected average trend after factoring in the macroeconomic and sector-specific constraints. However, the long-term bank-level data on the sectoral distribution of credit is not available for the Indian banks[22]. Hence, the following three credit segments and their distribution is considered to analyze the herding behavior of Indian banks. The first credit segment is based on the distribution of total credit by type of loan accounts viz. Bills, Cash-credit, Term-loans (BCTL) capturing the nature of business and risks to the bank. To illustrate, loans against bills (Bills) include short-term financing extended by banks against the payments due to the borrowers. Similarly, cash credit is akin to an overdraft facility provided to borrowers based on operational/financial parameters to manage routine business operations. In contrast, term loans are long-term commitments given to borrowers by the banks to finance investment projects of the borrowers.

Further from an operational standpoint, the bank requires higher domain expertise to assess the risks in a term loan, like financing an infrastructure project. On the contrary, the bank requires

[21] LSV measure follows a binomial distribution with a probability p_t, for details, please see the adjustment factor in Tran et al., 2017 for calculating the second term in Equation 1.
[22] The bank level data on sectoral credit distribution for Indian banks is available only from 2015.

a strong branch network and personnel to cater to borrowers availing cash credit/ bill financing. As banks enter new domains, the credit distribution based on the type of loan account reflects the relative preference of the banks in balancing risks and growth associated with each type of loan account, optimizing the associated monitoring costs and benefits.

The second credit segment is based on the distribution of total credit by type of security (SECU) viz. secured by tangible assets, secured by government guarantees, and unsecured advances, reflecting the extent of collateral security available to the banks. In the event of default by the borrower, the banks' recovery from a secured advance is expected to be higher than the unsecured advance. Also, the risk weights used in computing capital adequacy for secured advances are lower. Thus, a higher preference towards secured advances reflects greater risk aversion on the part of the bank in extending new loans across sectors. Further, in new areas/ product domains, the banks may demand higher collateral to extend loans to mitigate the associated information costs and improve recovery in case of defaults.

The third credit segment is based on the distribution of total credit by Priority and Non-priority sector advances (PNPL), i.e., Advances to the priority sector, public companies, banks, and other advances, reflects the strategic focus on the banks in balancing the regulatory requirements and business objectives. The RBI, to achieve the objective of inclusive development by enhancing credit access, mandates Indian banks to meet a prescribed level of credit disbursement to designated sectors of the economy, viz. agriculture, small and micro enterprises, retail housing, educational loans, etc., together called priority sector. Banks in India are mandated to lend a minimum of 40% of their advances to the priority sector, with specific sub-targets for loans to women borrowers, weaker sections, etc. Further, to reach these regulatory requirements, the banks must lend to borrowers in select sectors, locations (rural

centres), ticket size (small/ medium size loans), etc. Hence, to meet these targets, the bank must venture into new areas with potential (primarily rural and semi-urban) by opening branches and building the necessary infrastructure to handle the operations. The distribution trends of the credit segments mentioned above reflect the strategic choices of the banks to optimize operational and informational costs capturing the plausible herding tendencies. Hence, based on the LSV_{it} measures of the individual credit subsegments in year *t*, the mean LSV values were computed for each of these three credit segments and bank groups. The time series of mean LSV values of the credit segments and bank groups are then analyzed to capture the herding behavior within the bank groups.

3.3.3. Determinants of bank herding

Herding behavior is influenced by macroeconomic and bank-specific factors (Tran et al., 2017). From the LSV specification (Equation 1), p_t represents the overall lending policy of banks reckoning the macroeconomic and bank industry-specific factors. Hence, the macroeconomic/ monetary and bank industry-specific determinants of the bank herding are examined using the following equation.

$$LSV_t = \alpha + \sum_{e=1}^{n} \beta_e Macro_{et} + \sum_{j=1}^{m} \gamma_j Bank_{jt} + \varepsilon_t \qquad (2)$$

where LSV_t is the mean annual herd measure for a given credit segment; $Macro_{et}$ refer to macroeconomic variables including real GDP growth, inflation rate, change in unemployment rate, treasury-bill rate, broad money supply (M3) growth, and monetary conditions index (MCI).[23] Bank-specific variables (includes weighted average lending rate, deposit rate, profits, return on equity, risk-adjusted capital adequacy ratio, branch concentration (Hirschman and Herfindahl Index HHI), growth in the number of branches). The MCI indicates the stance of

[23] Monetary conditions index is used to identify the stance of monetary policy and to underscore differences in reaction of financial intermediaries during different monetary phase (Sharma et al.,2021; Bhaumik et al., 2011)

monetary policy and evolving monetary conditions, which have a bearing on credit growth. Using the methodology specified by Kannan et al. (2006), the MCI for India was developed for the period from 1995 to 2020, and the monetary phases (easy and tight) were identified accordingly.

However, most of the independent variables specified above are stationary at 1st difference, barring a few, which are level stationary, viz. real GDP, monetary phase, branch growth, and return on equity for FSBs. Also, there is a long-term relationship (cointegration) between the LSV values and the independent variables (both the macro and bank-specific variables).[24] In such cases, using Ordinary Least Squares may not yield optimal estimates. Hence, Fully Modified Ordinary Least Squares (FMOLS) developed by Philips (1995) is used, as it accommodates an unknown mixture of I (0) and I (1) variables with an unknown cointegrating rank. FMOLS is a modified version of the ordinary least square technique to account for serial correlation in the independent variables. Furthermore, it also considers the endogeneity among the regressors due to a cointegrating relationship (Chang and Philips, 1995). Further, FMOLS method produces reliable estimates even in small samples (Pedroni, 2001).

There are a good number of studies that leverage the FMOLS method to arrive at consistent estimates with small samples and to overcome the endogeneity in the regressors due to the presence of cointegration (Narayan and Narayan, 2004; Behera et al., 2009; Ucal and Bilgin 2009; Inoue and Hamori, 2014). The current sample is relatively small, with 26 observations (1995-2020). There is a cointegration relationship between the herd measures and the regressors with mixed order of integration among the variables; therefore the equation (2) is

[24] The co-integration between the LSV measures and independent variables is examined using Johansen co-integration test.

estimated using FMOLS methodology to derive reliable and consistent estimates. In addition, the impact of bank herding on the non-performing assets is also examined, as herding results in sub-optimal decisions, which plausibly leads to higher delinquencies limiting the overall responsiveness of banks to monetary impulses.[25] Following the method adopted in Tran et al., (2017), using the OLS estimator the effect of herding on the loan quality is examined using the following equation.[26]

$$NPA_t = \alpha + \beta_1 LSV_t + \sum_{j=1}^{m} \gamma_j Controls_{jt} + v_t \qquad (3)$$

where NPA is the Gross NPA ratio defined as the share of non-performing advances to the outstanding gross advances on the bank, LSV is the mean herding measure of the credit segment, and the control variables include credit growth, the efficiency ratio (cost to income ratio), capital adequacy ratio, and real GDP growth.

3.4. Results

3.4.1. LSV Herd measure

The results indicate that the mean LSV herd measures for all bank groups and credit segments are significant, establishing 'herd behavior' among Indian banks across credit segments and bank groups for a major portion of the sample period. The year-wise mean LSV values and the p-values from the chi-square test are given in **Table 3.1**. However, there is a difference in herding levels across bank groups and credit segments (**Table 3.2**). Compared to PSBs and FSBs, the PVBs show a higher level of herding across all credit segments, except for the BCTL credit segment, where PSBs exhibit a marginally higher herding level, reflecting difference in the business approaches undertaken by different bank groups for different credit segments.

[25] Banks with asset quality issues face severe capital constraints and impede smooth transmission of monetary impulses (Muduli and Behera, 2021, Raj et al., 2020)

[26] There is no cointegration between Gross NPA ratio and the herd measures across bank groups. Hence, equation (3) is estimated using OLS framework duly accounting for stationarity of the regressors.

Table 3.1: Bank group-wise and credit segments wise - yearly mean LSV herding measures and p-values from chi-square test (95% confidence)

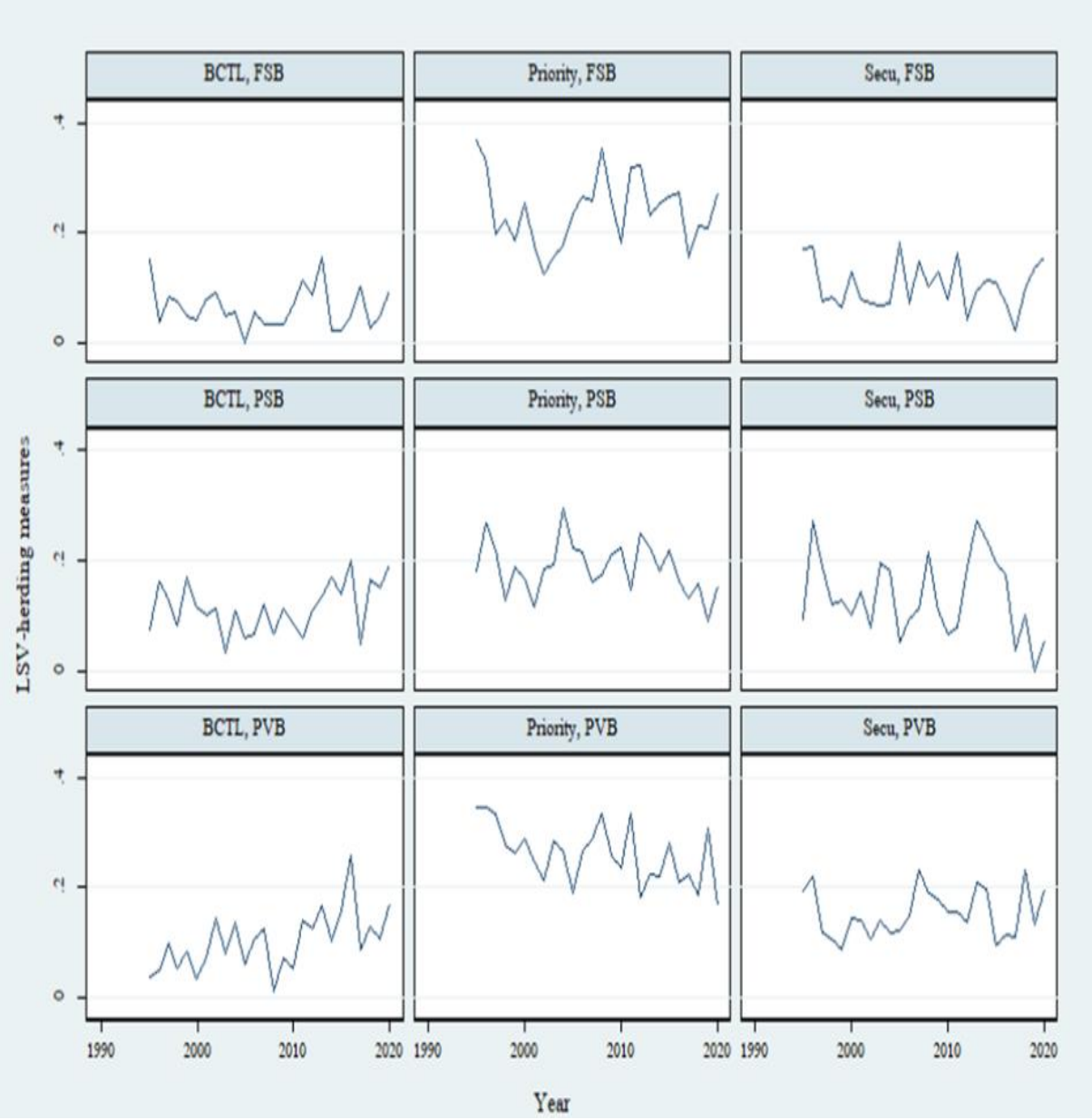
Year	BCTL PSB	Chi-test p-value	BCTL PVB	Chi-test p-value	BCTL FSB	Chi-test p-value	SECU PSB	Chi-test p-value	SECU PVB	Chi-test p-value	SECU FSB	Chi-test p-value	PNPL PSB	Chi-test p-value	PNPL PVB	Chi-test p-value	PNPL FSB	Chi-test p-value
1995	0.07	0.01	0.04	0.53	0.15	0.02	0.10	0.05	0.19	0.00	0.17	0.01	0.18	0.00	0.34	0.00	0.37	0.00
1996	0.16	0.00	0.05	0.49	0.04	0.80	0.27	0.00	0.22	0.00	0.17	0.01	0.27	0.00	0.34	0.00	0.33	0.00
1997	0.13	0.03	0.10	0.04	0.08	0.31	0.19	0.00	0.12	0.03	0.08	0.43	0.22	0.00	0.33	0.00	0.20	0.00
1998	0.08	0.07	0.05	0.36	0.08	0.23	0.12	0.03	0.11	0.08	0.08	0.24	0.13	0.00	0.28	0.00	0.22	0.00
1999	0.17	0.00	0.08	0.18	0.05	0.69	0.13	0.02	0.09	0.19	0.07	0.42	0.19	0.00	0.26	0.00	0.18	0.00
2000	0.12	0.00	0.04	0.53	0.04	0.78	0.10	0.05	0.15	0.00	0.13	0.03	0.17	0.00	0.29	0.00	0.26	0.00
2001	0.10	0.03	0.07	0.20	0.08	0.23	0.14	0.00	0.14	0.00	0.08	0.22	0.12	0.00	0.25	0.00	0.18	0.00
2002	0.11	0.01	0.14	0.02	0.09	0.22	0.08	0.18	0.11	0.13	0.07	0.42	0.18	0.00	0.21	0.00	0.12	0.03
2003	0.03	0.53	0.08	0.29	0.05	0.64	0.20	0.00	0.14	0.03	0.07	0.32	0.19	0.00	0.28	0.00	0.16	0.00
2004	0.11	0.03	0.14	0.00	0.06	0.59	0.18	0.00	0.12	0.07	0.07	0.34	0.30	0.00	0.27	0.00	0.18	0.00
2005	0.06	0.22	0.06	0.50	0.00	1.00	0.05	0.40	0.12	0.19	0.18	0.13	0.22	0.00	0.19	0.03	0.24	0.01
2006	0.07	0.01	0.11	0.09	0.06	0.62	0.09	0.01	0.15	0.01	0.07	0.51	0.21	0.00	0.27	0.00	0.27	0.00
2007	0.12	0.00	0.13	0.02	0.04	0.88	0.11	0.01	0.23	0.00	0.15	0.03	0.16	0.00	0.29	0.00	0.26	0.00
2008	0.07	0.08	0.01	0.93	0.04	0.86	0.21	0.00	0.19	0.00	0.10	0.22	0.17	0.00	0.34	0.00	0.35	0.00
2009	0.11	0.00	0.07	0.41	0.04	0.88	0.11	0.02	0.18	0.00	0.13	0.07	0.21	0.00	0.26	0.00	0.26	0.00
2010	0.09	0.03	0.05	0.67	0.07	0.49	0.07	0.25	0.16	0.03	0.08	0.33	0.22	0.00	0.24	0.00	0.18	0.00
2011	0.06	0.11	0.14	0.01	0.12	0.07	0.08	0.09	0.16	0.00	0.16	0.01	0.15	0.00	0.33	0.00	0.32	0.00
2012	0.11	0.00	0.12	0.00	0.09	0.22	0.19	0.00	0.14	0.06	0.04	0.79	0.25	0.00	0.18	0.00	0.32	0.00
2013	0.14	0.00	0.17	0.00	0.16	0.00	0.27	0.00	0.21	0.00	0.09	0.14	0.22	0.00	0.22	0.00	0.23	0.00
2014	0.17	0.00	0.10	0.20	0.02	0.93	0.24	0.00	0.20	0.00	0.11	0.02	0.18	0.00	0.22	0.00	0.26	0.00
2015	0.14	0.02	0.16	0.01	0.02	0.93	0.20	0.00	0.09	0.19	0.11	0.05	0.22	0.00	0.28	0.00	0.27	0.00
2016	0.20	0.00	0.26	0.02	0.05	0.72	0.17	0.01	0.12	0.46	0.07	0.46	0.16	0.00	0.21	0.09	0.27	0.00
2017	0.05	0.71	0.09	0.14	0.10	0.05	0.04	0.86	0.11	0.23	0.02	0.93	0.13	0.01	0.22	0.00	0.16	0.00
2018	0.16	0.04	0.13	0.02	0.03	0.91	0.10	0.31	0.23	0.00	0.10	0.08	0.16	0.05	0.19	0.00	0.21	0.00
2019	0.15	0.07	0.11	0.11	0.05	0.53	0.00	1.00	0.13	0.05	0.14	0.01	0.09	0.28	0.31	0.00	0.21	0.00
2020	0.19	0.01	0.17	0.01	0.09	0.08	0.06	0.77	0.20	0.01	0.16	0.00	0.16	0.03	0.17	0.01	0.27	0.00

Notes: Chi-square test is conducted using Zi statistics specified in the methodology section.

Table 3.2: Summary statistics of LSV herd measures across bank groups & credit segments

	BCTL			SECU			PNPL		
	PSBs	PVBs	FSBs	PSBs	PVBs	FSBs	PSBs	PVBs	FSBs
Mean	0.11	0.10	0.07	0.13	0.15	0.11	0.19	0.26	0.24
Min	0.03	0.01	0.00	0.00	0.09	0.02	0.09	0.17	0.12
Max	0.20	0.26	0.16	0.27	0.23	0.18	0.30	0.34	0.37
Std	0.05	0.05	0.04	0.07	0.04	0.04	0.05	0.05	0.06

Figure 3.1: Bank group and credit segment-wise - mean LSV herd measure



3.4.2. Herding Determinants

The time series of herd measures of different credit segments presented in **figure 3.1** indicates a cyclical herding behavior, suggesting the influence of macroeconomic/ monetary and bank-specific variables.

3.4.3. Impact of Macroeconomic factors on Bank Herding Measures

Table 3.3 A - Panel A reports the impact of macroeconomic determinants of loan herding for the bill, cash, and term-loans credit segment (BCTL). In the case of PSBs, the unemployment change and inflation are positively related to loan herding, while the M3 growth rate is negatively related. The T-bill rate and M3 growth negatively influence the herding measure for PVBs, while for FSBs, GDP growth is negatively associated with this herding measure. Similarly, **Table 3.3 B – Panel B** reports the macroeconomic determinants of the loan herding in the secured and unsecured credit segment (SECU). In the case of FSBs, both GDP growth and unemployment change positively influence these herd measures. Further, tight monetary conditions led to higher herding for PVBs and FSBs, reflected by the positive association of the monetary phase with this herding measure. In the case of the priority and non-priority (PNPL) credit segment (**Table 3.3 C – Panel A**), GDP growth, unemployment change, and monetary phase positively impact FSBs. While in the case of PVBs, the T-bill rate and M3 growth have a positive influence, and monetary phase negatively impacts this herding measure. Surprisingly for PSBs, in general, the impact of the macroeconomic factors on this herding measure seems muted.

3.4.4. Impact of Bank-specific factors on Bank Herding Measures

Similarly, the impact of the bank-specific determinants on the herding measures across bank ownership categories was examined. **Panel B of Table 3.3 A** indicates that in the case of the

BCTL credit segment, for PSBs, profits are influencing the herding measure positively, while equity and risk-adjusted capital ratio are exerting a negative influence. For PVBs' the risk-adjusted capital ratio has a negative influence, and the lending rate (WALR) positively influences this herding measure. Interestingly, the branch growth increases the herding in the case of PSBs, while the increase in branch concentration reduces herd measures for PVBs. The bank-specific factors have no impact on the BCTL herd measure for FSBs. In case of herding in SECU segment, it is evident from **panel B of table 3.3 B** that the deposit rate has a negative influence on herding measures for PSBs, while it has a positive impact on PVBs herding.

The lending rate (WALR) has a positive influence on herd measure in the case of PSBs, while it has a negative influence in the case of PVBs. Further, for PSBs, profit has a positive influence, and equity has negative influence on the herd measures in this SECU credit segment. Interestingly, branch growth increases herding for PSBs and FSBs, while branch concentration (HHI) lowers herding in PSBs and increase herding in FSBs. Similarly, **panel B of table 3.3 C** indicates that in the PNPL credit segment, the deposit rate negatively influences herd measures for PSBs. In contrast, it has a positive influence on PVBs and FSBs herding. The lending rate (WALR) yields a positive impact for PSBs and a negative effect on herding measures for PVBs. Further, in the case of PVBs, equity and risk-adjusted capital ratios are positively related, while profits are negatively related to this herding measure. Interestingly, in PVBs, the branch growth reduces herding while increasing it for PSBs.

Table 3.3 A: Macroeconomic and industry determinants of bills, cash credit, term loan segment's herding

BCTL	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.1221***	0.2602***	0.0944**	0.3528*	0.4820***	0.0394
	(0.0083)	(0.0002)	(0.0221)	(0.0998)	(0.0097)	(0.7767)
GDPG	0.0010	0.0013	-0.0096**			
	(0.8175)	(0.8150)	(0.0201)			
Unem-Change	0.0021*	-0.0009	0.0002			
	(0.0934)	(0.5547)	(0.8317)			
Inflation	0.0044*	0.0053	0.0017			
	(0.0956)	(0.1290)	(0.4675)			
T-bill rate	0.0046	-0.0113*	0.0052			
	(0.2836)	(0.0586)	(0.1878)			
M3 Growth	-0.0055***	-0.0078***	-0.0005			
	(0.0031)	0.0020)	(0.7351)			
MCI-Phase	0.0063	0.0079	-0.0103			
	(0.6284)	(0.6507)	(0.3875)			
Deposit Rate				-0.0022	-0.0096	0.0092
				(0.7133)	(0.2333)	(0.2077)
WALR				-0.0011	0.0323**	-0.0125
				(0.8687)	(0.0313)	(0.2262)
Profit				0.5108**	0.1001	-0.0678
				(0.0111)	(0.3860)	(0.1507)
Equity				-0.0333***	-0.0101	0.0083
				(0.0050)	(0.3233)	(0.2419)
CRAR				-0.0479**	-0.0319**	0.0077
				(0.0381)	(0.0180)	(0.1811)
HHI				0.0001	-0.0004***	0.0000
				(0.7151)	(0.0018)	(0.9171)
Branch Growth				0.4913*	-0.1413	0.0954
				(0.0723)	(0.5281)	(0.4866)
R^2	0.36	0.26	0.22	0.52	0.45	0.05
Obs	25	25	25	25	25	25

Notes: *, **, *** indicate significance at 10%,5%, and 1% confidence levels respectively.

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-phase*: Monetary Conditions Index; *WALR*: Weighted Average Lending Rate of loans/ advances; *Deposit*: Interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: Risk-adjusted capital ratio; *HHI*: branch concentration – Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches.

Table 3.3 B: Macroeconomic and industry determinants of secured & unsecured loan segment's herding

SECU	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.0936	0.1214**	-0.0016	0.6781**	0.2281	0.0862
	(0.3524)	(0.0229)	(0.9571)	(0.0334)	(0.1408)	(0.4368)
GDPG	-0.0035	0.0034	0.0093***			
	(0.7291)	(0.4936)	(0.0049)			
Unem-Change	-0.0031	0.0022	0.0041***			
	(0.2842)	(0.1274)	(0.0001)			
Inflation	0.0065	0.0002	-0.0008			
	(0.2875)	(0.9464)	(0.6392)			
T-bill rate	0.0111	-0.0042	-0.0003			
	(0.2781)	(0.4030)	(0.9107)			
M3 Growth	-0.0024	0.0009	0.0015			
	(0.5421)	(0.6446)	(0.2133)			
MCI-Phase	-0.0326	0.0436***	0.0396***			
	(0.2950)	(0.0097)	(0.0003)			
Deposit Rate				-0.0155*	0.0177**	0.0016
				(0.0914)	(0.0210)	(0.7800)
WALR				0.0543***	-0.0267**	-0.0136
				(0.0000)	(0.0439)	(0.1035)
Profit				0.5415*	-0.1229	0.0346
				(0.0520)	(0.2377)	(0.3460)
Equity				-0.0326**	0.0115	0.0023
				(0.0429)	(0.2115)	(0.6757)
CRAR				-0.0496	0.0058	-0.0019
				(0.1256)	(0.5979)	(0.6765)
HHI				-0.0013**	0.0001	0.0001*
				(0.0192)	(0.5921)	(0.0822)
Branch Growth				1.7924***	0.1541	0.2836*
				(0.0002)	(0.4418)	(0.0161)
R^2	0.25	0.26	0.41	0.67	0.28	0.28
Obs	25	25	25	25	25	25

Notes: *, **, *** indicate significance at 10%,5%, and 1% confidence levels respectively; refer table 3.3 A

Table 3.3 C: Macroeconomic and industry determinants of priority and non-priority loan segment's herding

PNPL	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.14047*	0.05025	0.06309	-0.00903	-0.09895	-0.01291
	(0.05340)	(0.24780)	(0.32250)	(0.96880)	(0.42280)	(0.92780)
GDPG	0.00148	0.00725	0.01515**			
	(0.83080)	(0.10270)	(0.02540)			
Unem-Change	-0.00065	-0.00014	0.00368*			
	(0.74200)	(0.91020)	(0.05170)			
Inflation	0.00503	0.00007	0.00292			
	(0.23650)	(0.97870)	(0.44610)			
T-bill rate	-0.00309	0.01196**	0.00218			
	(0.65890)	(0.01160)	(0.73200)			
M3 Growth	0.00182	0.00519***	0.00097			
	(0.50350)	(0.00550)	(0.69420)			
MCI-Phase	0.00241	-0.02673**	0.03980**			
	(0.90990)	(0.05440)	(0.05220)			
Deposit Rate				-0.01234*	0.02225***	0.01332*
				(0.08440)	(0.00110)	(0.08290)
WALR				0.02168**	-0.01839*	-0.00574
				(0.01080)	(0.08380)	(0.58330)
Profit				-0.14084	-0.28067***	0.03155
				(0.49310)	(0.00320)	(0.50470)
Equity				0.00890	0.02617***	0.00886
				(0.45260)	(0.00200)	(0.22270)
CRAR				0.01818	0.03613***	0.00669
				(0.45760)	(0.00080)	(0.25660)
HHI				-0.00016	0.00013	-0.00002
				(0.69970)	(0.13620)	(0.75480)
Branch Growth				0.56879*	-0.35112**	0.19389
				(0.06440)	(0.04200)	(0.17740)
R^2	0.08	0.42	0.32	0.36	0.63	0.57
Obs	25	25	25	25	25	25

Notes: *, **, *** indicate significance at 10%,5%, and 1% confidence levels respectively; refer table 3.3 A.

Table 3.3 D: Macroeconomic and industry determinants of BCTL, SECU and PNPL loan segments herding

MACRO & BANK	Panel A: BCTL			Panel B: SECU			Panel C: PNPL		
	PSB	PVB	FSB	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.4495***	0.6724***	-0.0948	0.6648**	0.0114	0.2105	0.2256	-0.0913	-0.0450
	(0.0095)	(0.0006)	(0.4093)	(0.0418)	(0.9025)	(0.1207)	(0.2872)	(0.5246)	(0.7276)
GDPG	-0.0006	0.0046	-0.0127***	0.0069	-0.0100***	0.0117***	0.0120***	0.0067	0.0080**
	(0.8313)	(0.3054)	(0.0014)	(0.2117)	(0.0039)	(0.0055)	(0.0073)	(0.1433)	(0.0389)
Unem	0.0022***	0.0015	0.0004	0.0017	0.0047***	0.0027**	0.0009	-0.0022*	0.0075***
	(0.0069)	(0.2481)	(0.6926)	(0.2288)	(0.0001)	(0.0314)	(0.3360)	(0.0998)	(0.0000)
Inflation	0.0028	0.0054	0.0020	0.0003	-0.0002	0.0015	0.0095***	0.0035	-0.0094***
	(0.1431)	(0.1201)	(0.3686)	(0.9422)	(0.9113)	(0.5641)	(0.0029)	(0.3018)	(0.0028)
T-bill	-0.0190***	-0.0090	0.0203***	-0.0137	0.0164***	-0.0110	-0.0101	0.0040	0.0137*
	(0.0043)	(0.2892)	(0.0051)	(0.2265)	(0.0094)	(0.1237)	(0.2046)	(0.6237)	(0.0637)
M3	0.0006	-0.0036	0.0029	0.0039	-0.0007	-0.0041*	-0.0001	0.0034	0.0038*
	(0.6941)	(0.1934)	(0.1286)	(0.1978)	(0.6679)	(0.0614)	(0.9595)	(0.2185)	(0.0824)
MCI	0.0340***	-0.0113	-0.0318**	0.0168	0.0288**	0.0513***	0.0211	-0.0095	0.0360**
	(0.0027)	(0.4801)	(0.0295)	(0.3663)	(0.0150)	(0.0044)	(0.1179)	(0.5458)	(0.0301)
Deposit	-0.0053	0.0044	-0.0149**	-0.0197**	0.0166***	0.0168**	-0.0166**	0.0110	0.0249***
	(0.2298)	(0.5829)	(0.0445)	(0.0401)	(0.0068)	(0.0455)	(0.0167)	(0.1805)	(0.0067)
WALR	0.0176**	0.0184	-0.0059	0.0726***	-0.0380***	-0.0143*	0.0459***	-0.0014	-0.0013
	(0.0130)	(0.2215)	(0.3667)	(0.0001)	(0.0016)	(0.0673)	(0.0002)	(0.9245)	(0.8591)
Profit	0.7445***	0.1220	-0.0185	0.4632*	-0.3099***	-0.0596	-0.3440*	-0.3346**	-0.0932**
	(0.0001)	(0.2984)	(0.5514)	(0.0963)	(0.0012)	(0.1082)	(0.0794)	(0.0113)	(0.0201)
Equity	-0.0477***	-0.0081	0.0053	-0.0306*	0.0330***	0.0108**	0.0202*	0.0253**	0.0158***
	(0.0000)	(0.4567)	(0.2069)	(0.0597)	(0.0005)	(0.0332)	(0.0729)	(0.0323)	(0.0047)
CRAR	-0.0793***	-0.0462***	0.0089*	-0.0558*	0.0332***	-0.0014	0.0292	0.0320***	0.0153**
	(0.0001)	(0.0008)	(0.0661)	(0.0732)	(0.0003)	(0.7865)	(0.1663)	(0.0080)	(0.0106)
HHI	0.0001	-0.0004***	0.0001	-0.0016**	0.0001**	0.0000	-0.0012**	-0.0001	-0.0002***
	(0.8348)	(0.0022)	(0.2001)	(0.0302)	(0.0497)	(0.4387)	(0.0252)	(0.4881)	(0.0015)
Branch	1.0064***	-0.3572	0.1543*	2.4877****	-0.4020*	0.1770*	0.4614	-0.1562	0.0965
	(0.0014)	(0.1913)	(0.0817)	(0.0003)	(0.0333)	(0.0784)	(0.1937)	(0.5497)	(0.3154)
R^2	0.74	0.57	0.38	0.71	0.62	0.63	0.54	0.73	0.81
Obs	25	25	25	25	25	25	25	25	25

Notes: *, **, *** indicate significance at 10%,5%, and 1% confidence levels respectively, also refer table 3.3 A

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-phase*: Monetary Conditions Index; *WALR*: Weighted Average Lending Rate of loans/ advances; *Deposit*: interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: Risk-adjusted capital ratio; *HHI*: branch concentration – Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches.

3.4.5. Impact of Macroeconomic & Bank-specific factors on Bank Herding Measures

It can be inferred that both the macroeconomic/ monetary and bank-specific factors impact the herding behavior of the banks across credit segments. However, interesting insights emerge when their effects are seen in conjunction, i.e., the combined impact of macroeconomic and bank-specific factors on herd measures. From **Table 3.3 D**, the macroeconomic factors generally have a sporadic influence on the bank herding measures, while bank-specific factors yield a more significant effect across credit segments.

In the BCTL segment, of the macroeconomic factors, GDP growth negatively influences FSBs, and unemployment change positively impacts PSBs herding. The T-bill rate lowers the herding in PSBs, while it positively influences FSBs. On the contrary, the monetary phase positively influences BCTL herd measures for PSBs and negatively affects FSBs. Among the bank-specific variables, for PSBs, the lending rate (WALR), profit, and branch growth have a positive influence, while equity and capital have a negative impact on herding measures. In the case of PVBs, only risk-adjusted capital ratio, and branch concentration negatively influence herd measures. For FSBs, the deposit rate has a negative influence, while risk-adjusted capital ratio and branch growth positively impact this herd measure.

In the SECU segment, the macroeconomic factors only influence herd measures of PVBs and FSBs. The GDP growth has a negative influence on PVBs and a positive influence on FSBs herding. The unemployment change and monetary phase have a positive impact on both PVBs and FSBs herding. T-bill rate has a positive impact on PVBs, while M3 growth has a negative impact on FSBs herding. On the contrary, bank-specific factors yield a more significant impact on herding in SECU segment across bank ownership types. The deposit rate negatively influences PSBs

herding, while it has a positive influence on both PVBs and FSBs. The lending rate positively influences the herding of PSBs, while it has a negative impact on PVBs and FSBs. For PSBs, while profit yields a positive influence, equity and risk-adjusted capital ratios are negative. In contrast, for PVBs, profit yields a negative influence, while equity and risk-adjusted capital have a positive influence. In the case of FSBs, only equity positively influences herd measures. Branch concentration (HHI) negatively impacts PSBs and has a positive impact on PVBs herd measures. Interestingly, branch growth has a positive influence on the herding of PSBs and FSBs, while it impacts herding negatively for PVBs.

In the PNPL segment, for PSBs, GDP growth, inflation, equity, and risk-adjusted capital ratio exert a positive influence, while deposit rate, profits, and branch concentration have a negative impact on herding measure. For PVBs, unemployment change and profits have a negative effect, while equity and risk-adjusted capital ratio positively influence herd measures. For FSBs, both macro and bank-specific factors are showing an impact on herding measures. Of the macroeconomic factors, GDP growth, unemployment change, T-bill rate, M3 growth, and monetary phase have a positive effect, while the inflation rate has a negative impact. Among the bank-specific factors, deposit rate, equity, and risk-adjusted capital ratio positively impact the herding measures, while profit, and branch concentration have a negative impact.

3.4.6. Influence of Herding on Asset Quality

Table 3.4 presents the impact of herding measures across credit segments on the bank asset quality after controlling for the macroeconomic and bank-level factors which potentially impact bank asset quality. The regression results indicate that bank herding negatively impacts bank asset quality across credit segments. However, the impact is significant only for PSBs, and PVBs. The herd

measures of PSBs and PVBs in the SECU segment are negatively associated with asset quality. While in the case of BCTL and PNPL segments, only the herd measures of PSBs are negatively associated with asset quality. Of the controlling variables, GDP growth has a negative impact on bank asset quality for PVBs (SECU) and FSBs (PNPL). At the same time, the bank level factors like credit growth have a negative influence on asset quality across credit segments for PSBs and FSBs. While cost to income ratio (inefficiency) has a positive impact only for PSBs. Further, the capital ratio influences the asset quality negatively only in the case of FSBs.

Table 3.4 : Impact of herding on non-performing assets

MACRO & BANK factors	Panel A: BCTL			Panel B: SECU			Panel C: PNPL		
	PSB	**PVB**	**FSB**	**PSB**	**PVB**	**FSB**	**PSB**	**PVB**	**FSB**
Constant	23.7384***	9.2795***	8.1579***	28.2521***	12.0879***	7.8797***	28.5754***	9.0208**	8.3810***
	(0.0000)	(0.0050)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0430)	(0.0000)
GDPG	-0.5492	-0.4873	0.0356	-0.4036	-0.5589**	0.0538	-0.2815	-0.5039*	0.0701
	(0.3310)	(0.1190)	(0.8520)	(0.4140)	(0.0480)	(0.7710)	(0.5610)	(0.0980)	(0.7020)
Herd	-20.7624*	-2.0712	-2.1828	-30.0719**	-17.3278*	0.1988	-37.4694***	1.3461	-4.6825
Measure	(0.0600)	(0.8510)	(0.6650)	(0.0040)	(0.0620)	(0.9760)	(0.0080)	(0.8930)	(0.2580)
CRAR	-0.1580	-0.3598	-0.3152**	3.0727	-0.2733	-0.3213**	2.3747	-0.3026	-0.3284**
	(0.9510)	(0.5470)	(0.0360)	(0.2050)	(0.3380)	(0.0360)	(0.3820)	(0.4750)	(0.0350)
CIR	0.3013	0.0037	-0.0176	0.3839	-0.0328	-0.0158	0.2134	0.0024	-0.0161
	(0.1540)	(0.9740)	(0.7820)	(0.0390)	(0.7690)	(0.8130)	(0.2640)	(0.9840)	(0.7960)
Credit	-0.2817***	0.0200	-0.1176***	-0.3000***	0.0055	-0.1174***	-0.2462**	0.0155	-0.0989**
	(0.0050)	(0.7270)	(0.0000)	(0.0000)	(0.8740)	(0.0040)	(0.0130)	(0.7390)	(0.0120)
Trend	-0.5178***	-0.1411	-0.1888***	-0.6178***	-0.1165*	-0.1892***	-0.5501***	-0.1482*	-0.1706***
	(0.0000)	(0.1690)	(0.0000)	(0.0000)	(0.0780)	(0.0000)	(0.0000)	(0.0790)	(0.0000)
R^2	0.63	0.39	0.72	0.72	0.48	0.72	0.68	0.39	0.73
Obs	24	24	24	24	24	24	24	24	24

Notes: *, **, *** indicate significance at 10%,5%, and 1% confidence levels respectively
GDPG: annual growth in real GDP; *Herd Measures*: LSV herd measure for the respective credit segment; *CRAR*: Change in risk-adjusted capital ratio; CIR: Change in cost to Income Ratio; *Credit Growth:* annual growth in credit outstanding.

3.4.7. Discussion

The results from empirical analysis indicate 'herding behavior' among Indian banks across the ownership groups. However, the varied impact of macroeconomic/monetary and bank-specific-

industry factors on herding measures across credit segments should be contextualized in terms of the business models of the bank groups. Banks facing uncertain informational costs try to optimize potential losses (credit delinquencies) by following herding behavior. Further, it is observed that the macroeconomic factors impact herding sparingly while the bank-specific-industry factors exert a greater significant influence. Of the macroeconomic factors, unemployment change has a more significant effect on bank herding, likely impacting the borrowers' repayment capacity. Interestingly, the monetary policy variables like M3 growth and monetary policy phase (MCI), and T-bill rate are more relevant for banks owing to their impact on bank interest rates. This may also explain the sparing impact of inflation and GDP growth, as the other bank-specific-industry factors plausibly internalize the impact of macroeconomic variables on bank herding.

Another interesting observation, hitherto not discussed in the literature, is the impact of branch concentration and branch growth on bank herding. The branch concentration measured by HHI generally exerts a negative influence on the herding across bank groups and credit segments, except in a few cases. This implies that a rise in branch concentration has a beneficial impact on 'bank herding.' It is also corroborated by the positive sign of the coefficient for branch growth, especially for PSBs and FSBs. While, for PVBs, branch growth reduces bank herding. While PSBs have a widespread branch network, their new branches may be adopting aggressive business expansion strategies in highly competitive markets and may follow the incumbent for faster results. On the contrary, the PVBs, which relatively have lower footprints, may gain informationally by opening branches, resulting in lower herding values. Hence, comparatively, a bank with a more concentrated branch network is less likely to exhibit a herding tendency due to more relevant domain knowledge about local economic conditions and growth possibilities.

In general, the 'bank herding' implies sub-optimal decisions by banks leading to delinquencies. However, results suggest 'bank herding' affects the asset quality of Indian banks albeit negatively as opposed to the positive influence found in the literature (Tran et al., 2017). The 'herd measures' of the Indian banks possibly suggest that the NPA ratio falls as 'herding' rises. The negative impact of herding can be on account of the 'credit shyness/ capital conservation behavior' exhibited by the banks in the wake of macroeconomic uncertainty /heightened informational costs, preferring to cater to well-known borrowers/ credit segments with higher security coverage and lower delinquencies. More importantly, the PSBs that hold the dominant share both in branches and assets show a negative response, suggesting that they supply lesser credit in the wake of uncertainty. The risk aversion tendencies may partly drive such behavior in the absence of proper risk-reward frameworks for the employees of PSBs. This is further corroborated by the sign and significance of the control variables like credit growth, cost to income ratio, and capital ratio. Credit growth has a negative and significant impact on asset quality across bank groups and credit segments, indicating that the delinquencies tend to be lower during the high growth phase.

3.5. Conclusion

It is well established in the literature that banks constrained by information asymmetry tend to follow (herd) credit disbursement strategies of other banks to enhance their profits (or to survive). The market-oriented reforms in the post-liberalization period posed varied challenges for Indian banks of different ownership types in pursuing their growth strategies in terms of accessing borrowers' information across sectors, thus resulting in plausible herding behavior over time. The findings based on the LSV herd measure indicate significant herding across credit segments and bank ownership types in the post-liberalization period. It also found that macroeconomic

factors like GDP growth inflation, unemployment rate had little impact on bank herding. On the contrary, monetary variables like, M3 growth, T-bill rate, and monetary phase impact bank herding owing to their close association with bank interest rates. Bank level factors like branch growth increases herding behavior, and banks with concentrated branch networks are likely to exhibit lower herding tendencies. Further, bank herding is negatively impacting asset quality, reflecting risk aversion on the part of the banks, specifically in public and private sector banks. Thus, in the Indian context, banks are likely to exhibit herding tendencies to avoid credit delinquencies and opt to concentrate branch networks in specific geographies.

From the monetary transmission perspective, such herding behavioural tendencies may result in banks attuning their credit growth strategies accounting for various bank and macro-economic factors, thereby limiting the transmission through the bank lending channel. Further, in the Indian context, credit delivery and ensuring inclusive credit access are still dependent on the physical branch networks. Furthermore, the geographical expanse/ network of the branches provides the banks with requisite domain knowledge and aids in optimal risk-taking, ensuring a stable flow of credit to the productive/ focus sectors. Considering, the influence of branch growth and network structure on banks' herding behaviour, and stylized facts (chapter 2) especially the divergence between PSBs and PVBs in terms of geographical dispersion of credit amongst States and sectors, it is pertinent to account for spatial features in analysing the monetary transmission through the bank lending channel. Hence, in the next chapter, a comprehensive analysis of the spatial differences in the monetary transmission through the bank lending channel across ownership / sectoral dimensions is taken up.

Chapter 4: Spatial Differences in Monetary Policy Transmission

4.1. Introduction

Evidence from earlier objectives suggests that spatial factors play a vital role in shaping a banks' credit growth strategy. Herding tendencies displayed by Indian bank across ownership categories and sectors also underscore the role of spatial features like branch location/ network etc. on their credit growth strategy. Further, in the post-liberalisation period as evidenced in stylized fact 4 (Chapter 2) the PSBs have chosen to concentrate credit in a few States preferring large corporate borrowers, while the PVBs have chosen to diversify their credit portfolio across States preferring retail borrowers. Such tendencies can be contextualised as part of banks risk and revenue optimization framework accounting for spatial, sectoral, and temporal features. Besides, from a monetary transmission standpoint, given an exogenous monetary shock, the spatial attributes may attune the banks' reaction thus leading to differential response across regions. Furthermore, the socio-economic diversities of regions (Indian States) can also accentuate the differentials in a regions' response to monetary policy in terms of variation in output (Nachane et al., 2002). However, only a few studies explore the spatial differences in monetary transmission through the bank lending channel in the Indian context viz. Bhatt and Kishor, (2013); Dhal (2012), Ghosh, (2019); Bardhan and Sharma, (2022). Whilst these studies analyze the spatial differences at the aggregate level in terms of impact of bank credit on output or the responsiveness of bank credit to monetary shocks, they do not account for the influence of bank ownership / bank level factors leading to differences in the spatial transmission of monetary policy impluses.[27]

[27] Ghosh, (2019) ; Bardhan and Sharma, (2022) account only for sectoral differences but not for the bank ownership.

As observed in the chapter 2, in the post-liberalisation period, the stylized facts indicate a clear and marked shift in the strategic orientation of different bank groups in terms focus sectors and States. Hence, in this background, in the present chapter, it is aimed to revisit the spatial variability in the transmission of monetary policy through the bank lending channel in the post-liberalisation period. The present chapter is structured accordingly, section 4.2 provides the literature review. Data and methodology are detailed in section 4.3, while the results are presented in section 4.4. The concluding observations and the context for next objective are set out in section 4.5.

4.2. Literature Review

Several studies have focussed on the spatial aspects of monetary policy transmission and have provided interesting insights. Dominguez-Torres and Hierro, (2019) provide a comprehensive review of the literature that focussed on regional effects of monetary transmission.[28] However, the majority of the studies are focussed on developed countries like US and EURO area. Studies like Carlino and Defina, (1998); Crone (2005); Owyang and Wall, (2009) analyzed the regional transmission in US. A recent study, Pizzuto, (2020) reassessed the regional effects of the monetary policy in United States and finds spatial differences in monetary transmission in the US. Carlino and DeFina, (1999); Potts and Yerger (2010) analyze territorial differences in case of Canada, while Weber, (2006); Fraser et al., (2014); Vespignani, (2015) focus on Australia, Mandalinci, (2015), focus on United Kingdom. In case of EURO area, studies have analysed the differential regional transmission of monetary policy both at the cross country (Tremosa-Balcells and Pons-Novell, 2001; Peersman, 2004; Barigozzi et al., 2014) and at sub-national levels (Anagnostou and Papadamou, 2016; De Lucio and Izquierdo, 2002; Rodriguez-Fuentes et al., (2004).

[28] Beare, 1976 first analyzed the role of money in resulting regional variabilities in business cycles

In case of emerging economies a few studies analyse the regional differences in monetary transmission. Cortes and Kong, (2007); Guo and Masron, (2017) analyzed provincial differences in monetary transmission in China. A recent study, (Tsang, 2021) examines output and credit growth of Chinese provinces using machine learning models and finds credit channel as the main channel affecting regional variability in monetary transmission. Similarly, studies find territorial differences in monetary policy in Brazil (Bertanha and Haddad, 2008; Rocha et al., 2011), Indonesia (Ridhwan et al., 2014) and Turkey (Duran and Erdem, 2014).

In the Indian context, Nachane et al., (2002), first explored the regional differences in the transmission of monetary signals using a Structural VAR framework and find evidence in terms of output variability among various Indian States. The authors identify that the nature of industrial development, presence of small-scale industries and the level financial development of a region impacts its response to monetary shocks. They find industrially advanced States showing greater response to monetary shocks as opposed to agriculturally dependent States. As opposed to this finding, Dahl (2012) analyzed the credit channel of monetary transmission at a disaggregated level using State level credit data and observes that poor States show greater response to a contractionary monetary policy than that of advanced States. The study also finds credit dispersion among States being dependent on infrastructural development, nature of commercial activities etc., Further a study by Ghosh (2019) analyses the bank lending channel at the disaggregated sectoral level (Agriculture, Industry etc.,) across Indian States using a Panel SVAR framework. The study reveals that good performing States with well-developed banking networks show greater response to monetary impulses (interest rate pass through). It observes, the sensitivity of bank credit growth to interest rates is higher in such States especially in the agriculture and industry sectors.

Furthermore, the presence of bank lending channel at the State level is well established for India. Bhatt and Kishor (2013) underscore the responsiveness of bank credit at the State level to the monetary impulses with consequent influence on State level output. Similarly, a recent study by Bardhan and Sharma (2022) highlights the impact of bank credit on State level output. The study analyses the impact of bank credit on output and finds the same has increased from mid 2000s specifically in the service sector as compared industry and agricultural sectors underscoring the role of financial intermediation.

From the literature review, it is evident that the studies both for the developed and emerging economies clearly establish the possibility for spatial differences in transmission of monetary impulses across regions and highlight the nature banking development as a key factor driving the regional differences. Further, in the Indian context only a few studies have analyzed the differences in regional transmission of monetary impulses through the bank lending channel. Furthermore, most of these studies have analyzed bank credit growth at the aggregate level leaving the sectoral and bank group dimensions. As evidenced in the earlier objectives, the spatial and bank ownership features influence the credit growth strategies of Indian banks and have become more prevalent in the post-liberalisation period. Hence, there is a need to revisit findings of the earlier studies in the post-liberalisation period. Therefore, leveraging the Structural VAR framework of Nachane et al., (2002), in this chapter a comprehensive analysis of the spatial transmission of monetary policy across Indian States in the post-liberalisation period is carried out including sectoral and bank group dimensions. [29]

[29]In their literature review, Dominguez-Torres and Hierro (2019) observe that, methodologically following Sims (1980), the Vector Auto Regression (VAR) models have emerged as the main analytical framework for examining the regional differences in monetary transmission (Carlino and DeFina, 1999; Fraser et al., 2014; Guo and Masron, 2017; Guo and Tajul, 2014; Nachane et al., 2002; Ghosh, 2019).

4.3.Data and Methodology

4.3.1. Methodology:

The SVAR models are typically used for analysing monetary transmission (Christiano et al., 1999) as they allow for a robust analysis of a system of endogenous variables with the feasibility to impose alternative economic constraints (Mazzi et al., 2016). As SVAR methodology is well established, for brevity the current discussion will only highlight the broad features of methodology and its adaptation to the present problem. While a detailed description of the SVAR methodology is provided in the appendix A. In the current context, the main variable of interest is the State credit growth and its responsiveness to monetary shocks, whilst factoring the plausible endogenous impact of other important macroeconomic factors. This chapter extends the model espoused in Nachane et al., (2002) based on the following SVAR framework:

$$Z_t = [Y_t^i, Y_t, (M3/P)_t, (Pf/P)_t]' \quad \text{---- (1)}$$

Where, Y_t^i represents the Growth in the Net State Domestic Product of State i at time t,

Y_t represents the Growth in the Net Domestic Product of the country at time t,

$(M3/P)_t$, represents the monetary policy variable arrived by deflating the growth in money supply with growth in inflation to arrive at real growth in money supply.

$(Pf/P)_t$ represents the adjusted food inflation rate

Further the model places restrictions for exact identification reckoning practical considerations in policy transmission. It is assumed that the structural shocks (inflation) induce contemporaneous monetary policy action (changes to money growth) which in turn impacts the current growth rates of output at the national level and consequently at the State levels. Furthermore, given an

innovation/ shock to the monetary policy variable, the forecast error variance decomposition (FEVDs) and impulse response functions (IRFs) depict the State level responsiveness in terms of output variability to the monetary shocks. Thus, portraying the underlying spatial variability. Extending the above model for the present problem, the SVAR framework is modified to include the State credit growth as the foremost endogenous variable.

$$Z_t = [C_t^i, Y_t^i, Y_t, (M3/P)_t, (Pf/P)_t]' \quad \text{---- (2)}$$

Where, C_t^i represents the credit growth of State i at time t,

Structural restrictions are placed on the variables for exact identification are depicted in the matrix 'A' given below. The restrictions form an upper triangular matrix.

$$A = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

From the above framework (2), the VAR model is estimated for each State and the variables are tested for stationarity required for estimating the VAR model [30]. The cumulative impulse response function (CIRF) and the forecast error variance decomposition (FEVD) with structural decompositions are thus arrived. The CIRFs and FEVDs for the credit growth are computed for each States for a given shock in monetary policy variable. The analysis of CIRFs and FEVDs depicts the variability in responsiveness of each State to the monetary policy shock, portraying spatial variability if any. As a first step the model is run for the aggregate credit growth and later incorporates bank group and sectoral credit dimensions. Further as a robustness check, the monetary policy variable i.e., M3 growth is replaced with Call rates.

[30] All estimations are done using STATA 13 / EViews software package.

4.3.2. Data

The time period of analysis for this objective is from 1990 to 2020, spanning the post-liberalisation period of the Indian economy. The data on the following variables is sourced from the Data Base on Indian Economy (DBIE), RBI and Centre for Monitoring Indian Economy (CMIE) for the above-mentioned period.

1. **State level credit growth:** The credit growth of fifteen major Indian States is considered for analysis. These States together represent 90 to 95 per cent of the population and credit outstanding. The list of States and codes used for representation are given in **Table 4.1.** The data on sectoral credit for the following sectors is also collated at the State level viz. Agriculture (AGL), Industry (IND), Transport Operators (TSP), Trade (TRD), Professional and Other Services (PRO), Personal Loans (PER), and Finance (FIN). Also, the data for two major banking groups viz. Public Sector Banks (PSBs) and Private Sector Banks (PVBS) is collected for the above dimensions at the State-sector levels.
2. **Growth in output:** The growth rate in real National Domestic Product (NDP) from 1990 to 2020 at the national level is sourced from CMIE. Similarly, the State wise growth rate in real State Domestic Product (NSDP) is also sourced for the select 15 States.
3. **Monetary Policy Variables:** The growth rate in broad Money (M3) is taken to represent the growth rate of money supply in the economy and is adjusted with inflation growth rate (Consumer Price Index _ Industrial Workers) to obtain the growth rate in real money supply. Also, the call rates i.e., annual weighted average call lending rate published by the RBI is taken as an alternative measure of monetary policy variable.
4. **Inflation:** Growth in consumer price index for industrial workers and the consumer price food inflation index are used for computing growth rates in inflation.

Table 4.1: List of States used for analysis and their representation codes

Sl.	State Name	State Code
1	Andhra Pradesh	AP
2	Bihar	BH
3	Delhi (National Capital Territory)	DL
4	Gujarat	GJ
5	Haryana	HR
6	Kerala	KL
7	Karnataka	KT
8	Maharashtra	MH
9	Madhya Pradesh	MP
10	Odisha	OR
11	Rajasthan	RJ
12	Punjab	PN
13	Tamil Nadu	TN
14	Uttar Pradesh	UP
15	West Bengal	WB

Notes: Andhra Pradesh represents both residual State of Andhra Pradesh and Telangana States post their bifurcation in 2014. Similarly, the States of Uttar Khand and Uttar Pradesh are represented by Uttar Pradesh, Bihar and Jharkhand by Bihar and Chhattisgarh and Madhya Pradesh by Madhya Pradesh, which were bifurcated in 2000. The data has been aggregated for these States for uniformity in comparison.

All variables are tested for stationarity using Augmented Dicky Fuller (ADF) test and are found to be stationary I (1) level. Hence, the VAR model is estimated in first differences of the variables mentioned in specification (2) above. Further the VAR estimations satisfy the stability conditions.

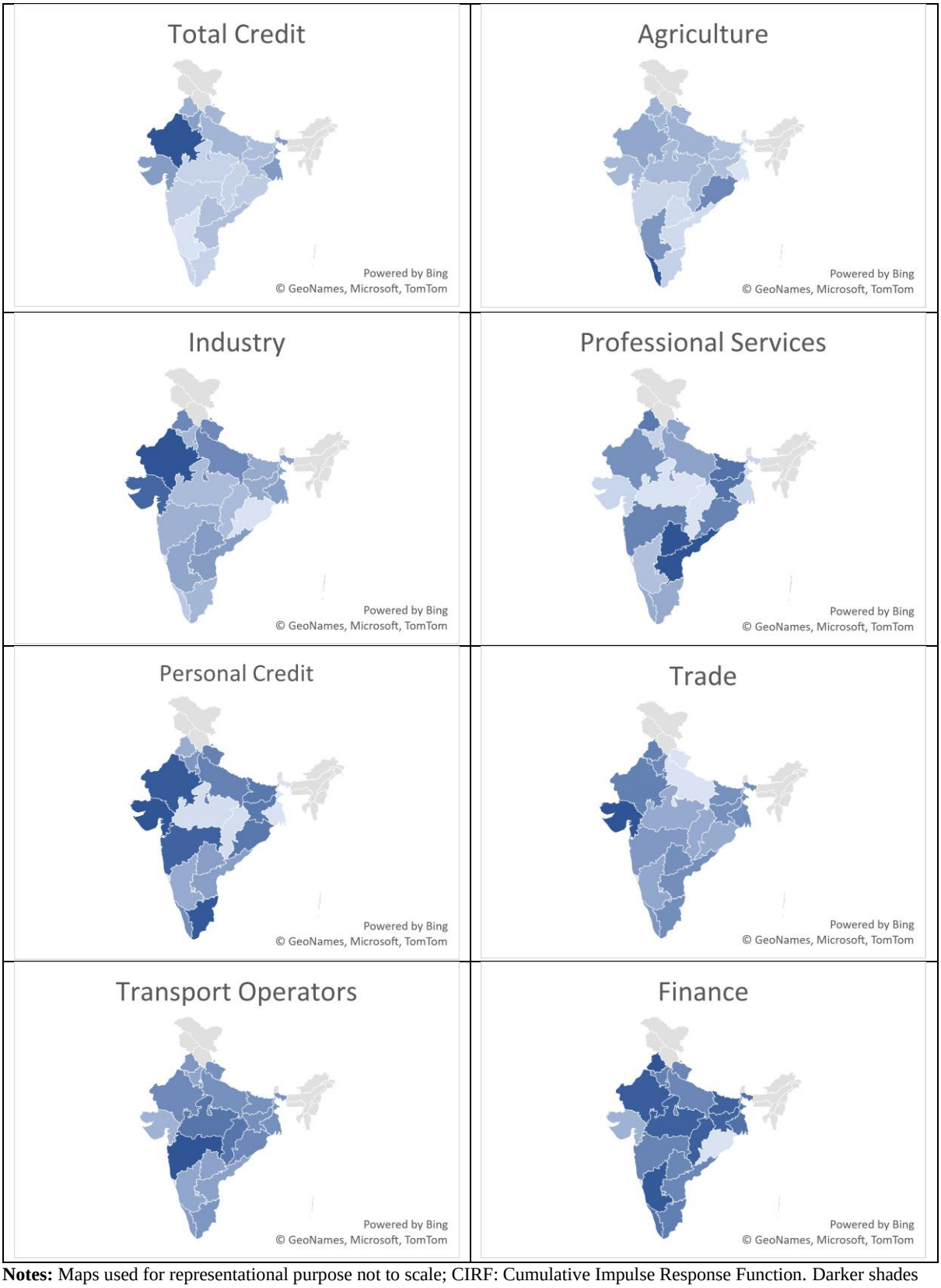
4.4. Results and Discussion

From the VAR estimates, to assess the responsiveness of credit growth to monetary shocks, the Cumulative Impulse Response Functions (CIRF) and Forecast Error Variance Decompositions (FEVD) are collated for each State over the ten-year horizon. The CIRFs and FEVDs of Scheduled Commercial Banks (SCBs) both at aggregate level at sectoral level are presented in Tables 12 and 13.[31] The CIRF of credit growth to shock/ innovation in the monetary policy variable (M3 growth in this case) clearly shows variability across States. Thus, corroborating the evidence from earlier studies (Nachane et al., 2002; Ghosh 2019) that spatial variability in monetary policy transmission through bank lending channel exists in the Indian case both at aggregate and sectoral levels. Similar trends are observed in bank group and sector wise cumulative impulse response functions and forecast error variance decomposition estimates.[32] A visual representation of cumulative impulse response of credit growth of SCBs to shock in M3 at the 10th year is depicted in **figure 4.1**, clearing indicating high degree of variability among Indian States in the responsiveness of their credit growth both at the aggregate Total credit and sectoral levels.

Further, the FEVD of credit growth clearly depicts the spatial variability in monetary transmission across Indian States. To illustrate, from **Table 4.2** which depicts the State and Sector FEVDs of credit growth at the 10th year, it is evident that for SCBs, the credit growth in States like Andhra Pradesh, Tamil Nadu, Rajasthan, Gujarat, Haryana shows higher responsiveness. As opposed the credit growth in States like Maharashtra, Karnataka, Odisha, Uttar Pradesh shows lower responsiveness. Similarly, at the sectoral level the spatial variability is quite stark.

[31] The CIRF values in the Tables 4.3 & 4.4 clearly depict to the presence of the spatial variability across States.
[32] The Bank group wise (Public and Private sector banks) and sector wise CIRF and FEVD over the 10-year horizon are provided in **Annexure C**.

Figure 4.1: Variations in CIRFs (10th Year) impulse (M3) to response (Credit growth)



Notes: Maps used for representational purpose not to scale; CIRF: Cumulative Impulse Response Function. Darker shades indicate higher responsiveness of credit growth to monetary shock.

Table 4.2: Sector and State wise Forecast Error Variance Decomposition of Credit Growth at 10th Year

Sector/ State	TCR	AGL	IND	PRO	PER	TRD	TSP	FIN	Sectors with FEVD >0.10	Share in Total Credit
AP	0.10	0.15	0.04	0.18	0.13	0.04	0.13	0.09	5	9.2%
BH	0.07	0.03	0.03	0.09	0.05	0.17	0.02	0.13	2	2.0%
DL	0.10	0.08	0.18	0.05	0.03	0.07	0.05	0.06	2	13.0%
GJ	0.03	0.02	0.12	0.05	0.13	0.10	0.01	0.27	4	5.8%
HR	0.12	0.20	0.07	0.04	0.04	0.11	0.02	0.19	4	2.9%
KR	0.05	0.40	0.07	0.26	0.06	0.06	0.03	0.08	2	3.4%
KT	0.08	0.22	0.04	0.02	0.03	0.02	0.05	0.09	1	7.1%
MH	0.07	0.08	0.06	0.06	0.09	0.02	0.15	0.07	1	23.9%
MP	0.08	0.03	0.02	0.03	0.12	0.03	0.02	0.28	2	3.7%
OR	0.01	0.07	0.06	0.04	0.04	0.02	0.05	0.16	1	1.4%
PN	0.03	0.01	0.11	0.03	0.07	0.17	0.07	0.06	2	2.3%
RJ	0.22	0.09	0.28	0.15	0.02	0.05	0.01	0.10	4	3.4%
TN	0.28	0.10	0.03	0.16	0.06	0.21	0.04	0.31	4	9.3%
UP	0.02	0.07	0.07	0.05	0.06	0.10	0.04	0.03	1	5.4%
WB	0.04	0.09	0.03	0.03	0.22	0.12	0.13	0.05	3	4.1%
Coefficient of Variation	0.83	0.89	0.83	0.83	0.67	0.69	0.81	0.67		
Share in Total Credit	100%	13%	31%	8%	24%	10%	2%	10%		
States with FEVD >0.10	5	4	4	4	4	7	3	7		

Notes: TCR: Total Credit; AGL: Agricultural Credit; IND: Industrial Credit; PRO: Professional and Other Services; PER: Personal Credit; TRD: Trade; TSP: Transport Operators; FIN: Finance. Sectors where with FEVD values higher than 0.10 are underlined.

For illustrative purposes, the share of sectors/ States in total credit is computed as on 31st March 2020.

At the aggregate level, there is wide variability in the FEVDs of Total Credit growth across States. Only five States show higher responsiveness viz. Andhra Pradesh, Tamil Nadu, Rajasthan, Gujarat, and Haryana (FEVDs >0.10); while other States show a lower responsiveness. Interestingly large States like Maharashtra, Uttar Pradesh, West Bengal; Madhya Pradesh display a lower responsiveness. The Coefficient of variance of FEVDs is at 0.83 for Total Credit corroborating the wide ranging 'Spatial Variability' of Monetary Transmission through the bank lending channel.

Further, at the sector level too, the spatial variability is evident. Higher responsiveness of credit growth is observed in Trade and Finance sectors, where 7 States have FEVD values of higher than 0.10. In the key sectors like Agriculture and Industry only 4 States show higher responsiveness. States like Andhra Pradesh, Kerala, Karnataka, and Haryana show higher responsiveness in agriculture, while Delhi, Gujarat, Punjab, and Rajasthan show higher responsiveness in Industrial credit. Further, as observed in stylized facts (chapter 2), the Services and Personal consumption sectors have emerged as main growth drivers in the post-liberalization period, these sectors have been focussed segments for banks.[33] Even in these sectors, higher responsiveness is witnessed in a few States only. Andhra Pradesh, Tamil Nadu, Karnataka, and Rajasthan show higher responsiveness in Professional and Other services; while in Personal credit Andhra Pradesh, Gujarat, West Bengal, and Madhya Pradesh show higher responsiveness. In case of transport operators, only 3 States show higher responsiveness viz. Andhra Pradesh, Maharashtra, and West Bengal. Interestingly, personal credit and finance sectors have lower variability (co-efficient of variation) of FEVDs among States; this underscores the emerging role of Personal Credit and Finance in the post-liberalization period.

[33] The share of service sector components viz. Personal Loans, Professional Services, and Finance in total credit increased from 12 per cent in 1990 to 42 per cent by 2020.

Further, as observed at the aggregate level, the spatial variability is evident, at the bank group level too. Interestingly the spatial variability observed across States in terms of CIRFs (10th year) in case of PSBs differs from that of PVBs (**Figure 4.2**). Similarly, the FEVDs of credit growth (10th year) also differ between PSBs and PVBs across States (**Figure 4.3**). The differences in CIRFs, FEVDs are also observed at the sectoral level (**Annexure C**), corroborating the stylized facts (chapter 2) and underscoring difference in the credit growth strategies adopted by the dominant bank groups, resulting in likely spatial variability in monetary transmission through the bank credit channel.

Figure 4.2: PSBs and PVBs Variations in CIRFs (10th Year) impulse (M3) to response (Credit growth)

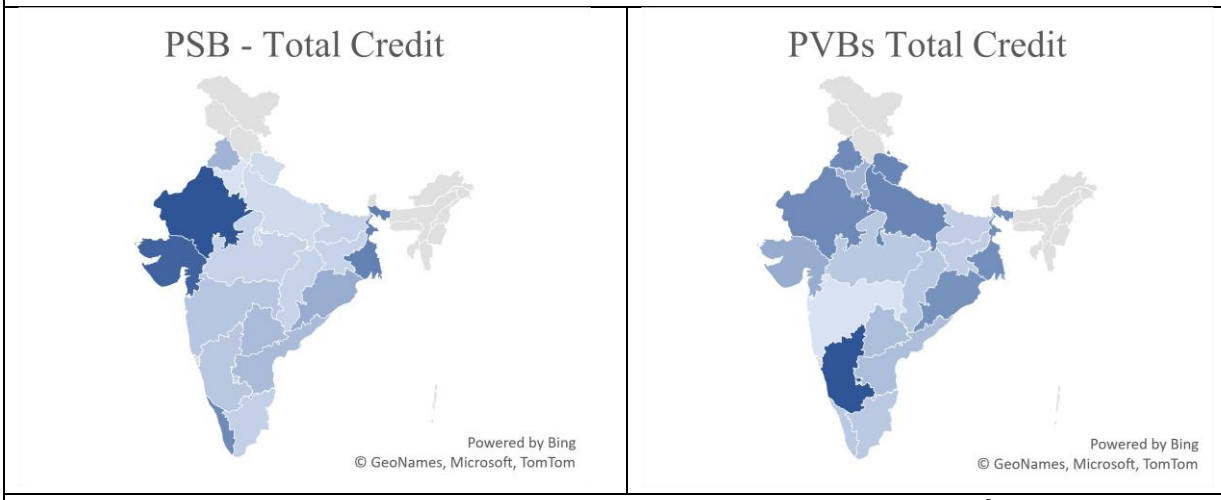


Figure 4.3: State and Bank Group wise FEVDs of Credit Growth at 10th Year

Notes: Refer table 4.1 and maps used for representational purpose only not to scale.

Table 4.3: CIRF (Structurally Decomposed) (M3 to Credit Growth): SCBs

CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	1.33	0.32	1.45	1.00	1.59	-0.34	0.16	0.44	-1.93	0.32	0.98	0.61	1.10	0.38	1.95
2	-0.82	-1.49	-1.11	0.21	-0.72	-0.85	-2.04	-0.70	0.75	-0.11	0.75	2.34	-1.94	-0.11	0.41
3	0.14	0.78	-1.01	1.57	1.24	0.33	-0.03	-0.96	-0.38	0.10	-0.81	3.31	0.73	0.76	1.15
4	0.52	1.26	-1.41	1.32	1.69	-0.57	-0.42	0.47	-0.15	0.54	1.39	1.95	-1.02	0.43	1.22
5	0.07	-1.26	0.16	0.51	-0.23	-0.34	-0.69	-0.54	-0.32	0.89	0.51	3.09	0.21	0.30	0.96
6	-0.12	0.49	-1.56	1.08	1.10	-0.19	-0.47	-1.20	-0.12	-0.39	-0.04	2.00	-0.64	0.43	1.25
7	0.37	0.43	-0.59	1.19	1.17	-0.37	-0.73	0.52	-0.22	0.36	0.64	2.55	-0.24	0.43	1.07
8	0.02	-0.17	-0.46	0.93	0.39	-0.29	-0.50	-0.75	-0.20	0.59	0.63	2.82	-0.37	0.36	0.97
9	0.16	0.16	-1.29	1.03	0.93	-0.30	-0.54	-0.55	-0.19	0.45	0.20	2.31	-0.36	0.47	1.23
10	0.19	0.24	-0.59	0.98	0.93	-0.32	-0.61	-0.18	-0.24	-0.09	0.55	2.59	-0.26	0.40	1.04
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-1.55	-2.15	-0.80	-0.55	-1.42	2.61	-0.63	-2.26	11.12	3.93	0.41	0.49	-2.15	-1.40	-0.34
2	-3.76	-1.28	5.04	-1.43	-1.80	3.32	3.09	-0.58	-8.37	0.52	-0.67	-0.88	-4.13	0.55	-3.99
3	-2.07	0.24	-0.02	0.43	1.00	5.49	0.17	-5.26	3.63	1.79	0.18	1.73	-0.87	-0.68	-5.56
4	-2.73	-2.24	2.60	-1.06	-3.31	6.06	2.14	-1.07	6.09	2.95	-0.17	-1.27	-2.27	0.02	-0.18
5	-2.93	-0.90	3.65	-0.69	0.66	2.53	1.05	-2.16	-6.16	2.32	-0.14	0.85	-2.25	-0.42	-4.69
6	-2.55	-1.46	0.10	-0.23	-1.75	5.13	1.44	-3.26	4.90	2.01	-0.41	0.21	-2.18	-0.14	-2.99
7	-2.60	-1.00	3.07	-0.97	-1.18	5.78	1.44	-2.73	1.79	2.10	0.10	-0.36	-2.15	-0.30	-2.64
8	-2.92	-1.17	2.46	-0.43	-0.47	3.44	1.35	-1.59	-1.97	2.21	-0.17	0.71	-2.19	-0.23	-3.79
9	-2.54	-1.36	1.43	-0.55	-1.64	4.71	1.38	-3.24	4.11	2.38	-0.21	-0.26	-2.13	-0.21	-2.83
10	-2.73	-1.16	2.60	-0.69	-0.50	5.33	1.42	-2.38	-0.71	2.19	-0.21	0.38	-2.14	-0.31	-3.20
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	3.21	-1.76	3.70	3.99	-0.79	-1.63	-0.68	1.91	-1.67	-3.78	3.45	1.46	0.61	2.85	1.22
2	0.05	0.43	-0.26	4.77	-1.92	-0.75	0.85	-0.44	0.73	0.48	0.49	5.57	-0.92	1.36	1.31
3	1.54	1.84	0.44	4.61	1.26	-1.31	1.69	-0.50	-1.88	-0.39	4.94	6.33	-0.15	3.21	0.84
4	1.40	0.23	3.18	6.51	0.29	-1.61	-0.27	1.09	-1.69	-5.00	1.37	4.43	0.12	2.11	1.53
5	1.60	-0.34	0.17	2.78	-0.52	-0.84	1.55	0.61	0.45	1.29	3.26	5.81	0.14	2.44	1.16
6	1.44	1.29	1.92	5.11	-0.63	-1.66	0.30	-0.71	-2.07	-1.22	3.13	5.06	-0.66	2.40	1.12
7	0.94	0.21	1.92	4.70	0.06	-1.11	1.00	0.71	-0.71	-3.25	2.10	5.10	0.22	2.49	1.36
8	1.64	0.69	0.59	4.73	0.02	-1.20	0.73	0.31	-0.54	-0.78	3.15	5.57	-0.24	2.33	1.10
9	1.45	0.38	1.75	4.78	-0.17	-1.43	0.76	0.23	-1.70	-0.32	2.87	5.11	-0.11	2.46	1.32
10	1.31	0.53	1.66	4.42	-0.18	-1.22	0.79	0.14	-0.50	-2.72	2.49	5.41	-0.18	2.41	1.16
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	9.80	8.03	0.55	-1.70	0.64	4.96	0.58	4.35	-6.78	5.83	0.54	-1.47	4.38	2.30	0.38
2	6.30	1.72	2.73	-2.61	-2.86	0.22	1.05	6.20	-1.21	3.94	13.85	4.74	-2.44	0.30	1.21
3	6.99	9.52	-0.23	-5.11	-0.91	3.73	-2.71	-0.14	-3.78	3.59	-1.51	5.72	3.52	2.32	-6.44
4	5.04	5.57	-1.03	4.41	-1.05	1.22	1.48	2.96	-4.49	5.51	7.18	2.22	-1.41	2.98	0.45
5	9.48	5.77	3.97	-3.96	-1.55	3.90	-0.91	7.80	-2.01	5.59	10.46	4.44	3.30	0.52	0.12
6	7.65	7.50	-2.56	-2.92	-1.60	0.61	-0.68	3.02	-6.05	3.21	2.58	4.27	-0.91	2.31	-4.44
7	6.17	5.53	3.01	0.65	-1.01	3.78	0.40	3.21	-0.87	5.12	6.02	3.62	1.76	2.56	-0.32
8	7.53	6.57	-0.75	-2.96	-1.52	1.74	-0.78	3.08	-5.12	5.43	6.85	3.88	1.25	1.22	-1.21
9	6.52	6.63	1.51	-0.86	-1.40	2.99	-0.37	4.38	-3.70	3.88	6.35	4.16	0.12	1.91	-2.34
10	8.42	6.12	0.21	-1.57	-1.25	1.77	0.05	4.81	-2.57	4.80	5.59	3.80	1.77	2.40	-1.55

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-1.47	-0.59	-1.00	-4.40	-3.02	-3.62	-3.22	0.43	-2.45	0.30	-1.89	-1.08	-0.27	-0.61	-3.81
2	-3.86	-2.38	-3.74	-1.36	-2.06	-2.54	-1.96	-1.19	-6.59	-2.65	-4.52	-0.92	-1.79	-2.29	-6.78
3	-1.56	-1.47	-3.98	3.00	-2.10	-1.06	-2.79	-0.12	-1.20	-0.81	-2.19	-0.11	1.69	-1.43	-2.18
4	-3.11	-0.69	-2.50	-3.92	-2.96	-2.37	-3.24	-2.07	-5.25	-1.47	-3.35	-0.65	-1.76	-2.10	-6.45
5	-2.49	-2.00	-3.56	-0.14	-1.74	-2.62	-2.52	0.17	-4.64	-1.25	-2.86	-1.06	-0.64	-1.15	-3.67
6	-2.71	-1.36	-3.19	-0.37	-2.56	-1.83	-2.84	-1.43	-3.30	-1.48	-3.38	-0.02	0.71	-2.35	-5.01
7	-2.40	-1.29	-2.77	-1.40	-2.43	-2.14	-3.04	-0.56	-4.33	-1.18	-2.87	-1.00	-1.12	-1.33	-4.54
8	-2.70	-1.57	-3.28	-0.22	-2.15	-2.41	-2.68	-0.99	-4.30	-1.52	-3.00	-0.46	-0.37	-1.92	-4.58
9	-2.65	-1.35	-3.08	-1.53	-2.46	-2.08	-2.94	-0.81	-3.78	-1.19	-3.30	-0.65	-0.16	-1.69	-4.81
10	-2.54	-1.47	-3.06	-0.47	-2.28	-2.05	-2.86	-0.85	-4.28	-1.45	-2.92	-0.63	-0.58	-1.73	-4.41
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-2.45	2.88	-4.94	11.30	1.43	0.71	-1.92	-0.17	-1.15	-2.60	-3.78	2.88	5.34	-3.26	-0.83
2	1.65	-3.66	1.47	-0.01	-1.45	-2.37	-1.40	-1.59	-3.79	-1.24	8.69	-0.39	-5.42	-9.47	-1.66
3	-0.12	2.41	-0.54	5.48	5.66	0.22	-2.05	0.89	-0.57	-1.48	-5.65	1.79	5.23	-3.06	2.80
4	-0.51	1.30	0.35	8.11	-0.79	0.32	-0.96	0.42	-3.44	-2.44	-0.37	3.27	-2.48	-6.41	-3.71
5	1.09	-1.04	-0.70	1.82	1.18	-0.33	-2.04	-1.47	-1.60	-1.47	3.95	0.84	0.28	-7.95	1.80
6	-1.18	1.17	-0.33	6.57	2.61	0.27	-1.67	0.07	-2.04	-1.64	-3.96	1.06	2.96	-3.38	-1.00
7	1.02	0.29	-0.04	5.03	0.45	-0.89	-1.22	0.81	-2.90	-2.00	2.09	2.40	-1.41	-8.09	-0.80
8	0.03	0.42	-0.33	5.01	1.92	-0.27	-2.03	-1.84	-1.42	-1.84	0.09	1.73	0.63	-5.03	0.60
9	-0.41	0.66	-0.33	4.70	1.59	0.34	-1.36	0.94	-2.75	-1.47	-1.39	1.41	0.84	-5.84	-1.38
10	0.43	0.22	-0.23	5.49	0.83	-0.38	-1.71	-0.43	-1.94	-2.08	1.60	1.62	0.44	-6.99	0.48
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-1.31	1.55	-12.09	-7.14	-3.29	-0.72	-7.93	5.98	4.85	0.61	-7.68	2.04	1.62	-1.24	-1.30
2	-6.07	0.70	-9.57	-5.38	-2.76	-3.74	-2.03	10.63	3.61	2.75	3.26	0.43	-4.30	0.94	5.05
3	1.85	-0.34	-5.82	-5.02	-2.31	0.39	-1.98	7.11	3.43	-0.62	-1.54	1.66	0.20	0.62	-6.78
4	-3.04	0.63	-16.25	-2.86	-2.94	-2.07	-4.55	13.40	4.83	3.05	-2.99	0.84	-0.49	2.92	4.91
5	-4.24	0.56	-9.71	-5.85	-3.24	-3.10	-3.76	4.63	5.12	-0.21	1.25	2.55	-0.94	-1.72	-1.55
6	-0.11	0.38	-6.64	-6.61	-2.53	0.05	-2.28	12.70	1.55	2.06	-1.98	-0.65	-1.04	2.07	-0.95
7	-2.99	0.37	-15.51	-2.93	-2.77	-2.02	-4.21	7.26	7.14	0.77	-1.76	1.97	-0.66	1.35	1.25
8	-2.32	0.42	-8.82	-5.41	-3.01	-2.38	-3.02	10.74	2.43	1.63	0.32	1.89	-0.45	-0.47	-0.43
9	-2.00	0.43	-8.94	-5.13	-2.72	-1.08	-3.53	7.96	4.33	0.72	-2.00	0.30	-1.40	2.05	-0.46
10	-2.38	0.46	-13.19	-5.16	-2.87	-1.64	-3.31	10.37	4.93	1.73	-0.78	1.50	-0.58	0.48	0.49
CIRF (Structurally Decomposed) (M3 -> Credit Growth): SCBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	5.53	-31.95	-9.63	-5.95	9.66	10.71	-1.41	3.59	19.18	6.66	23.62	-6.95	7.84	-5.78	6.21
2	-4.29	18.83	-5.70	-25.12	-10.78	-2.00	15.41	-0.66	4.64	-9.01	-5.35	12.33	-8.45	-3.57	2.65
3	2.23	-1.85	1.79	24.26	3.92	2.21	0.65	-2.77	-1.69	-28.27	10.33	-5.50	3.58	4.54	4.04
4	-3.25	-29.39	-4.49	-11.79	-2.33	6.33	10.06	5.33	10.90	-13.14	12.60	4.83	3.15	3.18	3.46
5	2.49	26.79	-4.20	-0.03	-0.74	0.38	5.25	-3.12	6.52	-3.08	8.85	7.31	-2.35	-6.49	3.11
6	-2.07	-24.84	-1.92	9.43	-1.16	2.75	8.98	0.60	5.22	-22.31	4.59	-5.33	1.41	5.54	5.63
7	0.52	0.92	-3.49	-19.07	-0.95	3.32	5.40	2.37	7.77	-16.14	11.56	6.20	1.14	-1.41	2.79
8	-1.13	2.99	-4.08	12.28	-0.46	2.90	8.13	-2.03	5.76	-8.61	8.33	5.90	0.29	0.08	4.22
9	0.33	-15.97	-2.05	-1.17	-2.27	2.34	6.21	1.71	5.82	-15.82	8.41	-4.43	0.24	1.36	4.13
10	-0.50	5.90	-3.46	-8.47	0.55	2.87	7.60	0.05	6.38	-17.13	8.49	6.80	0.93	-0.43	3.32

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

Table 4.4: Forecast Error Variance Decomposition (M3 to Credit Growth): SCBs

Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.01	0.06	0.02	0.04	0.00	0.00	0.02	0.01	0.01	0.00	0.25	0.00	0.02	0.05
2	0.07	0.01	0.11	0.02	0.03	0.00	0.00	0.04	0.05	0.01	0.00	0.27	0.03	0.01	0.03
3	0.11	0.02	0.11	0.02	0.07	0.01	0.05	0.04	0.08	0.01	0.00	0.24	0.19	0.02	0.04
4	0.11	0.04	0.10	0.03	0.09	0.03	0.08	0.03	0.08	0.01	0.01	0.22	0.26	0.02	0.04
5	0.11	0.04	0.10	0.03	0.09	0.05	0.08	0.04	0.08	0.01	0.03	0.22	0.27	0.02	0.04
6	0.10	0.06	0.10	0.03	0.11	0.05	0.08	0.05	0.08	0.01	0.03	0.22	0.28	0.02	0.04
7	0.10	0.07	0.10	0.03	0.12	0.05	0.07	0.05	0.08	0.01	0.03	0.22	0.28	0.02	0.04
8	0.10	0.07	0.10	0.03	0.12	0.05	0.08	0.06	0.08	0.01	0.03	0.22	0.28	0.02	0.04
9	0.10	0.07	0.10	0.03	0.12	0.05	0.08	0.07	0.08	0.01	0.03	0.22	0.28	0.02	0.04
10	0.10	0.07	0.10	0.03	0.12	0.05	0.08	0.07	0.08	0.01	0.03	0.22	0.28	0.02	0.04
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.13	0.03	0.02	0.00	0.02	0.53	0.09	0.05	0.00	0.07	0.00	0.00	0.01	0.00	0.06
2	0.12	0.02	0.03	0.00	0.02	0.51	0.13	0.05	0.01	0.05	0.00	0.00	0.02	0.03	0.06
3	0.14	0.02	0.05	0.01	0.01	0.47	0.18	0.04	0.02	0.07	0.01	0.01	0.04	0.06	0.06
4	0.15	0.02	0.07	0.02	0.05	0.42	0.21	0.07	0.02	0.07	0.01	0.04	0.09	0.07	0.06
5	0.15	0.03	0.07	0.02	0.13	0.40	0.22	0.09	0.02	0.08	0.01	0.07	0.10	0.07	0.07
6	0.15	0.03	0.07	0.02	0.18	0.41	0.22	0.08	0.03	0.07	0.01	0.09	0.10	0.07	0.09
7	0.15	0.03	0.08	0.02	0.19	0.40	0.22	0.08	0.03	0.07	0.01	0.09	0.10	0.07	0.09
8	0.15	0.03	0.08	0.02	0.19	0.40	0.22	0.08	0.03	0.07	0.01	0.09	0.10	0.07	0.09
9	0.15	0.03	0.08	0.02	0.19	0.40	0.22	0.08	0.03	0.07	0.01	0.09	0.10	0.07	0.09
10	0.15	0.03	0.08	0.02	0.20	0.40	0.22	0.08	0.03	0.07	0.01	0.09	0.10	0.07	0.09
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.00	0.01	0.04	0.13	0.01	0.06	0.02	0.01	0.00	0.00	0.08	0.28	0.00	0.07	0.05
2	0.02	0.03	0.05	0.09	0.03	0.05	0.03	0.05	0.00	0.01	0.06	0.33	0.00	0.05	0.03
3	0.04	0.03	0.12	0.08	0.03	0.05	0.03	0.06	0.01	0.02	0.07	0.31	0.02	0.06	0.02
4	0.04	0.03	0.12	0.07	0.07	0.05	0.03	0.05	0.01	0.02	0.10	0.30	0.03	0.06	0.02
5	0.04	0.03	0.14	0.08	0.07	0.05	0.03	0.06	0.01	0.03	0.11	0.29	0.02	0.07	0.02
6	0.04	0.03	0.17	0.11	0.07	0.06	0.04	0.05	0.02	0.05	0.11	0.29	0.02	0.07	0.02
7	0.04	0.03	0.18	0.12	0.07	0.06	0.04	0.06	0.02	0.06	0.11	0.29	0.03	0.07	0.02
8	0.04	0.03	0.17	0.12	0.07	0.07	0.04	0.06	0.02	0.06	0.11	0.28	0.03	0.07	0.02
9	0.04	0.03	0.18	0.12	0.07	0.07	0.04	0.06	0.02	0.06	0.11	0.28	0.03	0.07	0.02
10	0.04	0.03	0.18	0.12	0.07	0.07	0.04	0.06	0.02	0.06	0.11	0.28	0.03	0.07	0.03
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.27	0.11	0.00	0.00	0.02	0.03	0.00	0.05	0.01	0.04	0.01	0.16	0.00	0.06	0.01
2	0.21	0.06	0.00	0.00	0.04	0.25	0.00	0.03	0.01	0.03	0.01	0.16	0.04	0.04	0.01
3	0.22	0.07	0.01	0.00	0.04	0.25	0.00	0.03	0.02	0.03	0.01	0.15	0.11	0.05	0.01
4	0.20	0.09	0.01	0.00	0.04	0.24	0.01	0.04	0.02	0.03	0.02	0.15	0.13	0.05	0.02
5	0.19	0.09	0.01	0.03	0.04	0.24	0.01	0.04	0.02	0.03	0.02	0.15	0.13	0.04	0.03
6	0.19	0.09	0.02	0.05	0.04	0.24	0.02	0.05	0.02	0.03	0.02	0.15	0.15	0.05	0.02
7	0.19	0.09	0.03	0.05	0.04	0.25	0.02	0.06	0.02	0.04	0.03	0.15	0.16	0.05	0.03
8	0.19	0.09	0.04	0.05	0.04	0.26	0.02	0.06	0.03	0.04	0.03	0.15	0.16	0.05	0.03
9	0.19	0.09	0.05	0.05	0.04	0.26	0.02	0.06	0.03	0.04	0.03	0.15	0.16	0.05	0.03
10	0.18	0.09	0.05	0.05	0.04	0.26	0.02	0.06	0.03	0.04	0.03	0.15	0.16	0.05	0.03

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.08	0.02	0.01	0.00	0.02	0.04	0.04	0.05	0.13	0.02	0.05	0.00	0.00	0.05	0.14
2	0.06	0.03	0.01	0.05	0.03	0.04	0.03	0.09	0.12	0.03	0.05	0.00	0.00	0.06	0.12
3	0.09	0.04	0.02	0.06	0.03	0.04	0.03	0.08	0.12	0.04	0.07	0.00	0.00	0.06	0.14
4	0.12	0.04	0.02	0.07	0.03	0.05	0.03	0.08	0.14	0.04	0.07	0.01	0.03	0.06	0.18
5	0.13	0.04	0.03	0.12	0.03	0.06	0.03	0.08	0.15	0.04	0.08	0.01	0.05	0.05	0.21
6	0.13	0.05	0.03	0.13	0.03	0.06	0.03	0.09	0.13	0.04	0.07	0.01	0.05	0.06	0.22
7	0.13	0.05	0.03	0.13	0.04	0.06	0.03	0.09	0.13	0.04	0.07	0.01	0.05	0.06	0.22
8	0.13	0.05	0.03	0.13	0.04	0.06	0.03	0.09	0.12	0.04	0.07	0.02	0.05	0.06	0.22
9	0.13	0.05	0.03	0.13	0.04	0.06	0.03	0.09	0.12	0.04	0.07	0.02	0.06	0.06	0.22
10	0.13	0.05	0.03	0.13	0.04	0.06	0.03	0.09	0.12	0.04	0.07	0.02	0.06	0.06	0.22
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.02	0.01	0.00	0.02	0.01	0.01	0.03	0.00	0.02	0.03	0.01	0.04	0.00	0.11	0.00
2	0.06	0.02	0.04	0.03	0.01	0.00	0.02	0.00	0.01	0.02	0.01	0.02	0.03	0.08	0.00
3	0.05	0.12	0.07	0.08	0.02	0.05	0.01	0.00	0.02	0.02	0.09	0.04	0.11	0.09	0.00
4	0.04	0.18	0.07	0.08	0.07	0.06	0.01	0.01	0.02	0.02	0.16	0.04	0.17	0.10	0.03
5	0.04	0.16	0.07	0.09	0.11	0.05	0.01	0.01	0.03	0.02	0.15	0.04	0.20	0.10	0.08
6	0.04	0.17	0.07	0.10	0.10	0.05	0.01	0.01	0.03	0.02	0.15	0.04	0.20	0.09	0.11
7	0.04	0.17	0.07	0.10	0.10	0.05	0.01	0.01	0.03	0.02	0.16	0.04	0.20	0.10	0.11
8	0.04	0.17	0.07	0.10	0.11	0.06	0.02	0.01	0.03	0.02	0.17	0.05	0.21	0.10	0.11
9	0.04	0.17	0.07	0.10	0.11	0.06	0.02	0.01	0.03	0.02	0.17	0.05	0.21	0.10	0.11
10	0.04	0.17	0.07	0.10	0.11	0.06	0.02	0.02	0.03	0.02	0.17	0.05	0.21	0.10	0.12
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.02	0.00	0.06	0.00	0.02	0.01	0.00	0.23	0.03	0.00	0.01	0.00	0.00	0.02	0.00
2	0.02	0.01	0.04	0.01	0.02	0.01	0.03	0.19	0.01	0.00	0.05	0.00	0.00	0.03	0.00
3	0.04	0.01	0.04	0.01	0.02	0.01	0.05	0.14	0.01	0.01	0.07	0.00	0.03	0.03	0.02
4	0.09	0.01	0.04	0.01	0.02	0.02	0.05	0.12	0.01	0.02	0.07	0.00	0.04	0.02	0.08
5	0.11	0.02	0.04	0.01	0.02	0.02	0.05	0.12	0.01	0.04	0.07	0.00	0.04	0.02	0.12
6	0.11	0.02	0.05	0.01	0.02	0.02	0.05	0.13	0.01	0.05	0.07	0.00	0.04	0.03	0.13
7	0.12	0.02	0.05	0.01	0.02	0.03	0.05	0.14	0.01	0.05	0.07	0.01	0.04	0.04	0.13
8	0.13	0.02	0.05	0.01	0.02	0.03	0.05	0.14	0.02	0.05	0.07	0.01	0.04	0.04	0.13
9	0.13	0.02	0.05	0.01	0.02	0.03	0.05	0.15	0.02	0.05	0.07	0.01	0.04	0.04	0.13
10	0.13	0.02	0.05	0.01	0.02	0.03	0.05	0.15	0.02	0.05	0.07	0.01	0.04	0.04	0.13
Forecast Error Variance Decomposition (M3 -> Credit Growth): SCBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.02	0.00	0.00	0.07	0.03	0.00	0.07	0.00	0.01	0.24	0.01	0.02	0.00	0.02	0.07
2	0.05	0.04	0.05	0.10	0.15	0.04	0.07	0.01	0.16	0.30	0.02	0.05	0.05	0.03	0.05
3	0.07	0.07	0.04	0.10	0.20	0.07	0.08	0.02	0.24	0.20	0.06	0.08	0.23	0.02	0.05
4	0.08	0.06	0.05	0.20	0.21	0.07	0.09	0.02	0.23	0.17	0.06	0.09	0.30	0.02	0.05
5	0.08	0.07	0.06	0.24	0.21	0.08	0.09	0.04	0.28	0.17	0.06	0.09	0.30	0.02	0.05
6	0.09	0.10	0.06	0.23	0.20	0.08	0.09	0.06	0.28	0.16	0.06	0.09	0.31	0.02	0.05
7	0.09	0.13	0.06	0.22	0.20	0.08	0.09	0.06	0.28	0.16	0.06	0.09	0.31	0.03	0.05
8	0.09	0.13	0.06	0.25	0.20	0.08	0.09	0.06	0.28	0.16	0.06	0.10	0.31	0.03	0.05
9	0.09	0.13	0.06	0.27	0.19	0.08	0.09	0.07	0.28	0.16	0.06	0.10	0.31	0.03	0.05
10	0.09	0.13	0.06	0.27	0.19	0.08	0.09	0.07	0.28	0.16	0.06	0.10	0.31	0.03	0.05

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

4.5. Conclusion

The evidence from this objective indicates that the responsiveness of credit growth to the monetary impulses (growth in money supply) varies across Indian States reconfirming observations from the earlier studies (Nachane et al., 2002; Ghosh, 2019). Thus, establishing spatial differences in monetary policy transmission through the bank lending channel in the post-liberalisation period. Further, the SVAR framework was extended to examine the role of sector and bank group (ownership) dimensions to present a comprehensive view on spatial variability of monetary transmission at the disaggregated level. The results also indicate that the spatial variability of monetary transmission is also observed both at the sectoral and bank group level too.[34] The interesting feature of the spatial variability in monetary transmission is that, only a few States show higher responsiveness to the monetary impulses. To illustrate, only five States viz., Andhra Pradesh, New Delhi, Haryana, Rajasthan, and Tamil Nadu show higher responsiveness to monetary impulses (i.e., FEVDs at 10^{th} year being higher than 0.10). These States together account only for 30 per cent of the outstanding credit as on 31^{st} March 2020. In other words, the States showing lower responsiveness account for the 70 per cent of the outstanding credit. This may limit the overall efficacy of monetary transmission through the bank lending channel.

Further, only a few States show higher responsiveness at the level of individual sectors. To illustrate, only 7 States show higher responsiveness in case of trade and finance sectors. While in case of all other sectors, the higher responsiveness is observed even in a fewer number of States (4 or less). At the sectoral level, sectors showing higher responsiveness i.e., trade and finance contribute only to 20 per cent of the outstanding credit. This indicates that in key sectors

[34] The similar results are observed when alternate measures of monetary policy variables like call rates were used.

like agriculture, industry, professional and other services, and personal credit, the responsiveness of credit growth to monetary impulses is lower. As observed at the aggregate level, such muted responses may limit the efficacy of monetary transmission at the sectoral level too. Furthermore, at the bank group level too, the responsiveness of credit growth to monetary impulses is mixed both at the aggregate (total credit) and sectoral levels (Annexure C). To illustrate, for total credit, in case of PSBs, higher responsiveness is observed in Andhra Pradesh, Gujarat, Rajasthan, and Karnataka. As opposed to this, in case of PVBs, higher responsiveness is observed in Kerala, Madhya Pradesh, Maharashtra, Haryana, and Tamil Nadu. Similar differences between PSBs and PVBs are observed at the sectoral level too. Another interesting feature observed is the wide range of responsiveness of credit growth exhibited by different States within a given sector. To illustrate, the coefficient of variance of FEVDs at 10^{th} year ranges between 0.89 (Agriculture) to 0.67 (Personal Credit, and Finance Sectors) (**Table 4.2**). Though, the States may be exhibiting lower responsiveness i.e., based on value of FEVDs, such high degree of variability within a sector, alludes the fact that specific State and bank group/sectoral features may be influencing the observed responsiveness of credit growth to the monetary impulses. While earlier studies (Nachane et al., 2002; Ghosh, 2019; Bardhan and Sharma, 2022) indicated the degree of financial and industrial development, presence of small-scale industries as factors driving the responsiveness of credit growth. However, they do not provide a comprehensive account of the same at the disaggregated bank group and sectoral levels. Hence, in the next and final objective, the role of State specific macro-economic variables and banking industry features in influencing the responsiveness of Stat level credit growth to monetary impulses is examined. The analysis is extended to sectoral and bank group dimensions to present a comprehensive view and explanation of spatial variability of monetary transmission through the bank lending channel in India.

Chapter 5: Exploring Spatial Spill-overs in Monetary Transmission

5.1. Introduction

Monetary transmission through the bank lending channel in India displays spatial variability both at the aggregate and across sectoral / bank ownership dimensions. The results from the preceding chapter not only establish the spatial variability in the transmission of monetary impulses, but also corroborate the evidence from earlier studies in the Indian context. Further, given the geographical, social, and cultural diversity of the Indian economy, the consequent spatial variability in monetary transmission is rather expected. Earlier studies posited that State specific features like extent of industrialization, composition of firms i.e., small versus large, nature of financial deepening, and the infrastructure development as major reasons for the observed spatial variability in transmission of monetary policy impulses (Nachane et al., 2002; Dhal 2012; Ghosh, 2019). Another interesting feature borne out of the evidence from the earlier objectives is the potential role played by banks' in attuning the monetary policy impulses through their credit growth strategies. More specifically, the observed herding tendencies, the consequent concentration of branch networks to avoid delinquencies, the likely competition etc., often influence the banks' responsiveness to monetary policy impulses at the regional level (chapter 3). Further, the stylized facts (Chapter 2), indicate that in the post-liberalisation period, the bank ownership (public vs private) has significant influence on credit growth strategies as reflected in divergent sectors, customers and geographies focused by the dominant bank groups.[35]

[35] In the post-liberalization period, the PSBs concentrated their credit in a few States, often preferring large borrowers in industrial sector. While PVBs have diversified their credit across States focusing on retail / small borrowers in services and consumer loan segments. Besides, during the same period the per-capita size of credit of PSBs increased while that of PVBs decreased, despite the latter improving their share both in terms of number of accounts and amount.

Often, bank managements factor spatial features viz. concentration and composition of credit risks in their risk-reward optimisation framework (profit maximisation) (Bhuyan, 2022). In addition to the above, the nature and scope of competition across regions also influences a banks' credit expansion strategy in terms of branch network, choice of customer segment types i.e., small versus big borrowers, and finally the choice of focus sectors viz. services vs industry etc. Therefore, besides factoring macro-economic variables at the State level, it is pertinent to incorporate variables that are likely to influence a banks' credit delivery decision at the regional level viz. Competition, Concentration, and Composition of the credit / risks in the analytical framework.

Notwithstanding the influence of macro-economic and bank specific features, another important factor to consider in the analysis of spatial transmission of monetary policy is the impact of spill-overs of monetary policy impulses between the States. Studies elsewhere factor the role of spill-overs in analysing the transmission of monetary policy impulses across regions (Ridhwan et al., 2011; Svensson, 2013; Duran and Erdem, 2014). Taking cue from Tobler's first law of geography that "*everything is related to everything else, but near things are more related than distant things*", it can be expected that Indian States plausibly influence monetary transmission in their ***spatially related*** counter parts (Tobler, 1970). Primarily, States with shared borders are expected to be strongly inter dependent owing to their geographical proximity. Further, the spatial relations can also be characterised based on the nature of underlying phenomenon that resembles the dependencies between States. [36] However, an analytical framework that comprehensively

[36] Besides, geographical proximity, the spill-overs between two States can also be on account of features like relatively higher inter connectedness between two States in terms of trade connectivity i.e., movement of goods & services and the nature of financial deepening i.e., in terms of shared network of common bank branches etc.

analyses the role of both macro and bank specific factors including spill-overs in influencing the spatial variability of monetary transmission through the bank lending channel for India is missing.

Hence, reckoning the above, the present chapter aims to comprehensively analyse the factors driving spatial variability in the transmission of monetary policy impulses through the bank lending channel in India both at the sectoral and bank group levels. As a first step, the influence of macro-economic and bank specific factors on monetary transmission is analysed using a linear regression framework. Subsequently, to underscore the role of spatial spill-overs, the impact of bank and macro-economic factors is analysed using spatial autoregressive (lag and error) models factoring spatial dependence between the States. The rest of the chapter is organized as follows. A detailed literature review presented in section 5.2, highlights the gaps in the current studies in the Indian context and possible extensions of the analytical framework. Section 5.3 details data, methodology, the choice of variables and the construction of spatial weight matrices depicting the spatial dependence between the States. Section 5.4 discusses the results and section 5.5 concludes.

5.2. Literature Review

Only a few studies analyse the spatial variability of monetary policy transmission in India. (Nachane et al., 2002) first explored the differences in the transmission of monetary policy at the regional level. The study identified the differences in the impulse response functions of the State level GDP to shocks in price and money supply. While the study ascribed the regional differences in monetary transmission to the level of industrialisation, composition of small and large firms, and financial deepening, albeit it did not provide estimates for the same. Dhal (2012) explores the reasons for differential credit off take among Indian States. The study incorporates macroeconomic

attributes like State level GDP, infrastructure development, commercialisation of the economics activities and the bank level attributes like level of funding and monetary policy variables like call rates. The results of the study indicate that poor States show relatively higher response to monetary policy tightening and the infrastructure development of the State and commercialisation of economic activities also influence the credit off-take. However, the study does not consider credit growth at disaggregated sector and bank group levels, which are found to be significantly influencing a banks' credit growth strategy. Extending the framework development by (Nachane et al., 2002) the monetary policy transmission at the disaggregated sectoral and State level is analysed by (Ghosh, 2019) Using a panel VAR framework, the study analyses response of credit to interest rates and finds higher responsiveness in States with greater financial deepening and economic activity. Though, the study indirectly accounts for macro-economic factors like GDP growth, infrastructure etc., it does not incorporate them in the model. Further, the study does not consider the bank ownership dimension. The present chapter, taking cue from literature, aims to address the above gaps in Indian studies by developing a comprehensive analytical framework.

Dominguez-Torres and Hierro, (2019) provides a in depth review the literature on studies analysing monetary policy transmission at the regional level. Though, many studies focus on analysing regional effects in monetary transmission used cross country data viz. (Gerlach and Smets, 1995; Tremosa-Balcells and Pons-Novell, 2001; Peersman, 2004; Barigozzi et al., 2014; Georgiadis, 2015, 2015; Boeckx et al., 2020; Burriel and Galesi, 2018); given the focus on State level analysis in the current study, focus is more on studies using within country data e.g. Anagnostou and Papadamou, 2014 - Italy, Greece, Spain and Portugal; Arnold and Vrugt, 2002 and 2004 – Germany and Netherlands; Anagnostou and Papadamou, 2016; De Lucio and

Izquierdo, 2002 – Greece; Rodriguez-Fuentes (2004) – Spain, Ridhwan et al., 2014 – Indonesia, Duran and Erdem, 2014 – Turkey; Guo and Masron, 2017– China; and Torres-Preciado, 2021-Mexico. The above-mentioned studies identify the following variables as the key factors influencing the regional (spatial) differences in the transmission of monetary policy/impulses.

i. *Industrialisation:* Regions with greater share of industries are expected to show higher responsiveness to monetary shocks owing to their dependence on bank credit for meeting their investment and working capital demands (Carlino and Defina, 1998,1999); Owyang and Wall, 2009 Rocha et al., 2011; Ridhwan et al., 2014; Duran and Erdem, 2014 and Torres-Preciado, 2021). The proxies considered are the share of industries or manufacturing in the regions' GDP and the composition of the firms.

ii. *Export orientation:* The liberalisation of economies around the world, has increased the export orientation of the nations including India. However, within a country, the export orientation of the individual regions/ States varies significantly and can act as source for their divergent responses to monetary policy impulses [Weber (2006); Georgopoulos, 2009; Vespignani (2015); Svensson, 2013; Duran and Erdem, 2014, Ridhwan et al., 2014]. The openness of the regions computed as share of export and imports to regions' GDP is considered as the proxy for export orientation.

iii. *Population density:* Considering the role played by the banks in the bank lending channel, the population density of regions assumes greater significance. It reflects the size of potential market opportunities that are available to the banks. Studies also highlight the role of socio-economic and demographic features in driving the variability of monetary transmission across regions. Specifically, studies have found contradictory results in terms of the effects that population has on a regions' response to monetary

shocks. In case of Turkey, Duran and Erdem (2014) observe that most populous regions show greater response, while in case of Brazil, Rocha et al., (2011) report contrary results with most populous regions showing lower responses to monetary shocks.

iv. *Banking penetration and structure:* Studies have underscored the role of financial deepening and bank size as a major factor leading to regional differences in monetary transmission. (Nachane et al., 2002; Ghosh, 2019 in case of India; Rocha et al., 2011 - Brazil, Duran and Erdem, 2014 - Turkey; Carlino and Defina, 1998;1999 – USA). Also, studies highlight the importance of banking strcuture in terms concentration of branch networks in a region reflecting banking penetration (Guo and Masron, 2017 – China; Ridhwan et al., 2014 – Indonesia; Owyang and Wall, 2009 – USA). The variables used as proxies for reflecting banking penetration and structure are average bank size, average number of employees per bank in the region, concentration of credit/ branches in the region using market concentration measures like HHI and CR5.

Another interesting feature that impacts spatial variability of monetary transmission is the nature and scope of competition / complementarity amongst financial intermediaries at the regional level (Cleeren et al., 2010 and Fernandez 2016). Further spatial competition is analysed in different dimensions, studies like Ho and Ishii, (2011) and Huysentruyt et al., (2013) focus on consumer disutility due to distance. Dai et al., (2013) and Adams and Amel, (2007) analyse the density of branch networks leading to predatory growth strategies. Aguirregabiria and Ho, (2012) and Aguirregabiria et al., (2016) focus on externalities due to diversification of same bank branch networks. Furthermore, the emergence of non-banks especially has provided impetus to substitute/ complement bank credit especially for the small and retail borrowers, which may accentuate/

dampen the overall responsiveness to monetary impulses. Laura (2020) in case of Columbia observes that the entry of MFIs (Micro Finance Institutions) has benefited both the incumbent firms and the customers by providing complementary services. Therefore, given the rise of Non-Bank Financial Companies (NBFCs) in India, especially reckoning their role in last mile credit delivery, incorporating variables depicting the interaction between traditional banks and NBFCs may provide further insights into monetary transmission at the regional level.

Besides, the individual macroeconomic and bank specific factors, studies in this domain also underscore the role of spatial spill-overs affecting the transmission of monetary impulses across regions (Peersman, 2004; Beckworth, 2010; Potts and Yerger, 2010; Guo and Masron, 2017; Xiaohui and Masron, 2014; Duran and Erdem ,2014; and Burriel and Galesi, 2018). These studies indicate that not incorporating spatial spill over effects may lead to underestimation of the coefficients/ impact of the variables. Duran and Erdem (2014) adopt a simple yet insightful framework for analysing spatial variability of monetary transmission including spatial spill-overs. They deploy spatial weight matrices based on border contiguity to characterize the dependence between regions. The study using spatial autoregression models (Anselin, 2003) provides estimates for both the macroeconomic and bank level variables duly accounting for the spill-overs between regions. It clearly shows underestimation of coefficients if spatial spill-overs are ignored.

Therefore, studies analysing spatial transmission of monetary policy, besides accounting for spill-overs, also consider factors like industrialisation, export orientation, population density, banking structure & penetration, and competition by non-banks etc., in their models using suitable proxy variables. As mentioned earlier, though the studies in Indian context rightly point out the factors

that influence such differentials among States/ regions viz. GDP, infrastructure, financial deepening etc., they do not rigorously model the same. In this study, the analytical framework of Duran and Erdem (2014) i.e., spatial auto regressive model is extended incorporating both the sectoral, ownership dimensions of bank credit. Further, the aspect of spatial spill-overs is also incorporated using spatial weight matrices based on both geographical proximity and relational dependencies between States in terms of common bank branch networks, inter-State rail trade.

5.3. Data and Methodology

5.3.1. Methodology

The analytical framework of the current study is developed based on the methodology of adopted by Nachane et al., (2002) and Duran and Erdem, (2014). It estimates the impact of macroeconomic and bank specific factors including the spill-overs on spatial transmission of monetary impulses across Indian States. In chapter four the following endogenous system of equations was estimated using a SVAR framework with restrictions. [37]

$$\boldsymbol{Z_t = [C_t^i, Y_t^i, Y_t, (M3/P)_t, (Pf/P)_t]' \quad \text{---- (1)}}$$

Where, $\boldsymbol{C_t^i}$ represents the credit growth of State i at time t,

$\boldsymbol{Y_t^i}$ represents the Growth in the Net State Domestic Product of State i at time t,

$\boldsymbol{Y_t}$ represents the Growth in the Net Domestic Product of the country at time t,

$\boldsymbol{(M3/P)_t}$, represents the monetary policy variable arrived by deflating the growth in money supply with growth in inflation to arrive at real growth in money supply.

[37] For details, please refer section 4.3: Data and Methodology of chapter 4.

$(\boldsymbol{Pf/P})_{\boldsymbol{t}}$ represents the adjusted food inflation rate

From the above SVAR system, the cumulative impulse response functions (CIRFs) of credit growth to a shock in monetary policy variable i.e., M3 growth (Money supply) with structural decomposition was estimated for 15 select Indian States. The CIRFs are estimated for Total credit (TCR) at the aggregate bank group level viz. SCBs, PSBs, and PVBs and at the sectoral level for each bank group viz. Agriculture (AGL), Industry (IND), Professional Services (PRO), Personal Loans (PER), Trade (TRD), Transport Operators (TSP), and Finance (FIN).[38]

Following (Duran and Erdem, 2014) a two-step approach is adopted to estimate impact of factors affecting spatial variability of monetary transmission through the bank lending channel in India. In the first step the following regression model is estimated using Ordinary Least Squares (OLS).

$$\boldsymbol{CIRF_i^{jk} = \alpha + \sum \beta_i X_i + \epsilon_i} \quad \textbf{---- (2)}$$

Where, $\boldsymbol{CIRF_i^{jk}}$ is the CIRFs of State ***'i',*** for the bank group ***'j'*** *{SCB, PSB, and PVB}* and sector ***'k'*** *{TCR, AGL, IND, PRO, PER, TRD, TSP, and FIN}.*[39] $\boldsymbol{\beta_i}$ are the coefficients to be estimated using OLS and $\boldsymbol{\epsilon_i}$ is the error term; The CIRFs at the 2nd, 6th and 10th year horizon are regressed for each bank group and sector. $\boldsymbol{X_i}$ represents the vector of macro and bank specific factors at the State level considered to be influencing the spatial variability of transmission of monetary impulses. The following variables are considered as proxies for the macroeconomic and bank specific factors at the State level.

i. ***Industrialization***: The share of industry in a State GDP reflects the industrialisation of the State economy and its dependence on bank credit. It is expected that States with higher

[38] The CIRF values of SCBs provided in Table 4.3 of Chapter 4 and for PSBs and PVBs in Annexure C

[39] The current study considers 15 major Indian States. For details and their codes please see table 4.1 of Chapter 4.

share of industries often show higher responses to monetary shocks. The proxy is computed as average share of industry in State GDP.

ii. ***Export orientation:*** The share of exports to State's GDP is taken as proxy of export orientation and States with higher export orientation are expected to show higher responsiveness to monetary shocks. Computed as average share of exports to State GDP.

iii. ***Market Potential:*** States with higher Population Density present banks with higher market potential in each geographical location and expected to show greater response to monetary shocks. The proxy is computed as log value of population density of the State.

iv. ***Banking Penetration:*** To capture the financial deepening in the States, the branch concentration is taken as proxy. Highly concentrated branches may limit the transmission of monetary impulses. Based on the market share of the top 5 banks (in terms of number of branches) the CR5 ratio for each State is computed.

v. ***Banking Structure:*** To capture the business strategy and focus customer segments of the banks in the State, the Per Capita Credit Size is computed as the average size of a typical credit account i.e., obtained by dividing the total credit in the State by number of borrower accounts. The higher per capita size of the credit account reflects concentration of credit in few sectors or customer segments, thus limiting the transmission of monetary impulses.

vi. ***Competition:*** Given their nimble and agile business models NBFCs are expected to have small per capita size per branch reflecting their diversified presence thus enhancing competition to the traditional banking channels. To capture the nature of competition, the Per Branch Credit Size of NBFCs is computed as the total credit of NBFCs in the State divided by the number of NBFC branches in the State. Higher per capita size of credit reflects that NBFCs are concentrated and limiting the competition.

5.3.2. Spatial Autoregression Models

In the second step, the analytical framework is extended to include spill-overs effects using spatial autoregression (SAR) models. Akin to linear regression models, the SAR models are based on variables that reflect the characteristics of the spatial units as the underlying data. Further, SAR models have continuous outcome variable and other predictor variables, that are expected to influence the outcome variable. Both variables are defined at the level of the spatial unit (Cliff and Ord, 1973). However, SAR models differ from linear regression models as they allow influence of adjoining/ related spatial units on the outcome variable of the other adjoining/ related spatial units. This influence manifests in three forms viz.

A. Spatial lags of outcome variable (outcomes in nearby areas)
B. Spatial lags of covariates (covariates from nearby areas)
C. Spatial auto regressive errors (errors from nearby areas)

These features of SAR models are like that of 'Time Series' models and the same methodological framework can readily be applied to spatial modelling (Anselin, 2001). A simple time series auto regressive process of order 1 i.e., AR(1) and with a lag operator (L) can be expressed by the following equations.

$$\boldsymbol{y} = \gamma_0 + \gamma_1 \boldsymbol{L}.\boldsymbol{y} + \boldsymbol{\epsilon} \text{ ---------- (3)}$$

$$\boldsymbol{y} = \gamma_0 + \gamma_1 \boldsymbol{L}.\boldsymbol{y} + (\mathbf{I} - \rho\mathbf{L}.)^{-1}\boldsymbol{\epsilon} \text{ ---------- (4) [Including auto regressive errors]}$$

AR (1) model estimates γ_0 , γ_1 , and the parameter $'\boldsymbol{\rho}'$ which measures the correlation in the errors. The above time series model can be imposed into to a spatial domain. The lag operator '**L'** in the time series depicts the quantum of feedback that is there from time-period **'t-1'** to **'t'**. In the similar spirit, in a spatial setting, the lag operator is replaced by a 'spatial weight' matrix '**W',** which

captures potential spillovers between two regions **'*i*'** and **'*j*'**. Thus, a time series auto-regressive process can be formally represented as a spatial autoregression model as given below:

$$\boldsymbol{y} = \gamma_0 + \gamma_1 \boldsymbol{W}.\boldsymbol{y} + \boldsymbol{\epsilon} \text{ --------(5)}$$

$$\boldsymbol{y} = \gamma_0 + \gamma_1 \boldsymbol{W}.\boldsymbol{y} + (\mathbf{I} - \rho\mathbf{W}.)^{-1}\boldsymbol{\epsilon} \text{ ---------- (6) [Including spatial errors]}$$

'W' is a n*n matrix, where n is number of spatial units in the model, and '**W'** captures the relationships between the spatial units. The contents of '**W'** need to be specified before the SAR model is estimated and the '**W'** should be a non-zero matrix.

Further, incorporating independent variables given by n*1 vector **X**, two spatial autoregressive models viz. one based on lag values of $'\boldsymbol{y}'$ and another based on autoregressive errors $'\boldsymbol{\epsilon}'$ are defined as below. [40]

$$\boldsymbol{Y_i} = \boldsymbol{\alpha} + \boldsymbol{\rho W Y_j} + \boldsymbol{\Sigma \beta_i X_i} + \boldsymbol{\epsilon_i} \text{ --------(7) [Spatial Lag Model]}$$

$$\boldsymbol{Y_i} = \boldsymbol{\alpha} + \boldsymbol{\Sigma \beta_i X_i} + \boldsymbol{\lambda W \epsilon_j} \text{ -------(8) [Spatial Error Model]}$$

The spatial spill-overs from neighboring or related spatial units are captured by $'\boldsymbol{\rho}'$ (spillovers on dependent outcome variable) and $'\boldsymbol{\lambda}'$ (spillovers on error terms). However, the introduction of $'\boldsymbol{W y}'$ leads to non-zero correlation with the error terms in case of lag models (equation **7**) and $'\boldsymbol{W \epsilon}'$ leads to non-zero error co-variance between each pair of terms in case of error models (equation **8**). Therefore, in such cases the OLS estimations will not yield consistent estimates. Correcting for the same, the estimation of spatial model is done using maximum likelihood technique to avoid biased and inconsistent estimates (Anselin and Bera, 1998; Anselin, 2003).

[40] The model is developed based on Duran and Erdem (2014) and Anselin (2003)

Further, to establish dependence between spatial units and justify the specification of SAR models the spatial autocorrelation is to be established. The presence of spatial autocorrelation between spatial units (i.e., in this case Indian States) is tested using Moran's I value for CIRFs at 2nd, 6th, and 10th year horizons. Moran's I test is akin to test of significance of the serial correlation coefficient in univariate time series and it is strikingly like Durbin Watson (DW) statistic. The Moran's I test provides an inferential statistic with a null hypothesis that the underlying data of the spatial variable is randomly distributed. [41] Presence of significant spatial autocorrelation then justifies estimating spatial spill-overs using the SAR models mentioned above.

5.3.3. Spatial Weight Matrices

However, to compute Moran's I test for spatial autocorrelation and to estimate spill-overs using SAR models, the spatial dependence between units (i.e., in the form of 'Spatial Weight Matrices') needs to be specified. The spatial weight matrices capture relations between spatially connected regions. Effectively, they reflect the constraints placed on the individual spill-overs between spatial units and is formulated as part of the model specification (Anselin, 1988; Darmofal, 2015). As mentioned earlier, the spatial weight matrix **'W'** is a non-zero n*n matrix and each element of **'W'** i.e., w_{ij} has the following properties

- $\boldsymbol{w_{ij} \geq 0 \quad for\ all\ i \neq j}$ [i.e., weights are always positive; and '0' if ***i*** *and* ***j*** are unrelated]
- $\boldsymbol{w_{ij} = 0 \quad otherwise}$ [i.e., diagonal elements are zero by convention]

The matrix **'W'** may be standardized for ease of interpretation by normalizing $\boldsymbol{'w_{ij}'}$ i.e., standardizing the value of $\boldsymbol{w_{ij}^{s\,\prime}} = \frac{w_{ij}}{\Sigma_j\, w_{ij}}$; thus, making sum of rows unitary. This enables

[41] A technical note on Moran's I (as specification test / estimate of spatial autocorrelation) is given in **Annexure B**

interpreting the values of **'W'** as average of neighboring values. In general, the values of **'W'** are defined based on geographical proximity i.e., two spatial units being neighbors or based on distance between the central points of the spatial units (say between State capitals).

Further, while defining the spatial weight matrices the weights should be assigned in such a way that they reflect the underlying causal process between the outcome variables and independent predictors to establish meaningful inferences. For example, when considering spill-overs in monetary policy across countries through the exchange rate channel/ trade channel, defining spatial association merely in terms of geographical proximity may lead under/over estimation of spill-overs. To illustrate, though countries sharing a very long geographical border may not be influenced by one another (consider India and Pakistan, the trade between two countries is very not significant as compared to other neighbors like Bangladesh, Nepal, and even Sri Lanka, which is not geographically connected). Therefore, as noted earlier, the dependency between spatial units can also be formulated based on parameters that resemble their association/ underlying causal process. Hence, considering the same, the following four types of spatial weight matrices are defined for estimating SAR models in this chapter.

1. *Spatial Weight Matrices Border Association (with shared borders) '**SWMBA':*** The elements $'w_{ij}'$ of this matrix are assigned a value of '1' if two States share a physical border and '0' otherwise. To illustrate, for the row representing Andhra Pradesh, value '1' is assigned against columns with Tamil Nadu, Odisha, Karnataka, Maharashtra, Madhya Pradesh which share a physical border with Andhra Pradesh.

2. *Spatial Weight Matrices Border Contiguity (distance between centroids) '**SWMBC':*** The elements $'w_{ij}'$ of this matrix are assigned values based on the spatial distance between the geographical centers (centroid) of the States. The geographical center is based on the latitude and longitude of the State and represents a hypothetical central point of the geographical area covered by the State. The inverse distance measure assigns a value close to '0' if the States are quite distance and value closer to '1' if they are close to each other. To illustrate, for the row representing Andhra Pradesh, value close to '1' is assigned against columns with Tamil Nadu, Odisha, Karnataka, Maharashtra, Madhya Pradesh which share a physical border, and values close to '0' with States such as Punjab, Bihar etc.,

The spatial dependence defined in the above two matrices is straightforward and intuitive which is determined by physical proximity. However, for the analytical question at hand viz. monetary transmission through the bank lending channel, the association between States should be based on causal factors that drive credit demand/ supply. Reckoning the same, the following spatial weight matrices are defined.

3. *Spatial Weight Matrices Branch Affinity (Common Bank Branch Networks) **'SWMBF'***: As observed in chapter 3, banks exhibit herding tendencies to optimise informational costs as they expand into new areas. Physical branch networks play a great role in bringing down the information costs of the banks as they provide feedbacks to management about local operations. Therefore, for a bank management, which is optimising risks at the aggregate corporate level, not all spatial units are equal. Hence, bank managements attune their credit strategies in relation to the branch networks factoring risks and rewards in the areas of

operations. Consequently, a State's response to monetary impulses can be influenced by the nature of bank branch networks in the State. To illustrate, if a bank holds a dominant share of branches in a State, and these branches form a major share of the bank's branch network, it may be rational for the given bank managements to entirely focus on a such dominant State over other States where it has a lower foot print (branches /business).[42] Therefore, the spatial dependence between two states can be defined considering the share of common bank branches in both the States and also the share common branches in the total network of bank's branches.

$$\sum_{i=1}^{k}\left[\frac{(no.\ of\ Common\ Branches\ of\ a\ bank\ [k]\ in\ States\ a,b)}{(Total\ number\ of\ branches\ of\ the\ bank[k] in\ all\ States)} * \frac{(no.\ of\ Common\ Branches\ of\ a\ bank\ [k]\ in\ States\ a,b)}{(Total\ number\ of\ bank\ branches\ in\ States\ a\ and\ b)}\right]$$

Where 'k' is the number of unique banks in States a and b

Using the above formula, the elements of the spatial matrix $'\boldsymbol{w_{ij}}'$ are assigned values. Thus, States with higher share of common branches to total number of branches in the State and in overall branches of the bank are assigned higher values, and States with lower shares are assigned lesser values.

4. *Spatial Weight Matrices Rail Trade Gravity (Inter-State Rail Trade)* ***'SWMRG'***: The spatial dependence between two States can also be defined in terms of movement of goods & services between them. This is akin to factoring the dependence between two countries in terms of their trade volumes based on the gravity model of international trade (Isard, 1954). Though the concept of export and import (Trade) may not be directly applicable to States within a country, the movement of merchandise can be taken as proxy to reflect the

[42] For example, Andhra Bank, has 55% of its business and branches in Andhra Pradesh; and holds 25% of the market share in the State's banking business (deposits and advances; branches). Therefore, business strategy or reaction of Andhra Bank to monetary shocks is likely yield a greater influence on Andhra Pradesh's response than many other banks. By extension in other States, Andhra Bank's actions are likely to be focused on States where it has more branches/ business like Odisha, Tamil Nadu than in Punjab or Haryana where it has very few branches/ businesses.

connectivity, therefore the spatial dependence between the two States. Analytically, the conditions in one State may impact businesses in other States thus affecting the trade, consequently impacting the credit demand and supply in the other States, creating spill-overs. To capture the spatial dependence, the inter-State rail trade between Indian States is used. Using the below formula, the elements of the spatial matrix $'w_{ij}'$ are assigned values

$$\left[\frac{(quantum\ of\ trade\ between\ States\ i,j)}{(Total\ volume\ of\ trade\ by\ State\ i)} * \frac{(total\ trade\ volume\ by\ States\ i\ and\ j)}{(Total\ trade\ of\ all\ States)}\right]$$

where ***'i'*** and ***'j'*** are i^{th} and j^{th} States.

Thus, the States with higher volume of trade in relation to their own trade and overall trade in the country (quantum of rail trade) are assigned higher values, while States with lower relative share are assigned lesser values.

Row-Standardization of Spatial Weight Matrices: As noted earlier, the weights are row-normalised for ease of interpretation as averaging of neighboring values. However, in some instances, the standardization of spatial weights may supress the relative importance of spatial units (in case of branch network affinity or rail trade gravity models). Therefore, in this chapter, all SAR models are estimated using both the row Standardized and non-Standardized spatial weight matrices to avoid loss of information if any due to standardization.

5.3.4. Data

In the current SAR model, the outcome variable is the CIRFs of credit growth at 2nd, 6th and 10th year horizon and the predictor variables are defined at the State level viz. Share of Industry to GDP, Share of Exports to GDP, Population Density, CR5 of branches, Per Capita Credit Size of banks, and Per Capita Credit size of NBFCs branches. The CIRFs are collated from the results in

Chapter 4. The data on State level 'Share of Industry to GDP', 'Share of Exports to GDP', and 'Population density' is sourced from CMIE (Centre for Monitoring Indian Economy) data base. Further data on 'CR5 of branches' and 'Per Capita Credit Size' of banks is computed using Basic Statistical Returns published by the Reserve Bank of India. The 'Per Capita Credit size of NBFCs' branches is computed using data published by MFIN (Micro Finance Institutions Network – annual publications).[43] For spatial weight matrices based on geographical contiguity, the locational data of States for computing centroids is obtained from Survey of India (Latitude and Longitude). Further, reckoning the bifurcation of four States between 1990 to 2020 viz. Andhra Pradesh – Telangana, Uttar Pradesh – Uttarakhand, Madhya Pradesh – Chhattisgarh, and Bihar – Jharkhand, the average value of latitude and longitude of these States is taken to compute the geographical centroids. For the spatial weight matrix based on branch network affinity, the weights are computed using the individual branch level data available in the data base on Indian economy of RBI and is aggregated at bank- State level. The rail trade gravity based spatial weight matrix is computed using the data on inter-State freight movement through the rail networks, published by Directorate General of Commercial Intelligence and Statistics, under Ministry of Commerce, Government of India.

5.4.Results

As detailed in the methodology section the estimation of the impact the factors influencing spatial variability of monetary transmission through the bank lending channel is done in two steps. In the 1st step, the OLS model (**equation 2**) is estimated and then in the 2nd step, the SAR models lag &

[43] Considering the availability, consistency, and granularity of the data (State level details). The variables are computed as average values for the period between 1990 to 2020.

error (**equation 7 and 8**) are estimated using ML estimator along with the specification test (Moran's I) for spatial autocorrelation. In both the steps, the outcome (dependent) variable remains the CIRFs at 2nd, 6th, and 10th year at the bank group level (ASCB, PSB, and PVB) and the sector level (*TCR, AGL, IND, PRO, PER, TRD, TSP, and FIN)*. The predictor (independent) variables are Industry to GDP; Export to GDP; Population density; Branch CR5; Per Capita Bank Credit; and Per Capita NBFC credit. Further, four spatial matrices are used for estimating SAR models and for specification tests (Moran's I) viz. ***SWMBA, SWMBC, SWMBF, SWMRG.*** [44] The results are presented here under. [45]

5.4.1. Results from OLS model

The results from OLS model, indicate that at the level of total credit for SCBs, only export orientation, population density, branch concentration, and Per Capita credit of NBFC branches are significantly impacting the CIRFs. For PSBs, none of the variables, except branch concentration is found to be significant and for PVBs industrialisation, export orientation, and population density are significant **(Table 5.1 A).** Given large number of OLS estimates, for brevity, sector wise results (i.e., coefficients, their significance and sign) are collated in **Table 5.1 A to H** as presented below.

[44] All spatial models are estimated using both row-standardized and non-standardized versions of the matrices. Further, the matrices ending with subscript **'S'** indicate **standardized** matrix (e.g., ***SWMBFS*****),** while matrices ending with subscript **'NS'** indicate **non-standardized** matrix (e.g., ***SWMBFNS***).

[45] All model estimations are carried out using STATA 13 software. In total **72** regression models (OLS) are estimated in the 1st step; and in the 2nd step a total of **576** SAR models are estimated.

Table 5.1 A: Estimates of coefficients from OLS regression of CIRFs (Total Credit)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	2.09	-21.83	-1.09	-0.40	0.00	-0.73
SCB	6	2.18	-5.75	0.26	10.12	0.00	-0.65
SCB	10	3.48	-9.43	-0.09	7.71	0.00	-0.59
PSB	2	-3.24	4.51	-0.63	10.88	0.00	0.38
PSB	6	1.38	2.64	0.42	15.59	0.00	-0.40
PSB	10	2.79	-1.29	0.03	11.98	0.00	-0.33
PVB	2	59.51	-160.40	-8.68	7.89	0.00	-0.66
PVB	6	-1.30	1.24	-2.44	20.01	0.00	1.13
PVB	10	-7.87	-6.57	-2.47	15.41	0.00	0.72

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1 B: Estimates of coefficients from OLS regression of CIRFs (Agricultural Credit)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	-11.66	43.13	0.50	19.71	0.00	1.77
SCB	6	-27.62	27.30	-1.81	-10.58	0.00	0.89
SCB	10	-21.43	35.89	-0.53	-0.06	0.00	1.27
PSB	2	-5.84	37.67	0.68	23.48	0.00	1.64
PSB	6	-18.67	22.91	-0.52	-0.51	0.00	0.91
PSB	10	-15.54	36.37	0.15	8.23	0.00	1.36
PVB	2	-137.56	-114.44	-48.13	-420.81	0.00	4.47
PVB	6	-179.97	611.93	-22.52	71.00	0.00	10.54
PVB	10	-234.09	571.55	-24.95	-10.87	0.00	8.00

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1 C: Estimates of coefficients from OLS regression of CIRFs (Industrial Credit)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	-1.13	2.10	-0.76	24.63	0.00	-1.02
SCB	6	7.75	-4.46	0.31	37.98	0.00	-1.15
SCB	10	10.17	-14.58	-0.23	34.21	0.00	-1.20
PSB	2	-9.71	21.90	0.96	19.12	0.00	-0.91
PSB	6	12.66	-14.10	1.11	38.30	0.00	-1.28
PSB	10	11.32	-17.07	0.51	31.42	0.00	-1.22
PVB	2	251.09	-472.98	-9.37	239.18	0.00	-8.56
PVB	6	-99.69	177.62	-5.96	-21.12	0.00	4.25
PVB	10	-58.59	113.32	1.64	99.46	0.00	-0.16

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1D: Estimates of coefficients from OLS regression of CIRFs (Professional Services)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	6.17	-50.55	-3.64	5.41	0.00	1.02
SCB	6	-8.02	18.93	0.41	27.50	0.00	0.59
SCB	10	-2.29	0.08	-0.30	10.13	0.00	0.74
PSB	2	9.15	-73.80	-6.46	0.97	0.00	0.97
PSB	6	-14.30	13.31	-1.09	-2.40	0.00	0.89
PSB	10	-4.15	-14.33	-2.34	-9.61	0.00	0.81
PVB	2	-134.47	613.16	10.47	239.34	0.00	5.41
PVB	6	-138.85	603.66	3.52	175.63	0.00	6.56
PVB	10	-133.29	623.68	5.94	203.49	0.00	6.40

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1 E: Estimates of coefficients from OLS regression of CIRFs (Personal Credit)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	-0.65	34.07	0.25	13.32	0.00	0.44
SCB	6	-3.52	30.60	0.45	5.91	0.00	0.09
SCB	10	1.13	21.17	0.50	6.61	0.00	0.02
PSB	2	13.48	21.05	0.54	26.96	0.00	0.46
PSB	6	8.94	7.58	0.36	19.58	0.00	-0.21
PSB	10	12.36	-0.21	0.36	16.26	0.00	-0.05
PVB	2	31.41	-104.95	0.23	-63.99	0.00	0.11
PVB	6	65.80	-171.86	4.24	-17.19	0.00	-3.46
PVB	10	70.52	-148.60	7.05	16.53	0.00	-3.57

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1 F: Estimates of coefficients from OLS regression of CIRFs (Trade Credit)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	6.35	-7.67	-2.07	27.27	0.00	1.04
SCB	6	7.66	50.15	2.99	25.58	0.00	-0.75
SCB	10	9.87	28.83	1.60	35.72	0.00	-0.40
PSB	2	6.69	-7.39	-1.94	19.16	0.00	1.30
PSB	6	15.35	53.33	3.80	33.07	0.00	-0.88
PSB	10	14.86	29.31	1.97	40.23	0.00	-0.45
PVB	2	-9.19	-16.81	-8.11	-11.03	0.00	3.94
PVB	6	-37.05	61.09	3.12	-14.19	0.00	0.18
PVB	10	-28.27	29.59	-1.03	-9.02	0.00	1.73

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1G: Estimates of coefficients from OLS regression of CIRFs (Transport Operators)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	13.11	-67.25	-3.03	-53.11	0.00	-0.72
SCB	6	15.55	-51.75	-2.52	-52.83	0.00	0.16
SCB	10	12.61	-52.44	-3.15	-50.08	0.00	-0.61
PSB	2	2.47	84.70	1.12	0.00	0.00	-1.46
PSB	6	31.47	35.17	-0.20	3.92	0.00	-1.44
PSB	10	18.46	43.13	-0.11	-0.39	0.00	-1.69
PVB	2	325.01	-1079.29	-51.93	-257.10	0.00	2.46
PVB	6	463.86	-921.72	24.08	653.50	0.00	-22.33
PVB	10	605.59	-1363.44	0.11	534.60	0.00	-21.15

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

Table 5.1 H: Estimates of coefficients from OLS regression of CIRFs (Finance)

Bank Group	CIRF Year	Industry to GDP	Export to GDP	Population density	Branch CR5	Per Capita Bank Credit	Per Capita NBFC credit
SCB	2	-101.22	57.83	-2.31	47.44	0.00	1.84
SCB	6	104.67	-178.49	-5.41	38.20	0.00	-0.82
SCB	10	-3.63	-39.66	-0.65	57.15	0.00	0.02
PSB	2	-149.37	-152.60	-10.93	-103.76	0.00	6.55
PSB	6	150.04	30.33	6.82	230.31	0.00	-5.86
PSB	10	-35.53	-239.27	-5.19	-61.18	0.00	4.01
PVB	2	7508.86	-9703.16	498.36	12717.07	0.00	-353.29
PVB	6	2356.40	-3340.21	86.94	3732.24	0.00	-85.56
PVB	10	4027.58	-5439.97	216.15	6651.79	0.00	-169.82

Notes: Green, yellow indicates significance at 5%,10% levels respectively, red font for negative values (directional).

The estimates at the sectoral level (**Tables 5.1 B to H**) also show that across bank groups, only a few predictor variables are significantly influencing the CIRFs. To illustrate, in case of agricultural credit, for SCBs industrialisation, per capita bank credit, and per capital NBFC credit are significant. For PSBs none of the predictors are significant, while for PVBs population density, branch concentration, per capita bank credit are significant. In case of professional services, predictor variables viz. industrialisation, export orientation, branch concentration, and per capita bank credit are significant only in case of PVBs. For personal loan segment, almost all predictors are insignificant except for export orientation for PSBs, and per capita bank credit for PVBs are

significant at 10% level. In case of trade credit, no predictor is significant in case of PVBs, while for PSBs and SCBs, export orientation, population density, and branch concentration are significant. For credit to transport operators, in case of SCBs, branch concentration and per capita bank credit are significant, while for PVBs, industrialisation, export orientation, and population density are significant. While for PSBs, none of the predictors are significant in this segment. Furter, in finance segment, only industrialisation (for SCBs, PSBs) and branch concentration (for PVBs, PSBs) are significant. Furthermore, interestingly in case of credit to industry, the predictor variables have a broad-based impact. Industrialisation is significant for SCBs and PVBs, while branch concentration is significant for all bank groups. Per capita NBFC credit is significant for both SCBs and PSBs, while export orientation is significant only in case of PVBs. This corroborates evidence from earlier studies in India (Nachane et al., 2002; Ghosh, 2019). However, the muted impact of predictor variables across sectors and bank groups may be on account not factoring the potential spatial autocorrelations in the model (Duran and Erdem, 2014 ;Anselin and Bera,1998). Hence, the Moran's I specification test is carried out to examine the potential spatial autocorrelation in CIRFs and the results are presented in the next section.

5.4.2. Results Moran's I Specification test for Spatial Autocorrelation

Moran's I specification test measures the presence of spatial autocorrelation for a given attribute among the spatial units[46]. However, computation of Moran's I test is dependent on the spatial weight matrix. Hence, using the four spatial weight matrices defined earlier, the Moran's I test carried out for CIRFs at 2nd, 6th, and 10th years both at the bank group and sectoral levels. The results from Moran's I test for all CIRFs displaying significant spatial autocorrelation is

[46] Refer **Annexure B** for technical details of Moran's I specification test

consolidated in **Table 5.2,** which indicates that spatial autocorrelation is observed across bank groups and sectors.[47] Further, the Moran's I test is significant for CIRFs with use of different spatial weight matrices (including row-standardized and non-standardized matrices). This indicates that spatial autocorrelation observed in the CIRFs is a broad-based phenomenon and provides ground for using SAR models to estimate coefficients and spatial spill-overs.

Table 5.2: Number of instances where significant spatial autocorrelation is observed in CIRFs

Credit	Spatial Weight	Public Sector			Private Sector			All Scheduled Banks			Co
Sector	Matrix*	1%	5%	10%	1%	5%	10%	1%	5%	10%	unt
Total Credit	SWMBANS					1					3
	SWMBAS						1				2
	SWMBCS						1				1
	SWMBFNS					1	1			2	3
	SWMBFS									2	3
	SWMRGNS									1	3
	SWMRGS									1	2
Agriculture	SWMBANS						1				1
	SWMBAS					2					1
	SWMBCNS						2			1	1
	SWMBCS						2				4
	SWMBFS					1					2
	SWMRGNS						1				1
	SWMRGS					1				1	1
Industry	SWMBANS					1				2	1
	SWMBAS		2	1			1		2	1	1
	SWMBCNS			3					2	1	2
	SWMBCS						1				3
	SWMBFNS		1	2					1		7
	SWMBFS			1						1	6
	SWMRGS					1					1
Professional	SWMBANS					1					5
	SWMBAS	1		2					1	1	4
	SWMBCNS		1						2		1
	SWMBCS					1	2		1	1	3
	SWMBFS					3				1	1
	SWMRGNS									1	6
	SWMRGS					3					5
Personal	SWMBANS						1				4
	SWMBAS			1		1	2	1	1		2
	SWMBFNS			1		1	1		1	1	1
	SWMBFS						1	1	1		1
	SWMRGNS							1	1		5
	SWMRGS									1	3
Trade	SWMBCS						1		1	1	1

[47] A total of **576** Moran's I specification tests were done for CIRFs across bank groups, sectors, and spatial matrices.

Credit Sector	Spatial Weight Matrix*	Public Sector			Private Sector			All Scheduled Banks			Co unt
		1%	5%	10%	1%	5%	10%	1%	5%	10%	
	SWMBFNS						1		2		1
	SWMBFS					1		1		1	1
Transport	SWMBANS					1		1			3
	SWMBAS						1				3
	SWMRGNS						1				1
Finance	SWMBCNS						1				1
	SWMBCS		1	1			1				2
	SWMBFNS		1	1			1				3
	SWMBFS						1				2
Significant Count		**1**	**6**	**13**	**0**	**20**	**26**	**5**	**16**	**21**	**108**

Notes: Spatial matrices ending with ***'NS'*** indicates non-standardized matrices, while the ones ending with ***'S'*** indicate row-standardized matrices.

5.4.3. Results from Spatial autoregression models

Moran's I specification test on CIRFs of credit growth at 2nd,6th and 10th years confirm the presence of spatial autocorrelations. Hence, the SAR models (lag/ error) are estimated using ML technique. The SAR models besides providing the estimates of coefficients for the predictor variables, also estimates the 'spatial spill-overs' viz., '*Rho'* $'\boldsymbol{\rho}'$ **(lag model)** and *Lambda* $'\boldsymbol{\lambda}'$ ***(error model).*** Further, the sign of $'\boldsymbol{\rho}'$ and $'\boldsymbol{\lambda}'$ indicates nature of spill-overs i.e., positive spill-overs imply the outcomes in one area enhance the outcomes in another, while negative spill-overs have the opposite effect. Also, the sign of the coefficient of predictor variable indicates whether it impedes or accelerates transmission of monetary impulses. A negative sign on the coefficient of the predictor variable confirms that in a tightening monetary policy, it leads to contraction of the outcome variable i.e., credit/ GDP growth. While the positive sign on the coefficient of predictor variable indicates that it impedes transmission of monetary impulses (Duran and Erdem, 2014). As mentioned earlier, four spatial weight matrices (including both row standardized and non-standardized versions) are used to estimate the coefficients/ spill-overs using both the SAR models (lag/error). Further, given

the large number of estimations (**1152** SAR models were estimated[48]), for brevity and ease of comparison, the results are presented in a collated form at the sector, bank group, spatial matrix, and model level. The entire set of results are furnished in the **Annexure D.** Furthermore, keeping in view the above-mentioned caveats, the results are interpreted both at the sector and bank group levels, juxtaposing the results from the OLS estimations (**see *section 5.4.1***.)

Spatial effects at the aggregate 'Total Credit' level: To show the impact of predictor variables at the aggregate level, the results from SAR models on CIRF of credit growth at the 10th years for SCBs, PSBs, and PVBs are presented in the **Table 5.3**. At the aggregate level i.e., for total credit (CIRF at 10th year), unlike the OLS regression model, the SAR models indicate broad based impact of the predictor variables. For SCBs, export orientation, industrialization, branch concentration, and per capital NBFC credit are found to be significant across spatial weight matrices (both for row standardized and non-standardized versions). For PSBs, the only branch concentration, and per capita NBFC credit are significant, while for PVBs, population density, branch concentration, and per capita bank credit are significant. Further, industrialisation, per capita NBFC credit have a negative sign suggesting they impact the outcome variable in the direction of monetary policy. While export orientation and branch concentration have a positive sign suggesting the regions with higher share of exports to GDP and with concentrated branch networks can wade off monetary shocks. These results are in line with observations from studies like (Duran and Erdem, 2014) and Laura (2020). Another interesting observation from the results is the presence of significant 'negative' spatial spill-overs across bank groups and spatial matrices, especially for the matrices based on branch network affinity (common bank branches).

[48] In total **1152** SAR models were estimated i.e., 3 bank groups * 3 CIRFs (2nd,6th, and 10th years) * 8 Sectors (total credit and 7 sectors) * 8 Spatial Matrices (four standardized and four non-standardized) * 2 models (lag and error).

Table 5.3: Spatial Autoregression Models : Coefficient Estimates, Significance and Sign for Total Credit

SCB_TCR_10	Exp	Ind	Pop. Density	BCR5	PCBK	PCNB	'ρ' or 'λ'
SWMBANS -Lag	3.94	-8.48	0.02	8.61	0.00	-0.51	0.09
SWMBANS – Error	1.00	-13.59	-0.80	3.99	0.00	-0.72	-0.04
SWMBAS -Lag	3.52	-8.75	-0.02	7.84	0.00	-0.55	0.26
SWMBAS – Error	3.33	-8.02	-0.11	7.12	0.00	-0.56	0.33
SWMBCNS -Lag	3.86	-9.12	-0.07	8.21	0.00	-0.55	0.25
SWMBCNS – Error	3.14	-5.93	-0.09	8.47	0.00	-0.45	0.50
SWMBCS -Lag	3.68	-9.39	-0.08	7.82	0.00	-0.56	0.25
SWMBCS – Error	3.41	-8.64	-0.15	7.30	0.00	-0.52	0.36
SWMBFNS -Lag	5.51	-10.34	0.01	5.80	0.00	-0.41	-2.15
SWMBFNS – Error	5.93	-14.29	-0.14	12.99	0.00	-0.50	-3.98
SWMBFS -Lag	3.07	-8.02	-0.07	6.52	0.00	-0.50	-3.09
SWMBFS – Error	9.46	-20.46	0.01	10.10	0.00	-0.65	-6.60
SWMRGNS -Lag	1.74	-8.61	-0.18	5.98	0.00	-0.72	-0.01
SWMRGNS – Error	-0.49	-2.72	-0.19	8.26	0.00	-0.62	-0.02
SWMRGS -Lag	3.68	-9.51	-0.08	7.86	0.00	-0.57	0.11
SWMRGS – Error	1.78	-2.42	0.32	11.64	0.00	-0.67	-1.19
PSB_TCR_10	Exp	Ind	Pop. Density	BCR5	PCBK	PCNB	'ρ' or 'λ'
SWMBANS -Lag	2.31	-0.09	-0.23	9.19	0.00	-0.38	-0.32
SWMBANS – Error	-0.12	1.42	-0.23	12.55	0.00	-0.45	0.10
SWMBAS -Lag	3.04	-0.96	-0.02	11.83	0.00	-0.34	-0.28
SWMBAS – Error	1.92	5.93	0.32	14.94	0.00	-0.32	-0.84
SWMBCNS -Lag	2.45	3.21	0.10	10.73	0.00	-0.34	-1.43
SWMBCNS – Error	2.25	-0.19	-0.02	11.61	0.00	-0.36	0.19
SWMBCS -Lag	2.06	3.03	0.10	11.91	0.00	-0.31	-1.03
SWMBCS – Error	1.61	11.36	0.57	16.36	0.00	-0.34	-1.63
SWMBFNS -Lag	4.85	-4.74	0.07	7.28	0.00	-0.21	-2.37
SWMBFNS – Error	5.37	-3.39	0.21	13.04	0.00	-0.32	0.10
SWMBFS -Lag	2.01	-0.84	0.00	8.61	0.00	-0.24	-4.28
SWMBFS – Error	2.69	-0.76	0.03	11.82	0.00	-0.27	-4.13
SWMRGNS -Lag	-1.00	-2.82	-0.32	4.55	0.00	-0.52	-0.04
SWMRGNS – Error	0.40	1.61	-0.22	12.69	0.00	-0.40	0.01
SWMRGS -Lag	1.67	-1.88	-0.04	9.42	0.00	-0.39	-0.81
SWMRGS – Error	1.13	-0.48	0.08	11.07	0.00	-0.33	-0.84
PVB_TCR_10	Exp	Ind	Pop. Density	BCR5	PCBK	PCNB	'ρ' or 'λ'
SWMBANS -Lag	-5.07	-13.67	-1.34	10.19	0.00	0.14	-0.38
SWMBANS – Error	6.34	-51.25	-0.64	38.00	0.00	-0.70	-0.52
SWMBAS -Lag	-6.40	-8.89	-1.63	12.97	0.00	0.59	-0.78
SWMBAS – Error	-10.48	-7.80	-0.10	42.69	0.00	-0.08	-1.48
SWMBCNS -Lag	-5.81	-8.45	-1.92	13.92	0.00	0.29	-0.63
SWMBCNS – Error	-19.48	2.72	-1.73	9.35	0.00	0.15	-1.18
SWMBCS -Lag	-6.22	-6.20	-1.83	16.54	0.00	0.33	-0.75
SWMBCS – Error	-9.63	-4.09	-0.68	29.00	0.00	-0.28	-1.52
SWMBFNS -Lag	9.68	-17.09	-0.54	5.53	0.00	0.32	-3.14
SWMBFNS – Error	-9.89	5.37	-2.13	12.88	0.00	1.00	-4.12
SWMBFS -Lag	-3.39	-4.85	-1.32	9.09	0.00	0.39	-5.93
SWMBFS – Error	-3.76	-12.55	-2.00	16.08	0.00	0.59	-6.04
SWMRGNS -Lag	-5.88	0.25	-1.12	12.25	0.00	0.32	-0.03
SWMRGNS – Error	-1.95	-10.02	-0.78	13.14	0.00	0.24	-0.03
SWMRGS -Lag	-4.50	1.55	-1.16	13.79	0.00	0.73	-0.93
SWMRGS – Error	-9.64	18.17	-0.16	28.91	0.00	0.35	-1.26

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, and red font indicates negative values (directional).; Refer Notes for **Annexure D**

In general, positive spatial spill-overs are expected between connected regions. However, 'negative' spill-overs are plausible, indicating that the outcomes of a region (responses to monetary shocks) can dampen outcomes in other regions (Kao and Bera, 2016)[49]. This may be on account of Bank's spatial focus in rationalising managerial resources to a select region(s) dampening its responsiveness in other regions. Coupled with herding behavior (concentration of branch networks) this may result in some States being subject to excessive credit squeeze/ growth. The results from estimation of SAR models on Sector level CIRFs (**Annexure D**) are discussed hereunder:

- ***Agricultural Credit:*** Like in the case of aggregate credit, SAR models indicate a broad-based impact of predictor variable on responsiveness of States to monetary shocks in the agricultural credit. In case of SCBs export orientation has a negative impact, while industrialisation, per capita bank credit and per capita NBFC credit have a positive impact. For PSBs, the impact of predicator variables is found to be sparser, while export orientation has negative impact, industrialisation and per branch NBFC credit have positive impact. As opposed to PSBs, in case of PVBs, population density has a significant negative impact along with the export orientation, while industrialisation, per capita bank credit, and per capita NBFC credit yield positive impact. 'Negative' spatial spill-overs are observed in case of credit to agriculture, although to a lesser extent observed at the aggregate 'total credit' level. The sparser impact of predictor variables in case of PSBs can be attributed to their focus on agriculture and priority sector lending.

[49] Negative spill-overs can be contextualized as 'the backwash effect of Myrdal (1957), which indicates that growth / response in one region reduces the responses from **associated** [neighbouring] regions.

- ***Industrial Credit:*** Predictor variables show varied impacts across bank groups in case of credit to industry, reflecting the underlying business strategies. At the SCB level, only branch concentration and per capita bank credit have positive impact, and per capita NBFC credit has negative impact. The positive impact of export orientation, and the negative impact of industrialisation become evident only on CIRF at 10^{th} year. As opposed to this, for PSBs the impact of export orientation and industrialisation become sparser towards 10^{th} year, while branch concentration (positive impact) and per capita NBFC credit (negative impact) strengthen towards 10^{th} year. In quite contrast, for PVBs, the export orientation has negative impact, industrialisation and per capita bank credit have positive impact, while per capita NBFC credit has negative impact. 'Negative' spatial spill-overs are observed for SCBs, and PSBs, while PVBs dominantly witness 'Positive' spatial spill-overs. The positive impact of branch concentration shows that banks with concentrated branch networks can effectively block monetary signals to industrial sector owing to their proximity to borrowers. Further, in case of PVBs, the positive impact of industrialisation, can be reckoned as their risk aversion to this segment, which is also evident from their increased focus on retail and services segments in the post-liberalisation period.
- ***Professional Credit:*** The predictor variables have negligible impact on this segment for both SCBs and PSBs towards the 10^{th} year. Though negligible, the population density, industrialisation, and branch concentration have negative impact, while per capita bank credit, and per capita NBFC credit have positive impacts for SCBs, and PSBs. In contrast to this, for PVBs, barring population density all other variables viz. industrialisation, branch concentration, per capital bank credit, per capita NBFC credit have positive impact, while export orientation has a negative impact across time horizons. The positive impact of per capita

bank credit and NBFC credit, specifically for PVBs indicates that complementarity between bank and NBFC credit in this segment. Another interesting feature for PVBs is the positive impact of branch concentration, which indicates that through concentrated branch networks, the PVBs may be blocking transmission of monetary impulses in this segment, which further corroborates the herding tendencies observed in Chapter 3. All bank groups witness 'negative' spill-overs in this segment.

- ***Personal Loans:*** At the aggregate SCB level, only industrialisation has a sustained positive impact, while population density and branch concentration have sparing positive impacts. While for PSBs, the impact of predictor variables fades with time and no variable has significant impact by the 10th year. As opposed to this, for PVBs, almost all variables show significant impact by the 10th year. Export orientation, population density, and per capita bank credit have positive impact, while industrialisation, and per capita NBFC credit have strong negative impact on PVBs. The variation in the impacts can be contextualised by the underlying business strategy of the banking groups. The absence of significant impact at the SCB level underscores the rising credit demand from retail loan segment in the post-liberalisation period, especially the housing market, consumer loans, and vehicles loans effectively impeding transmission of shocks. Further, for PVBs all variables have the right signs, especially population density which indicates PVBs are likely to focus on segments with greater market potential, and in such dense markets, PVBs can block transmission of monetary impulses owing to the presence of broader credit demand and lesser substitutability. The negative sign on per capita NBFC credit also confirms the competitive forces faced by PVBs from NBFCs, which accentuate transmission of monetary impulses. Further, 'negative' spill-overs are starker in case of SCBs, and PSBs, while PVBs witness 'negative' spill-overs to a lesser extent in this

segment. This can be attributed to the fact that in the post-liberalisation period, the PVBs diversified their credit, while PSBs increased their credit concentration across States.

- ***Trade:*** Predictor variables yield quite divergent impacts across bank groups in this segment. Export orientation, branch concentration, and population density have positive impact for SCBs and PSBs, they have negative impact in case of PVBs. On the contrary, per capita NBFC credit has positive impact for PVBs, while it has negligible negative impact on PSBs. For both PSBs, and PVBs, per capita bank credit has a positive impact in this segment. Industrialisation has positive impact only in case of PVBs. Like in case of personal loans, the borrowers in this segment are low ticket customers, usually dispersed geographically. The positive impact of branch concentration and population density for PSBs, and opposite impact for PVBs, corroborates the stylised facts observed in chapter 2, where PSBs focused on large value advances, while PVBs focussed on small ticket advances. Further, the positive sign on per capita NBFC credit for PVBs suggests that NBFC credit acts as complement to PVB credit, while the negative sign for PSBs suggest it is acts as a substitute for PSB credit. As a result, it dampens the transmission of monetary impulses in the former (PVBs) and accelerates in the latter (PSBs). Like in case of other sectors, all bank groups witness 'negative' spill-overs in this segment also.
- ***Transport Operators:*** In this credit segment, the impact of predictor variables is significant for SCBs, while they have sparing impact at the level of individual bank groups viz. PSBs, and PVBs. For SCBs, industrialisation, population density, branch concentration, and export orientation have a negative impact, while per capita bank credit has positive impact. In case of PSBs, per capita NBFC credit, branch concentration, population density, and export orientation have negative impacts, while industrialisation, and per capita bank credit have positive impact.

On the contrary, for PVBs, export orientation and branch concentration have positive impact, while industrialisation and population density have negative impacts. Unlike vehicle loans under personal loans category, the demand for credit from transport operators is driven its linkages with broader economic sectors like industry, exports etc., which may explain the negative sign on the coefficient for export orientation, industrialisation, population density, and branch concentration. Further, like other sectors, in this sector too, the 'negative' spatial spill-overs are observed across the bank groups.

- ***Finance***: The impact of predictor variables in this segment is sparse across bank groups. This may be on account of the nature of credit in financial sector, which is highly concentrated. The major borrowers in this segment are NBFCs (corporates) which are located a few metro centres, thus limiting the spatial impacts. Further, for both SCBs and PVBs branch concentration has a positive impact, while industrialisation and per capita NBFC credit have negative impact. The positive impact of branch concentration underscores the borrower concentration in this credit segment. Interestingly, for PSBs, the per capita NBFC credit has a positive impact suggesting that NBFCs may be acting as substitutes for credit from PSBs in this segment and dampening the monetary transmission. All three bank groups witness 'negative' spatial spill-overs in this segment.

Advantages of Spatial analysis: Compared to plain vanilla OLS models, the results from SAR models (lag/ error) clearly bring out the broader impact borne out by the predictor variables in influencing the spatial variability of monetary transmission through the bank lending channel in India. To illustrate, for the total credit, the OLS model indicates no significant impact of industrialisation on the outcome variable at any time horizon i.e., CIRF at 2^{nd}, 6^{th}, and 10^{th} years.

While in case of PSBs, the OLS models found significant impact only in case of branch concentration, and for PVBs significant impacts are found only for export orientation, industrialisation, and population density. As opposed to this, the SAR models confirm the expected negative impact of industrialisation on the outcome variable, underscoring the findings from earlier studies that States with higher share of industries are likely to show greater response to monetary shocks. Besides, in case of PSBs, the SAR models also find the significant impact of export orientation, population density, per capita NBFC credit. In case of PVBs, the SAR models identify branch concentration, per capita bank credit, and per capita NBFC credit also to be significant. Thus, in presence of confirmed spatial autocorrelations, using SAR models offers better explanations on the impact of predictor variables on outcome variables. **Table 5.4** depicts a summary position of the number of instances with significant coefficients of the predictor variables in the estimation of SAR models. As mentioned earlier, a total of 1152 (all iterations) SAR models were estimated, with 8,064 estimated coefficients including the spill-over values i.e., 'ρ' and 'λ'. Of these 39% of the coefficient estimates of SAR models were found to be significant, while for the OLS models only 16% of the coefficient estimates were found to be significant.[50]

Another interesting feature of the SAR models is the use of spatial weight matrices, which can be developed/ defined based on the underlying causal relation between predictor and outcome variables. In this chapter, besides using the spatial weight matrices based on geographical proximity, new matrices, resembling the causal connect between predictor and outcome variables were developed viz. Spatial Weight Matrices – Branch Network Affinity, and Rail Trade Gravity. For the current analytical question at hand, the role of banks is crucial in transmitting the monetary

[50] comparison is made only to underscore the better explanatory power of SAR models over OLS models.

impulses to the broader economic regions. This is reflected in the use of spatial weight matrices based on branch network affinity (common bank branches), which yield the maximum per centage (48%) of significant coefficients higher than spatial matrices defined based on geographical contiguity (47%). SAR models also bring out the importance of spatial spill-overs, in 50% of the estimations, spill-overs are found to be significant. Further, the use of SAR models also underscored the importance of incorporating banking specific variables that capture banking structure, penetration, and competition at the regional levels. Compared to the macro-economic variables, branch concentration (48%), per capita NBFC credit (41%), and per capita bank credit (32%) emerged as prominent predictor variables in influencing spatial transmission across States.

Table 5.4: Instances with coefficients of predictor variables found significant in SAR models

Spatial Matrix	Ind	Exp	Pop. Den	BCR5	PCBK	PBNB	'ρ' / 'λ'	Count	Total	%*
SWMBANS -Lag	20	28	17	29	21	31	36	182	504	36%
SWMBANS - Error	34	24	23	41	27	34	30	213	504	42%
SWMBAS -Lag	24	27	14	30	23	24	16	158	504	31%
SWMBAS – Error	34	27	26	40	29	34	47	237	504	47%
SWMBCNS -Lag	22	25	14	32	19	26	25	163	504	32%
SWMBCNS - Error	32	34	22	37	25	34	24	208	504	41%
SWMBCS -Lag	24	28	14	32	24	26	24	172	504	34%
SWMBCS – Error	26	27	29	37	21	32	60	232	504	46%
SWMBFNS -Lag	**22**	**32**	**13**	**31**	**22**	**27**	**59**	**206**	**504**	**41%**
SWMBFNS - Error	**35**	**40**	**28**	**45**	**22**	**39**	**31**	**240**	**504**	**48%**
SWMBFS -Lag	17	20	17	31	19	26	49	179	504	36%
SWMBFS – Error	30	22	19	34	21	31	60	217	504	43%
SWMRGNS -Lag	20	23	14	26	20	28	29	160	504	32%
SWMRGNS - Error	32	26	20	41	26	26	20	191	504	38%
SWMRGS -Lag	28	22	15	27	20	30	21	163	504	32%
SWMRGS – Error	20	15	21	39	26	28	43	192	504	38%
Significant Coefficients	420	420	306	552	365	476	574	3113	8064	
Total Coefficients	1152	1152	1152	1152	1152	1152	1152	8064	**39%**	
% of Significant*	**36%**	**36%**	**27%**	**48%**	**32%**	**41%**	**50%**			

Notes: Variables notations: Ind – Industrialization; Exp – Export Orientation; Pop. Den – Population Density; BCR5 – Branch Concentration; PCBK – Per Capita Bank Credit; PCNB – Per Capita NBFC Credit;
'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively; * % of Significant Coefficients

5.5. Conclusion

This chapter explored the factors driving the observed spatial variability in the transmission of monetary policy through the bank lending channel across Indian States. Taking cue from the literature, six factors viz. export orientation, industrialisation, population density, banking concentration, per capita bank credit, and per capita NBFC credit are chosen as predictor variables. These predictor variables are used to explain the observed variation in the cumulative impulse response function (obtained through SVAR framework) of the credit growth to the shock in monetary policy variable (M3 growth). Initially, the impact of predictor variables on outcome variables was tested through a normal OLS regression model, and sparing impact of predictor variables was observed. Further, reckoning the spatial features at play and possibility of spatial spill-overs, analytical framework is extended using SAR models, and spatial weight matrices reflecting the dependencies in line with the causal relations between predictors and outcome variables.

The SAR model estimates clearly point to a broader impact borne out by the predictor variables in influencing the spatial variability across bank groups and sectors. Particularly, the SAR models find significant impact of bank specific features like structure, penetration, and competition at the regional levels driving spatial variability in monetary transmission. While macro-economic variables like industrialisation, export orientation were expected to be significant (based on evidence from earlier studies), the inclusion of variables like branch concentration, per capita bank/ NBFC credit in the analytical model provides an explanation to the ‘negative’ spatial spill-overs. Further this offered a new perspective on the spatial variability of monetary transmission in the Indian context, factoring the nuances in the behavior of banks to rationalize managerial resources,

resulting in selective focus on certain States/ sector in terms of concentration of branch network, per capita credit size etc., Furthermore, the results, also point to the role of competition, specifically from the NBFCs, which act as both substitutes and complements to the bank credit, thus accentuating/ dampening the transmission of monetary impulses. Besides extending the literature on spatial variability of monetary transmission in India, the results from SAR models also corroborate the findings like herding tendencies, diversified focus on customer segments/ sectors among bank groups.

Chapter 6: Summary and Conclusion

6.1. Introduction

The genesis of this study stems from an interesting methodological perspective put forth by the IMF in its Global Financial Stability Report (GFSR, 2016) for analysing '*transmission of monetary policy through the reaction of financial intermediaries'* (see ***Figure 1.2***). Post global financial crisis, across countries monetary policy has assumed a central role in ensuring financial stability and reviving growth. The quantitative easing that followed led to a low-interest rate regime and abundant liquidity. Despite these efforts, the revival of growth was not broad based, and the financial risks were building up in search for better yields. This has called for revisiting the methodological approaches to analyse the efficacy of monetary policy transmission.

In the Indian context, RBI has moved to inflation targeting revamping the liquidity management framework and relying on credit pricing formulas to transmit monetary impulses to the broader economic sectors. Unlike advanced economies, Indian economy continues to be a bank dependent economy, despite the increasing role of other financial markets in the post-liberalisation period. Therefore, the efficacy of monetary transmission is still largely dependent on the banks, with bank lending channel becoming prominent next only to the interest rate channel. Albeit, as acknowledged in multiple studies, the transmission of monetary impulses through the bank lending channel is inefficient. Specifically, the banks are blocking or delaying the transmission of rate cuts to borrowers. To overcome such issues and to improve transmission through the bank lending channel, the RBI over time, has specified changes to the pricing formulas (PLR, BPLR, Base Rate, MCLR formulas) and finally moving towards rates based on external benchmarks (EBLR).

While many studies in the Indian context have analysed the issues in the bank lending channel, they focussed their attention on the parameters like GDP/ Credit at the aggregate systemic level. Further, they generally do not account for the impact of bank ownership or consider sectoral/ spatial differences, which are found to be significantly impacting the monetary transmission through the bank lending channel. In this context, the present thesis, aimed to portray "*some issues and new evidence in the monetary transmission in India*" through the bank lending channel. The study shifts the methodological perspective to analyse the banks' responses to monetary impulses, duly reckoning for the ownership, sectoral, and spatial dimensions. To this end, the study has set out the following four objectives. Furthermore, to present a comprehensive and cogent explanation of the role played by the banks in attenuating monetary policy responses, successive objectives were formulated reckoning results from the preceding objectives.

1. The first objective analysed structural changes in the post-liberalisation period to bring out stylized facts on Indian banking system. It provided a historical context to the current study by identifying the shifts in banks' credit growth strategies as reflected from the changes in the credit distribution trends across ownership, size, sectoral, and spatial dimensions.
2. Taking cue from the first objective, in the second objective the plausibility of herding behaviour amongst Indian banks was explored. The objective addressed the question whether banks adopt herding as a credit growth strategy to optimise informational asymmetries conditioned by macro, monetary factors and the relevant bank-specific characteristics viz. ownership, branch concentration, competition etc.,
3. The third objective was developed reckoning the results of first and second objectives which underscored the role of spatial features in conditioning banks' behaviour and credit

growth strategies. More specifically, the third objective explored whether there are spatial differences (State level) in monetary transmission as reflected in the responsiveness of credit growth to policy shocks conditioned by macro-economic factors and bank specific features.

4. The final and the fourth objective explored the reasons for observed 'Spatial Differences' in the monetary transmission (objective three). The objective analyzed the factors influencing the 'Spatial Differences' and the possible 'Spatial Spill-overs' affecting responsiveness of the States' credit growth to monetary policy shocks across sectoral and bank ownership dimensions.

6.2. Analytical Framework

The analytical framework of this study is centred on understanding the role of banks in attuning their credit growth strategies in response to the monetary shocks and the consequent impact on overall monetary transmission through the bank lending channel in India. Accordingly, the methodological tools are chosen for carrying out the objectives mentioned above. Therefore, for the first objective, exploratory data analysis (trends/ visualisations) on long term and granular bank credit data was used to bring out the structural changes in the Indian banking system in the post liberalisation period. The per capita credit size is computed to gauge the strategic focus of different bank groups across size, sector, and spatial dimensions. In the second objective, following literature Lakonishok et al., (1992), a herding measure at the bank group and sector level was developed for Indian banks. Extending the methodology of Tran et al., (2017) the impact of macro and monetary conditions, and bank specific features on the herding measures was assessed using FMOLS methodology.

For the third objective, a SVAR framework is used for analysing the spatial differences in the transmission of monetary impulses across Indian States. The SVAR framework extends the methodology of Nachane et al., (2002), by incorporating State level credit growth as the foremost endogenous variable and describes the structural restrictions from other variables viz. State level GDP growth, National GDP growth, Growth rate of Money Supply, and Inflation. Accordingly, the impulse responses and forecast error variance decomposition of State level credit growth to monetary shocks (M3 growth) are examined both at the sectoral and bank group levels.

In the fourth objective, the factors driving the observed spatial differences in responsiveness of credit growth at the State level (CIRFs from objective three) are examined. As banks try to optimise competition, concentration, and composition of credit risks at the regional level, the factors like *export orientation, industrialisation, population density, branch network concentration, per capita bank credit, and per capita NBFC credit* are chosen to reflect both the macro-economic, banking specific attributes that are likely to impact the credit growth strategies of banks. Extending the methodology adopted by (Duran and Erdem, 2014) in assessing regional monetary transmission for Turkey, in this objective, the impact of the above factors on credit responsiveness is assessed initially using an OLS regression model. Further, to account for the potential spatial spill-overs between States, the SAR models were used to estimate the impact of macro-economic and bank specific factors on the credit responsiveness. Furthermore, to strengthen the analytical output, the spatial weight matrices used for SAR models (viz. spatial weight matrices based on branch network affinity, inter-State rail trade) were defined to reflect the banks' behaviour accounting for the underlying causal relations between the outcome and independent (predictor) variables.

6.3.Major Findings

The stylized facts from the first objective clearly indicate the structural changes in the Indian banking sector, with PVBs improving market share both in terms of accounts and credit amount, displacing PSBs as the dominant market player. Further, the stylised facts also point to the divergent credit growth strategies adopted by the PSBs and PVBs in the post-liberalisation period. While the former focussed on large value advances, in the industrial sector, concentrating credit in select large States, the latter targeted small and medium value advances, in the retail and service sectors, diversifying its credit across States. From a monetary transmission standpoint, the stylized facts point to the important role played by bank ownership, sector, and spatial features in shaping the banks' credit growth strategies.

The stylised facts also point to clear divergences between PSBs and PVBs regarding their credit growth strategies, suggesting plausible herding behaviour among banks. In the post-liberalisation period, as banks pursued growth opportunities and expanded to new domains, they faced increased informational asymmetries often leading them to exhibit herding tendencies to optimise informational costs. The LSV herding measures confirm the presence of herding among Indian banks both at the sector and bank group level. Further, the herding measures are found to be influenced to by the macroeconomic, monetary, and bank-specific features. As herding represents departure from the optimal decisions, such herding tendencies can result in banks attuning their credit growth strategies following the leader banks in their ownership / sectoral categories. As a result, this may at times lead the banks to accelerate (over-react) or repress (under-react) to the transmission of monetary impulses impacting the overall monetary transmission. Besides, it is observed that banks with highly concentrated branch networks exhibit lower herding tendencies

and bank's asset quality is negatively associated with herding, suggesting risk aversion on the part of the banks. These features impact the spatial distribution of bank credit, with banks choosing to limit their credit expansion to known regions/ centres or to avoid delinquencies. Such tendencies can lead to differential responses among States to the monetary impulses leading to spatial variability in overall monetary transmission.

The State level variations of the cumulative impulse response functions of credit growth to a shock in monetary policy variable (M3) growth from the SVAR framework confirms the spatial variability of monetary transmission in India. These results not only corroborate the findings from the earlier studies in the Indian context, but also shed new light on the spatial variability at the sectoral and bank group level. Interestingly stark variability in credit responsiveness across sectors is found within in same States. While earlier studies have indicated the factors that might be leading to divergences in credit responsiveness of States to monetary impulses, the current study has extended the analytical framework to estimate their impact.

The spatial variability of monetary transmission at the State level is expected to be driven by the factors like industrialisation, export orientation, and financial deepening. Besides these factors, variables that reflect the banking structure, penetration, and competition are found to be yielding a greater impact on spatial variability of monetary transmission. At the methodological level, the use of Spatial Autoregression Models (SAR) proved beneficial than the normal OLS models, as the former estimates the impact of the variables duly reckoning for the possible spatial spill-overs. Further, the use of spatial weight matrices specifically the matrices based on branch network affinity, offered a new perspective on the spatial variability of monetary transmission in the Indian

context. The variables like population density (reflecting market size in an area), the branch concentration (reflecting the banking density), the per capita bank credit (reflecting the strategic choice of banks on large or small customers), the per capita NBFC credit (reflecting the competition at the regional level) are found to be significant across different versions of spatial weight matrices and across bank groups / sectors.

The results also indicate the presence of negative spatial spill-overs in term of credit responsiveness between Indian States. In general, positive spill-overs are expected between geographically connected regions. However, the negative spill-overs can be explained by factoring the nuances in the behavior of banks to rationalize managerial resources, in terms of concentration of branch networks, per capita credit size etc., Furthermore, the results, also point to the role of competition, specifically from the NBFCs, which act as both substitutes and complements to the bank credit, thus accentuating/ dampening the transmission of monetary impulses.

To summarize, the current thesis analysed the monetary transmission through the bank lending channel in India by pivoting the analytical framework to examine the factors shaping the reaction of banks to monetary policy impulses. The results from this thesis provide insights on the structural transformation of banking sector in the post-liberalisation period underscoring the importance of sector, size, spatial, and ownership dimensions. Besides extending the literature on spatial variability of monetary transmission in India and use of innovative spatial matrices, the results provide novel insights on the herding tendencies, diversified focus of bank groups on customer segments and sectors impacting monetary transmission at large.

6.4.Policy Implications

Three policy implications emanate from the results of current thesis:

- *Importance of using micro level data and cross dimensional analysis:* The key insights that guided the study emerged on account of using micro level data at the bank or bank group level. Further, the use of cross dimensional analysis of credit trends i.e., incorporating sectoral, size, spatial dimensions unravelled the divergent focus of the bank groups highlighting nuances which otherwise would have been lost in the aggregate analysis. Policy formulation can immensely benefit from the research studies that complement aggregate analysis with the micro data trends. In the Indian context, using BSR data of RBI can aid in such explorations.
- *Incorporating spatial features in monetary analysis:* The diversity of the Indian economy is bound to impact the credit variability and its responsiveness to monetary impulses across States. However, only a few studies incorporate spatial features in the analysis of monetary transmission. As evidenced in this study, spatial features often influence the bank credit growth strategies impacting the overall monetary transmission. Hence, incorporating spatial features can enrich the analytical models to gauge the efficiency of monetary transmission.
- *Factoring business strategy implications to the changes in the policy framework/ tools*: The most important policy take away from current study is the need to factor reactions of the participants (banks) and their business implications in designing the monetary policy frameworks/ tools. As profit maximising entities, the banks will cater to stake holder preferences and accordingly the reckon risk optimisation strategies. Though the banking in India is universal in nature, the bank may face rigidities in being able to aggregate risks smoothly across maturities, sectors, and geographies, resulting in delaying or dampening the transmission of monetary impulses. Therefore, considering business strategy implications can improve the efficacy of policy tools.

6.5.Limitations

Like all analytical exercises, the current study also has limitations both in terms of methodology and data. At the methodological level, the study did not analyze the impact of monetary shocks during various monetary policy regimes. Further, the direct impact of bank herding on monetary transmission is not currently assessed. In addition to the above, the impact of balance sheet factors like profitability and asset quality, which impact monetary transmission were not factored in carrying out the spatial analysis, due to paucity of bank level data on sectoral – spatial distribution of advances. Furthermore, the recent changes to loan pricing formulas (external benchmark linked rates) are not analysed due to their recent vintage and lack of adequate data.

6.6.Scope for Future Research

The analytical framework used in current study can be extended in three ways. First, with the availability of granular bank and branch level geo-coded data (latitude and longitude), the complexity of spatial analysis can be improved to provide sharper inputs on the factors driving the spatial variability of monetary transmission. Second, another possible extension to the spatial analysis is examining the nature of market structures and institutions at the regional levels in supporting efficient transmission of monetary impulses. Third, considering the advent of digital technologies and big data analytics, the business models of the banks have undergone a change in terms of centralised loan approval process, transforming the branches as mere marketing outlets. In this background, the current framework can be revisited to see if digital sourcing of loans has improved efficacy of monetary transmission.

Annexures

A. Technical discussion on Structural Vector Autoregression (SVAR)

Sims (1980) pioneered the introduced of VAR models to answer the "impulse" and "propagation" questions often encountered in applied macroeconomics, dealing with system of endogenous variables (Watson, 1994). Since, then VAR models have become the go-to models for analysing the monetary transmission mechanism (Christiano et al., 1999) and business cycles (Blanchard and Quah, 1989). SVAR models are a variant of the broader VAR models (Stock and Watson, 2001), which leverage underlying economic theory to impose restrictions on the variance – covariance matrix determining the ways in which contemporaneous correlations act among the endogenous variables in the VAR system (Bernanke, 1986; Blanchard and Watson, 1986; Sims, 1980). Consider the following VAR system

$$y_t = A_1 y_{t-1} + \epsilon_t \ (\epsilon_t \sim (0, \sum)$$

Where y_t is a vector of k variables (k*1) in period *t*, A_1 is a k*k coefficient matrix, and ϵ_t is a k*1 vector of errors with a multivariate normal distribution with zero mean, and $\sum$ is the k*k variance-covariance matrix. The matrix $'\sum'$ is characterized by the variances of the endogenous variables as its diagonal elements, and covariance of errors as the off-diagonal elements. SVAR models have symmetric variance-covariance matrices $'\sum'$. By imposing restriction on the $'\sum'$, SVAR enables to delineate or assign the impact of innovations (Shocks) in one variable on another variable. There are four ways for imposing restrictions on endogenous variables in the VAR systems (Lütkepohl, 2007). The A-model, the B-model, the AB-model, and long-run restrictions (Blanchard and Quah, 1989). These models vary based on the nature of covariance matrices. In A-model the covariance matrix is diagonal, containing the variances of the error terms only.

Further, an additional matrix A describes the contemporaneous relationships between the observable variables.

$$Ay_t = \sum_{i=1}^{p} A_i^* y_{t-1} + \epsilon_t$$

Where $A_i^* = AA_j$ and $\epsilon_t = Au_t \sim (0, \sum_\epsilon = A\sum_u A')$; the matrix A is normalised by setting the diagonal elements of A. Further, (K(K−1)/2) restrictions are placed to obtain unique estimates for the structural coefficients. If more restrictions are placed the model is said to be over identified.

In the B type models, adding a matrix B directly to the error terms describes the structural relationship between errors. Further, the matrix B normalises the variance of the error terms to 1. The B model is described by the following equation.

$$Ay_t = \sum_{i=1}^{p} A_i y_{t-1} + B\,\epsilon_t$$

Where $u_t = B\,\epsilon_t$ and $\epsilon_t \sim (0, I_k)$ further K(K-1)/2 restrictions are placed on matrix B.

The A-B model combines both features of the A and B models; the errors in this model are described by the following equation

$$Au_t = B\epsilon_t \; and \quad \epsilon t \sim (0, I)$$

In these models, one of the matrices is an identity matrix (I) and the other matrix specifies the restrictions. Further, the AB model is also called a short-run SVAR model. The A and B matrices model all the information about contemporaneous correlations among the endogenous variables. Further, as the B matrix also scales the shocks (innovations) ϵ_t to have unit variance. This enables the structural IRFs obtained from the model estimations be interpreted as the effect on a variable i of a one-time unit increase in the structural innovation to variable j after s periods.

B. Technical discussion on Moran's I Value and hypothesis testing

Estimating Moran's I Statistic: Moran's I is a simple measure of spatial autocorrelation, which is measured by the formula given below (Moran, 1950).

$$\text{Moran's } I = \frac{N \sum_{i=1}^{n} \sum_{j=1}^{n} W_{ij} \ (X_i - \overline{X})(X_j - \overline{X})}{(\sum_{i=1}^{n} \sum_{j=1}^{n} W_{ij}) \sum_{i=1}^{n} (X_i - \overline{X})^2}$$

where

N is the number of observations (points or polygons)
$\bar{X}$ is the mean of the variable
Xi is the variable value at a particular location
Xj is the variable value at another location
Wij is a weight indexing location of i relative to j (*Spatial weight matrix*)

Test for Statistical significance of Moran's I: Moran's I provides an inferential statistic, and the null hypothesis is that there is no spatial autocorrelation for the attribute across the spatial units under consideration. The statistic asymptotically follows a standard normal distribution (Kondo, 2021). The expected value of Moran's I under Null hypothesis is

$$E\ (I) = \frac{-1}{N-1}$$

where N is the number of observations (spatial units), in large samples as N → ∞, E(I) → 0

The test statistic is then converted into a Z-score as below

$$Z = \frac{I\ -\ E\ (I)}{SE(I)}$$

Where, I is the calculated Moran's I and SE is standard error. The corresponding *p-value* establishes significance. The spatial autocorrelation is positive if the p-value *is* statistically significant, and the z-score is positive, indicating clustering spatial attributes amongst neighbours. If the p-value *is* statistically significant, and the z-score is negative, this indicates negative spatial autocorrelation, resulting in repulsion of spatial attributes amongst neighbours.

C. Data on Bank Group and Sector wise Impulse Response and Forecast Errors

Table A: Sector wise Cumulative Impulse Response Functions of Public Sector Banks (PSBs)

CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	1.15	-0.67	-0.56	2.35	-0.60	0.02	-1.95	-0.18	1.75	0.06	0.38	0.37	0.53	0.60	1.84
2	-1.20	-1.44	0.23	0.82	-2.21	1.90	0.93	-0.70	-1.35	1.38	1.51	2.41	-1.01	-1.64	1.32
3	0.64	-0.21	-1.29	2.79	-0.10	1.09	-0.41	-0.35	-0.83	0.14	-1.14	2.80	0.57	0.12	1.25
4	-0.04	0.58	0.34	2.00	-0.58	1.09	-0.09	-0.02	-0.46	0.43	0.70	2.21	-0.89	-0.42	1.51
5	-0.01	-1.69	-0.70	1.74	-1.00	1.12	-0.23	-0.33	-0.44	1.25	0.96	2.47	0.52	-0.87	1.54
6	0.03	-0.01	-0.55	2.17	-0.83	1.37	-0.20	-1.00	-0.88	0.31	-0.14	2.27	-0.54	-0.08	1.30
7	0.09	-0.36	-0.14	2.11	-0.73	1.02	-0.05	0.47	-0.37	0.51	0.17	2.27	-0.10	-0.73	1.57
8	0.00	-0.67	-0.60	1.91	-0.81	1.26	-0.25	-0.79	-0.69	0.78	0.73	2.55	-0.23	-0.42	1.31
9	0.03	-0.42	-0.38	2.06	-0.80	1.19	-0.13	-0.35	-0.72	0.77	0.17	2.29	-0.02	-0.40	1.54
10	0.10	-0.41	-0.35	2.05	-0.77	1.18	-0.16	-0.15	-0.42	0.42	0.26	2.37	-0.35	-0.59	1.39
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-2.88	-1.47	-2.78	-1.04	-4.39	3.53	0.36	-1.99	5.78	1.88	-1.31	-0.88	-2.10	-1.35	1.46
2	-4.65	-1.88	1.62	-1.46	-1.42	5.35	2.68	-0.29	-8.01	-1.20	-1.21	-0.54	-4.02	0.57	-4.08
3	-3.33	0.53	-1.75	-0.70	-2.55	5.49	0.40	-3.24	0.60	0.78	-0.82	1.24	-0.35	-0.77	-5.21
4	-3.31	-2.77	0.53	-1.54	-3.54	8.41	2.15	-0.84	3.50	1.26	-1.39	-1.87	-1.98	0.23	1.83
5	-4.42	-1.00	1.05	-1.04	-1.49	3.22	1.23	-1.32	-8.12	0.56	-1.06	0.73	-2.27	-0.70	-4.80
6	-2.96	-1.16	-1.70	-1.03	-3.51	6.56	1.38	-2.27	2.25	0.23	-1.31	-0.31	-1.83	0.16	-1.78
7	-3.88	-1.53	0.47	-1.50	-2.12	6.66	1.63	-1.76	-0.27	0.77	-1.00	-0.65	-1.90	-0.53	-1.83
8	-3.94	-1.18	0.16	-0.97	-2.87	4.94	1.37	-0.88	-4.21	0.60	-1.19	0.31	-1.92	-0.04	-3.61
9	-3.39	-1.37	-0.50	-1.16	-2.49	6.12	1.45	-2.24	1.44	0.71	-1.19	-0.61	-1.94	-0.33	-1.16
10	-3.80	-1.39	0.08	-1.26	-2.72	6.09	1.52	-1.68	-2.69	0.51	-1.19	-0.01	-1.90	-0.24	-3.01
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	2.74	-1.91	2.14	3.96	-4.90	-1.55	-2.64	1.54	-1.40	-5.75	3.57	0.58	-0.62	3.23	1.04
2	-0.53	2.12	1.60	5.87	-4.42	0.77	0.32	-1.64	0.98	3.65	0.55	4.53	1.01	0.89	4.17
3	1.60	-0.93	0.37	3.62	-3.00	-0.50	-0.47	0.72	-2.94	-3.20	5.21	4.87	-0.74	3.15	1.12
4	1.33	1.48	2.44	3.49	-3.65	-0.95	-0.84	-0.39	-2.13	-5.12	1.21	4.31	1.32	1.80	2.64
5	0.76	-1.04	0.76	4.39	-4.19	-0.80	-0.33	0.14	0.29	1.15	3.69	4.06	-0.09	2.40	2.30
6	1.39	1.30	1.31	4.16	-3.22	-1.09	-0.86	-0.41	-2.52	-2.50	3.11	4.43	0.48	2.38	2.22
7	0.51	-0.23	1.72	4.70	-3.85	-0.03	-0.40	0.08	-1.25	-3.06	2.15	4.08	-0.14	2.14	2.34
8	1.61	0.52	0.98	4.03	-3.75	-0.62	-0.68	-0.12	-0.85	-1.27	3.43	4.48	0.99	2.31	2.22
9	0.89	0.11	1.50	4.11	-3.67	-0.96	-0.53	-0.15	-2.12	-1.75	2.89	4.19	-0.24	2.39	2.37
10	0.99	0.41	1.39	4.08	-3.60	-0.68	-0.59	-0.05	-0.98	-2.40	2.62	4.36	0.65	2.16	2.22
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	13.34	8.26	-5.82	-11.36	6.62	4.28	0.05	7.02	4.00	5.65	0.55	-0.84	8.05	0.63	0.19
2	10.32	0.27	3.44	-1.52	2.51	-0.01	0.61	6.26	0.21	6.74	18.37	9.75	-1.12	1.69	-1.04
3	10.80	10.38	-2.35	-2.56	4.29	3.13	-2.90	1.64	1.48	3.29	-2.06	2.68	6.74	0.14	-7.44
4	8.15	5.26	-2.04	-0.45	4.75	0.26	0.98	5.67	0.21	4.81	9.82	4.40	0.72	2.54	-1.81
5	10.13	4.95	1.86	-5.68	4.05	3.16	-1.41	7.90	1.25	7.59	12.32	7.06	5.54	1.09	-1.35
6	10.48	7.93	-3.89	-4.22	3.78	0.38	-0.89	2.97	1.03	4.63	4.14	3.11	2.30	0.22	-5.31
7	10.37	5.04	1.30	-0.39	4.81	3.32	-0.13	5.01	1.92	5.40	7.87	6.10	3.64	1.86	-2.59
8	10.39	6.32	-2.00	-4.32	3.69	0.97	-1.16	5.89	-0.23	5.62	8.55	4.89	3.89	1.65	-2.78
9	9.12	6.62	-0.36	-3.32	4.40	2.36	-0.71	4.74	1.23	5.88	8.16	4.47	2.80	0.40	-3.49
10	10.60	5.73	-1.19	-2.97	4.33	1.38	-0.41	5.33	1.99	5.49	7.44	5.55	3.96	1.42	-3.31

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	3.39	-0.79	-2.53	-2.74	-1.12	-4.00	-1.58	-3.45	-6.12	4.33	-0.36	-0.18	-1.01	1.32	-0.06
2	2.32	-2.07	-4.23	1.62	0.52	-1.60	-1.06	-1.05	-8.22	0.33	-2.70	-0.21	-0.55	-2.51	-3.97
3	3.54	-1.65	-3.91	4.71	1.73	-3.71	-1.26	-2.29	-2.36	2.11	-0.29	0.68	0.03	1.20	0.90
4	1.60	-0.65	-1.02	-2.43	0.02	-2.73	-1.73	-1.39	-9.71	2.16	-1.40	0.04	-1.21	-2.05	-2.39
5	3.07	-1.78	-3.70	1.78	0.37	-2.48	-1.31	-0.87	-6.78	1.71	-0.87	-0.23	-0.11	0.63	-1.83
6	2.09	-1.38	-3.33	2.32	0.91	-2.77	-1.27	-2.74	-5.50	1.83	-1.58	0.57	-0.85	-1.30	-0.94
7	3.22	-1.35	-2.38	0.12	0.56	-3.08	-1.60	-1.19	-6.81	1.98	-1.03	-0.16	-0.54	-0.15	-1.70
8	2.17	-1.42	-3.05	1.58	0.47	-2.85	-1.26	-2.06	-6.96	1.78	-0.99	0.30	-0.45	-0.66	-1.29
9	2.68	-1.33	-3.06	0.87	0.68	-2.62	-1.46	-1.35	-6.53	1.95	-1.37	0.03	-0.63	-0.60	-1.79
10	2.49	-1.44	-2.80	1.14	0.59	-2.81	-1.44	-1.68	-6.77	1.82	-1.15	0.19	-0.61	-0.34	-1.26
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-3.79	1.09	-6.72	12.82	-3.51	0.86	-3.74	-1.27	-4.64	-1.98	-4.45	3.21	4.32	-4.02	-2.23
2	1.89	-4.49	3.73	-0.43	-2.85	0.12	-3.15	-0.34	-4.14	-0.34	9.32	0.99	-2.54	-9.63	-2.59
3	0.31	2.34	-0.88	7.33	6.16	-0.57	-2.14	1.37	-3.47	-1.24	-6.14	2.52	4.64	-3.16	4.07
4	-2.64	0.11	-0.64	8.37	-2.52	1.68	-3.71	1.54	-6.33	-2.27	-0.56	3.33	-3.02	-7.40	-6.00
5	1.80	-2.04	0.71	2.96	-0.86	0.56	-2.44	-0.96	-2.25	-0.48	4.31	2.02	1.26	-8.05	2.35
6	-2.00	0.53	-1.18	7.39	1.66	0.53	-3.31	0.74	-5.73	-1.31	-4.47	2.01	3.33	-3.69	-1.22
7	0.32	-0.40	0.12	5.90	-1.23	0.43	-2.66	1.97	-3.91	-1.53	2.19	2.71	-1.38	-8.75	-2.37
8	-0.10	-0.57	-0.06	5.74	0.71	0.14	-3.10	-1.46	-4.29	-1.31	0.09	2.61	0.49	-5.31	1.55
9	-1.07	-0.14	-0.56	5.69	0.44	1.27	-2.87	1.73	-4.63	-0.89	-1.70	2.21	1.97	-6.24	-2.89
10	-0.08	-0.49	-0.03	6.36	-0.88	0.39	-2.97	0.50	-4.04	-1.64	1.76	2.30	0.37	-7.45	0.50
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	1.05	2.78	-0.42	21.43	-5.80	5.94	2.27	9.34	2.02	5.02	-10.45	10.44	6.13	-0.09	7.83
2	-14.26	2.90	-1.84	11.81	-3.13	-1.55	-4.87	12.62	-1.44	2.93	0.67	7.15	0.81	-1.02	-4.21
3	7.08	0.96	-3.27	11.00	-3.79	-8.42	3.01	14.44	6.96	0.32	-8.77	-1.86	2.21	-1.88	0.92
4	-6.73	2.09	4.29	11.94	-3.32	2.08	-1.67	15.85	5.03	3.30	-2.35	10.04	4.97	0.79	-0.46
5	-5.27	2.16	-4.64	17.10	-5.36	-3.03	-0.47	8.45	-0.10	2.94	-3.66	3.72	2.56	-1.68	0.06
6	-1.07	1.81	0.71	12.90	-2.90	-4.65	0.77	18.41	-0.25	2.44	-5.69	3.95	2.16	-0.63	-0.42
7	-4.28	2.04	-0.43	11.64	-4.00	-0.99	-1.97	10.12	8.94	2.26	-4.42	5.64	3.98	-0.31	0.11
8	-2.76	1.87	-1.73	14.69	-4.44	-2.24	0.76	15.54	0.94	2.39	-3.67	5.17	2.91	-1.44	-0.43
9	-3.95	1.96	0.51	13.97	-3.50	-3.39	-0.56	12.04	1.75	2.74	-4.70	4.43	2.81	-0.20	-0.05
10	-3.17	1.98	-1.56	13.09	-4.04	-2.41	-0.70	14.56	3.69	2.56	-4.50	4.87	3.21	-0.92	-0.14
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PSBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	8.54	-12.10	-4.26	2.02	13.16	22.08	-12.03	2.08	20.93	-8.68	45.30	-11.64	10.80	-12.13	7.85
2	-6.84	11.25	-6.91	-86.46	-11.92	-3.93	17.34	-5.18	4.50	-20.11	-12.76	14.57	-2.57	-6.95	3.83
3	11.47	10.76	1.55	74.52	4.69	9.84	-5.68	-4.38	-3.95	-24.93	7.52	-4.40	4.73	1.07	2.13
4	-0.19	-24.29	-6.84	-18.26	-0.58	12.35	11.91	4.50	14.77	-30.31	33.66	5.33	3.11	1.72	5.97
5	2.85	28.90	-2.71	-28.84	0.00	3.75	-0.57	-6.35	4.89	-12.10	7.74	8.17	3.61	-11.18	4.11
6	3.43	-15.76	-2.31	61.10	-0.99	5.30	7.18	-2.07	4.14	-25.37	2.64	-4.93	3.17	2.26	5.79
7	4.59	6.88	-5.01	-84.92	0.35	11.44	2.80	1.51	9.35	-28.35	21.52	7.31	3.04	-4.23	4.67
8	1.01	3.58	-3.03	52.02	0.63	6.00	4.80	-5.43	5.32	-16.92	16.63	6.26	3.74	-3.66	3.70
9	4.17	-2.97	-3.14	7.60	-1.86	6.44	4.74	0.05	6.22	-22.48	8.62	-2.89	2.61	-1.19	5.29
10	3.46	5.29	-4.01	-62.10	1.55	8.51	3.42	-2.08	6.45	-27.06	11.42	6.38	3.69	-4.50	4.79

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

Table B: Sector wise Forecast Error Variance Decomposition of Public Sector Banks (PSBs)

Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.00	0.00	0.11	0.00	0.04	0.00	0.00	0.03	0.01	0.00	0.20	0.00	0.02	0.07
2	0.05	0.01	0.00	0.09	0.00	0.06	0.04	0.00	0.06	0.01	0.00	0.23	0.00	0.04	0.04
3	0.10	0.01	0.00	0.10	0.02	0.10	0.08	0.00	0.07	0.02	0.00	0.21	0.03	0.07	0.03
4	0.13	0.01	0.02	0.11	0.05	0.10	0.08	0.00	0.07	0.02	0.02	0.20	0.05	0.09	0.03
5	0.14	0.01	0.03	0.11	0.05	0.10	0.08	0.00	0.07	0.02	0.03	0.19	0.06	0.09	0.03
6	0.13	0.03	0.03	0.11	0.05	0.10	0.08	0.00	0.06	0.02	0.03	0.19	0.08	0.08	0.03
7	0.13	0.03	0.03	0.11	0.05	0.10	0.08	0.00	0.06	0.03	0.03	0.19	0.08	0.09	0.03
8	0.13	0.03	0.03	0.11	0.05	0.10	0.08	0.01	0.06	0.03	0.03	0.19	0.08	0.09	0.03
9	0.13	0.04	0.03	0.11	0.05	0.10	0.08	0.02	0.06	0.03	0.03	0.19	0.08	0.09	0.03
10	0.13	0.04	0.03	0.11	0.05	0.10	0.08	0.02	0.06	0.03	0.03	0.19	0.08	0.09	0.03
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.20	0.03	0.01	0.02	0.02	0.31	0.05	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.04
2	0.20	0.03	0.03	0.02	0.05	0.27	0.06	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.05
3	0.20	0.02	0.05	0.02	0.06	0.24	0.07	0.01	0.01	0.02	0.01	0.00	0.03	0.04	0.05
4	0.20	0.03	0.05	0.02	0.05	0.22	0.09	0.02	0.01	0.03	0.01	0.01	0.09	0.05	0.05
5	0.18	0.04	0.06	0.02	0.05	0.21	0.10	0.02	0.01	0.03	0.01	0.04	0.10	0.06	0.07
6	0.18	0.04	0.06	0.02	0.06	0.23	0.11	0.02	0.01	0.03	0.01	0.06	0.09	0.06	0.08
7	0.19	0.04	0.06	0.02	0.06	0.24	0.11	0.02	0.02	0.03	0.01	0.06	0.09	0.06	0.09
8	0.19	0.04	0.07	0.02	0.07	0.24	0.11	0.02	0.02	0.03	0.01	0.06	0.09	0.07	0.09
9	0.19	0.04	0.07	0.02	0.07	0.24	0.11	0.02	0.02	0.03	0.01	0.06	0.09	0.07	0.09
10	0.19	0.04	0.07	0.02	0.07	0.24	0.11	0.02	0.02	0.03	0.01	0.06	0.09	0.07	0.09
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.00	0.00	0.00	0.21	0.00	0.16	0.00	0.01	0.01	0.01	0.09	0.18	0.01	0.02	0.04
2	0.01	0.01	0.02	0.19	0.06	0.16	0.01	0.03	0.01	0.01	0.06	0.24	0.02	0.02	0.04
3	0.03	0.02	0.02	0.19	0.05	0.18	0.02	0.06	0.02	0.06	0.07	0.23	0.03	0.04	0.06
4	0.03	0.02	0.03	0.19	0.05	0.17	0.02	0.07	0.02	0.08	0.10	0.22	0.05	0.05	0.09
5	0.03	0.03	0.04	0.17	0.05	0.17	0.02	0.07	0.02	0.08	0.11	0.22	0.06	0.05	0.09
6	0.03	0.03	0.05	0.17	0.05	0.16	0.02	0.07	0.03	0.09	0.11	0.22	0.07	0.05	0.09
7	0.03	0.03	0.05	0.17	0.06	0.16	0.02	0.07	0.03	0.10	0.11	0.21	0.06	0.05	0.09
8	0.03	0.03	0.05	0.17	0.06	0.17	0.02	0.07	0.03	0.10	0.11	0.21	0.06	0.05	0.09
9	0.03	0.03	0.06	0.17	0.06	0.17	0.02	0.07	0.03	0.10	0.11	0.21	0.06	0.05	0.09
10	0.03	0.03	0.06	0.17	0.06	0.17	0.02	0.07	0.03	0.10	0.11	0.21	0.07	0.05	0.09
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.32	0.10	0.00	0.00	0.02	0.10	0.00	0.03	0.00	0.01	0.01	0.12	0.02	0.01	0.02
2	0.28	0.05	0.04	0.07	0.03	0.32	0.00	0.02	0.02	0.02	0.01	0.12	0.05	0.01	0.02
3	0.28	0.06	0.07	0.07	0.04	0.26	0.00	0.02	0.02	0.02	0.02	0.12	0.12	0.01	0.02
4	0.26	0.09	0.07	0.06	0.03	0.22	0.01	0.03	0.02	0.02	0.03	0.13	0.14	0.01	0.03
5	0.23	0.09	0.06	0.06	0.03	0.22	0.01	0.03	0.02	0.02	0.03	0.12	0.15	0.02	0.03
6	0.22	0.09	0.06	0.07	0.03	0.22	0.01	0.03	0.02	0.03	0.03	0.11	0.16	0.02	0.03
7	0.22	0.09	0.07	0.07	0.03	0.23	0.01	0.04	0.02	0.03	0.04	0.12	0.16	0.02	0.03
8	0.22	0.09	0.08	0.07	0.03	0.23	0.01	0.05	0.02	0.03	0.04	0.12	0.15	0.02	0.03
9	0.21	0.09	0.08	0.07	0.03	0.24	0.01	0.05	0.02	0.03	0.04	0.12	0.15	0.02	0.03
10	0.21	0.09	0.08	0.07	0.03	0.24	0.01	0.05	0.02	0.03	0.04	0.12	0.15	0.02	0.03

Notes: FEVD: Forecast Error Variance Decomposition (Structurally Decomposed)

Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.06	0.01	0.00	0.03	0.02	0.11	0.03	0.00	0.30	0.00	0.01	0.00	0.00	0.07	0.03
2	0.11	0.01	0.01	0.07	0.06	0.11	0.02	0.02	0.24	0.03	0.01	0.00	0.00	0.17	0.04
3	0.08	0.02	0.02	0.08	0.06	0.14	0.02	0.03	0.17	0.05	0.03	0.00	0.00	0.19	0.09
4	0.08	0.02	0.02	0.07	0.06	0.17	0.02	0.03	0.18	0.05	0.04	0.01	0.01	0.21	0.15
5	0.11	0.02	0.04	0.11	0.06	0.17	0.02	0.03	0.21	0.04	0.05	0.01	0.02	0.22	0.17
6	0.12	0.02	0.06	0.12	0.06	0.17	0.02	0.03	0.20	0.04	0.04	0.01	0.02	0.23	0.17
7	0.12	0.02	0.06	0.12	0.06	0.17	0.02	0.04	0.20	0.04	0.05	0.01	0.03	0.23	0.17
8	0.12	0.02	0.06	0.12	0.06	0.17	0.02	0.04	0.19	0.04	0.05	0.01	0.03	0.23	0.17
9	0.13	0.02	0.06	0.12	0.06	0.17	0.02	0.04	0.19	0.04	0.05	0.01	0.03	0.23	0.17
10	0.13	0.02	0.06	0.12	0.06	0.17	0.02	0.04	0.19	0.04	0.05	0.01	0.03	0.23	0.17
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.00	0.00	0.03	0.02	0.01	0.03	0.02	0.04	0.04	0.01	0.05	0.01	0.11	0.00
2	0.04	0.00	0.08	0.03	0.07	0.01	0.02	0.03	0.02	0.03	0.01	0.03	0.04	0.07	0.02
3	0.04	0.07	0.17	0.07	0.05	0.01	0.01	0.03	0.02	0.02	0.09	0.03	0.06	0.07	0.01
4	0.03	0.14	0.18	0.08	0.11	0.01	0.01	0.02	0.02	0.02	0.16	0.03	0.09	0.08	0.05
5	0.03	0.13	0.17	0.08	0.16	0.02	0.01	0.02	0.02	0.02	0.15	0.03	0.12	0.08	0.12
6	0.04	0.14	0.17	0.09	0.16	0.02	0.01	0.03	0.03	0.03	0.15	0.03	0.12	0.08	0.16
7	0.04	0.14	0.18	0.09	0.16	0.02	0.01	0.03	0.03	0.03	0.16	0.03	0.12	0.08	0.17
8	0.04	0.14	0.18	0.09	0.17	0.02	0.01	0.03	0.03	0.03	0.17	0.03	0.13	0.08	0.16
9	0.04	0.14	0.18	0.09	0.17	0.02	0.02	0.03	0.03	0.03	0.17	0.03	0.13	0.09	0.17
10	0.04	0.14	0.18	0.09	0.17	0.02	0.02	0.04	0.03	0.03	0.17	0.03	0.13	0.09	0.18
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.05	0.00	0.00	0.04	0.02	0.58	0.00	0.27	0.01	0.00	0.00	0.00	0.01	0.00	0.04
2	0.07	0.01	0.00	0.04	0.01	0.74	0.01	0.21	0.01	0.02	0.03	0.04	0.01	0.00	0.11
3	0.16	0.00	0.00	0.04	0.01	0.71	0.06	0.16	0.01	0.02	0.04	0.04	0.02	0.00	0.14
4	0.30	0.01	0.00	0.04	0.01	0.68	0.11	0.14	0.02	0.02	0.05	0.06	0.02	0.00	0.14
5	0.34	0.01	0.02	0.03	0.01	0.69	0.13	0.13	0.02	0.03	0.05	0.09	0.02	0.00	0.14
6	0.33	0.01	0.03	0.04	0.01	0.69	0.13	0.13	0.02	0.03	0.05	0.09	0.02	0.01	0.14
7	0.33	0.01	0.04	0.04	0.02	0.68	0.13	0.14	0.02	0.02	0.05	0.09	0.02	0.01	0.14
8	0.33	0.01	0.04	0.04	0.02	0.68	0.13	0.15	0.02	0.02	0.05	0.09	0.02	0.01	0.13
9	0.33	0.01	0.04	0.04	0.02	0.68	0.14	0.15	0.03	0.02	0.05	0.09	0.02	0.01	0.13
10	0.33	0.01	0.04	0.04	0.02	0.68	0.14	0.15	0.03	0.02	0.05	0.09	0.02	0.01	0.13
Forecast Error Variance Decomposition (M3 -> Credit Growth): PSBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.00	0.02	0.10	0.02	0.00	0.07	0.00	0.00	0.17	0.03	0.04	0.00	0.01	0.06
2	0.01	0.00	0.02	0.10	0.16	0.04	0.11	0.00	0.08	0.20	0.07	0.09	0.08	0.03	0.04
3	0.05	0.01	0.02	0.22	0.22	0.07	0.14	0.01	0.13	0.16	0.19	0.12	0.21	0.02	0.04
4	0.08	0.01	0.06	0.47	0.23	0.08	0.15	0.01	0.13	0.12	0.17	0.11	0.23	0.02	0.04
5	0.09	0.01	0.09	0.47	0.23	0.08	0.15	0.02	0.18	0.12	0.18	0.10	0.23	0.02	0.05
6	0.09	0.03	0.10	0.41	0.22	0.08	0.16	0.03	0.20	0.12	0.19	0.10	0.23	0.02	0.05
7	0.09	0.04	0.10	0.42	0.22	0.08	0.16	0.03	0.19	0.12	0.18	0.10	0.22	0.03	0.05
8	0.09	0.04	0.10	0.49	0.21	0.08	0.16	0.03	0.20	0.11	0.19	0.10	0.22	0.03	0.05
9	0.09	0.04	0.10	0.53	0.21	0.08	0.16	0.03	0.20	0.11	0.18	0.10	0.22	0.03	0.05
10	0.09	0.04	0.10	0.51	0.21	0.08	0.16	0.04	0.20	0.11	0.18	0.10	0.22	0.03	0.05

Notes: FEVD: Forecast Error Variance Decomposition (Structurally Decomposed)

Table C: Sector wise Cumulative Impulse Response Function of Private Sector Banks (PVBs)

CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.51	21.86	3.05	-3.89	1.78	-0.66	7.76	-2.12	1.00	12.91	4.26	1.32	0.09	-5.91	4.94
2	-0.85	-22.67	-2.79	0.96	-2.92	-3.97	3.01	-3.01	-2.20	-8.11	0.45	3.24	-4.16	3.61	1.00
3	-2.05	4.60	0.66	2.79	3.32	0.40	8.00	-5.58	-1.55	-1.96	6.50	2.89	-1.24	1.24	2.19
4	1.23	-1.53	1.49	1.37	-1.34	-2.08	6.23	-1.25	-1.66	-7.20	1.55	2.86	-0.41	-1.21	3.82
5	-0.33	2.15	1.42	-1.28	0.27	-1.97	9.18	-4.73	-1.60	16.46	2.71	3.97	-1.75	5.83	3.07
6	-1.25	-4.82	1.10	1.85	1.33	-0.54	4.93	-3.70	-1.66	1.29	4.53	1.81	-2.18	-4.43	2.52
7	-0.23	0.14	-1.72	-0.09	-1.66	-2.36	6.37	-2.52	-1.37	0.80	2.31	3.05	-1.34	3.51	2.41
8	-0.46	-3.70	3.14	1.68	1.85	-0.97	8.06	-4.49	-1.79	-8.46	4.00	3.63	-1.19	1.96	3.00
9	0.03	1.54	0.08	0.50	-0.40	-1.73	6.41	-3.11	-1.57	10.28	3.01	2.47	-1.83	-1.57	3.19
10	-0.79	-1.91	0.13	0.52	-0.01	-1.60	6.90	-3.45	-1.53	2.48	3.04	3.02	-1.56	3.36	2.66
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	11.57	60.68	4.46	72.93	8.64	7.42	15.75	-3.64	8.24	-5.84	13.39	9.04	0.99	3.18	-109.61
2	1.97	-40.02	10.82	3.45	4.11	-0.52	4.21	14.09	94.28	24.30	8.87	-1.26	-1.04	2.41	-45.96
3	7.10	30.48	-2.64	35.73	2.24	6.49	8.83	-2.12	69.98	-4.30	10.74	6.34	-0.24	3.36	-150.30
4	3.91	6.85	6.37	72.41	7.03	7.10	13.75	9.66	-16.18	5.84	12.97	3.02	-1.03	0.25	-98.66
5	6.28	18.46	6.29	30.19	5.36	1.74	8.72	2.68	104.19	10.91	12.10	3.71	-0.51	4.71	-75.83
6	4.80	-0.38	-0.60	37.10	3.53	5.05	7.45	6.86	22.89	0.84	11.08	4.36	-0.23	1.56	-116.86
7	5.50	15.50	5.33	42.23	5.71	6.20	13.18	3.30	55.52	9.60	11.21	3.03	-0.89	2.08	-110.87
8	5.42	9.47	7.57	48.51	5.08	3.30	7.08	6.84	50.50	3.71	12.11	4.35	-0.76	3.22	-88.12
9	5.11	11.53	-1.49	41.57	4.56	4.68	11.05	3.86	44.54	7.55	11.75	3.59	-0.28	2.19	-106.40
10	5.53	8.05	6.31	37.13	5.09	5.47	10.60	5.97	55.76	4.40	11.47	3.64	-0.64	2.20	-102.81
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	8.31	82.66	5.78	6.61	5.94	-2.50	17.99	-4.92	4.45	111.47	5.66	6.61	1.74	1.17	4.76
2	5.34	-42.99	-7.00	5.19	-4.11	-1.46	1.07	3.96	0.32	-84.95	-1.82	16.40	-4.41	7.03	-4.53
3	-1.75	52.95	-1.29	4.55	7.76	0.78	18.48	-2.14	1.19	-11.90	25.06	10.31	-0.54	4.44	0.33
4	2.00	33.95	-1.28	9.15	0.47	-0.45	8.65	-2.06	2.21	-54.06	3.54	13.77	-1.03	2.83	4.20
5	5.83	37.05	1.05	-0.11	1.93	-0.43	16.47	0.10	0.38	99.52	9.52	16.15	-0.22	12.34	-0.65
6	4.04	12.21	1.39	9.52	3.62	-0.11	11.05	-0.54	2.08	38.25	15.00	10.36	-3.08	-3.79	0.59
7	2.88	35.30	-7.71	3.96	0.50	-0.82	9.66	-0.76	1.19	-22.08	7.16	14.31	-1.09	9.73	1.66
8	1.01	27.23	4.53	5.92	3.90	-0.27	15.33	-1.72	1.20	-61.10	12.91	14.03	-0.14	6.48	-0.14
9	3.28	35.96	-2.33	5.33	1.91	-0.07	11.22	0.06	1.66	79.04	9.27	11.85	-2.23	0.43	1.37
10	5.10	23.39	-2.53	5.38	1.96	-0.50	12.66	-0.74	1.17	4.16	10.66	14.69	-1.23	9.49	1.14
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	7.02	34.62	3.41	34.81	-2.51	2.20	10.05	-12.03	-21.77	10.99	-2.57	-3.27	1.69	-1.38	-64.49
2	6.45	34.97	13.94	34.56	-1.06	-0.67	12.60	-0.64	-15.32	6.58	1.65	-1.61	-7.13	-14.66	-41.53
3	4.22	15.56	0.18	10.42	-1.58	2.03	-15.91	-10.82	-21.96	0.76	-5.11	1.84	1.23	6.72	-74.74
4	9.34	23.96	8.11	52.28	0.75	-0.31	16.24	-0.53	-9.46	-13.40	-7.64	-2.21	0.01	-9.42	-68.62
5	6.98	40.78	8.46	20.07	-1.92	2.33	1.63	-6.61	-24.86	30.07	2.56	5.28	-1.93	2.48	-51.00
6	5.24	18.34	4.02	25.76	-2.06	-0.45	-3.94	-7.55	-17.94	1.74	-5.20	-2.23	-2.12	-9.21	-76.45
7	7.06	24.23	7.09	43.04	0.00	1.44	8.65	-4.13	-16.41	9.92	-4.09	-3.11	-0.14	-0.83	-56.43
8	7.36	33.94	7.50	19.90	-1.04	0.73	1.99	-4.85	-20.10	-7.75	-2.31	5.03	-0.91	-2.89	-66.81
9	6.68	24.75	5.16	32.83	-1.39	0.83	0.09	-6.37	-15.68	13.58	-3.19	-1.24	-2.29	-5.85	-62.36
10	6.40	23.85	6.96	34.38	-1.14	0.99	5.69	-5.34	-20.44	8.58	-3.20	-0.55	-0.54	-0.31	-65.90

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-21.66	3.24	0.58	0.55	1.47	-3.75	-7.91	-2.01	-6.35	-40.62	0.12	-8.55	-6.99	20.33	11.20
2	-30.69	-12.59	-15.21	-16.69	-0.72	-4.36	1.02	-5.99	-17.39	-7.23	-1.07	-4.57	0.49	25.88	0.79
3	-23.74	-22.06	-21.14	-12.85	-4.59	2.35	-23.00	-11.00	-1.44	-9.64	-3.14	-10.41	-4.05	-6.88	9.75
4	-11.83	8.67	-9.45	-11.60	0.80	-2.44	-3.72	-4.49	-11.17	-47.28	2.24	-5.88	0.19	19.37	3.18
5	-20.45	-17.69	-10.18	-12.27	-2.82	-3.10	-11.15	-8.82	-13.16	-16.58	-2.92	-10.07	-5.14	8.58	6.85
6	-19.91	-11.90	-9.25	-12.31	-1.70	-0.40	-10.87	-7.42	-8.56	-21.93	-1.72	-5.98	-2.51	13.01	5.07
7	-20.97	-2.82	-8.37	-13.00	-1.01	-2.13	-9.62	-6.56	-8.63	-28.36	0.62	-8.28	-0.64	9.61	5.73
8	-22.16	-12.36	-11.97	-12.26	-2.12	-1.71	-10.30	-7.68	-10.23	-21.65	-1.91	-7.86	-4.03	10.50	5.98
9	-19.05	-10.10	-11.37	-12.54	-1.71	-1.26	-10.40	-7.76	-10.05	-24.26	-1.21	-8.00	-2.54	12.40	5.33
10	-18.52	-6.81	-10.65	-12.21	-1.38	-1.95	-9.69	-6.98	-10.13	-27.36	-0.64	-7.56	-1.64	10.65	5.73
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	6.57	10.17	10.77	-0.55	8.81	-0.30	0.23	-9.78	-1.72	8.13	-10.08	-0.47	0.54	-10.13	9.59
2	-1.94	-17.40	-3.09	-3.66	-2.82	-6.92	16.90	-10.97	-0.44	4.30	-2.24	-1.16	4.48	-8.71	7.34
3	2.04	3.98	11.03	-0.03	8.43	-1.51	-12.78	-14.91	-2.06	7.67	-10.38	-5.58	-1.32	-7.00	3.10
4	8.55	-0.94	4.64	-1.90	1.92	-1.64	17.46	-7.71	2.87	4.73	-4.16	3.59	7.31	-3.12	6.89
5	-0.88	-6.25	3.68	-4.12	2.71	-3.41	0.64	-13.55	-6.04	7.29	-6.85	-4.20	-1.75	-7.91	5.61
6	3.47	2.12	6.47	-0.07	6.18	-1.10	0.01	-12.05	4.40	5.70	-7.37	-2.12	5.60	-9.87	5.83
7	3.86	-5.95	6.30	-2.15	0.99	-4.04	11.66	-9.48	-5.06	5.99	-5.54	-0.47	0.27	-5.92	5.43
8	2.33	-2.35	3.78	-2.81	5.46	-2.62	-1.07	-13.92	2.05	6.85	-7.23	-1.83	3.91	-5.25	6.07
9	3.71	0.30	6.43	-1.03	3.23	-1.91	5.74	-10.20	-2.30	5.46	-6.03	-1.98	1.78	-7.44	5.57
10	2.74	-4.98	5.37	-2.53	2.97	-2.97	6.48	-11.63	-0.77	6.62	-6.75	-1.41	2.71	-8.06	5.78
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	-0.22	-296.44	-94.75	-122.33	2.23	-4.74	-26.11	-17.85	36.36	-390.47	-33.19	-5.55	-2.24	-29.31	8.87
2	-2.52	-139.90	-35.78	-51.34	-8.88	-5.11	2.06	-9.54	21.09	-54.31	-12.43	-6.78	-2.38	-27.46	18.16
3	-4.38	22.47	-46.60	-62.95	2.48	5.03	-11.01	-0.98	28.11	-192.63	-11.81	5.05	0.37	-24.32	-1.70
4	3.85	-78.36	-105.37	-124.86	-4.91	-3.65	-16.95	-3.49	30.66	-600.74	-25.85	-3.56	0.24	-25.49	18.20
5	-0.61	-219.43	-61.26	-76.59	-2.43	-2.74	-3.60	-15.59	34.23	-98.52	-17.92	-1.13	-0.03	-26.20	7.22
6	-3.20	-11.91	-48.57	-70.56	-2.79	1.20	-12.25	-0.92	24.70	-287.93	-13.86	-1.23	-1.43	-26.88	9.19
7	-0.42	-79.32	-88.65	-103.35	-3.37	-1.44	-12.64	-4.44	29.01	-382.40	-21.11	-0.59	0.85	-24.66	11.47
8	-0.16	-146.37	-65.08	-76.83	-2.24	-1.54	-7.48	-10.61	31.75	-222.51	-20.20	-1.31	0.23	-26.14	9.54
9	0.11	-82.41	-58.92	-87.71	-3.37	-1.60	-10.89	-6.07	28.56	-313.01	-15.71	-2.00	-1.87	-26.12	9.37
10	-1.95	-69.44	-78.00	-88.00	-2.68	-0.45	-11.11	-3.52	29.55	-300.03	-18.18	0.22	0.19	-25.91	10.62
CIRF (Structurally Decomposed) (M3 -> Credit Growth): PVBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	3.13	-18.60	-22.07	-62.67	4.61	-4.51	167.69	4.80	0.70	-5335.30	49.44	7.57	8.20	85.79	3.87
2	0.37	-141.63	-7.67	1.81	-6.35	-10.75	-32.02	-18.26	2.73	-4008.20	125.73	-1.77	-15.00	-23.42	-1.32
3	2.73	-210.49	-9.99	-18.33	2.34	-6.43	178.19	-8.91	-3.45	-513.15	12.41	0.63	4.55	61.80	12.48
4	6.37	-110.49	-7.71	-5.46	-2.94	-4.81	54.23	-2.78	-2.00	-2194.21	-6.03	1.67	-1.46	46.05	-4.06
5	0.23	-153.75	-15.62	-42.59	-0.28	-8.49	81.28	-15.19	2.71	-4948.86	128.99	1.36	-6.72	14.56	6.85
6	3.26	-154.30	-10.95	-14.74	-1.31	-5.08	118.04	-7.61	-4.07	-1199.55	-5.03	3.16	-0.95	46.16	4.68
7	3.97	-149.05	-8.85	-10.86	-1.51	-8.82	62.08	-7.58	0.67	-2321.48	46.18	-2.84	-2.76	46.21	1.25
8	2.43	-145.16	-10.57	-23.58	-1.02	-6.26	108.22	-10.97	-0.49	-3551.15	59.23	3.75	-1.87	18.23	5.56
9	2.91	-150.48	-13.96	-23.47	-1.04	-6.00	83.36	-8.39	-2.14	-2494.91	50.96	1.81	-3.87	47.12	3.16
10	3.29	-151.85	-8.89	-16.25	-1.01	-7.34	89.11	-9.07	0.56	-2117.71	37.73	-0.39	-2.33	37.10	3.29

Notes: CIRF: Cumulative Impulse Response Function (Structurally Decomposed)

Table D: Sector wise Forecast Error Variance Decomposition of Private Sector Banks (PVBs)

Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Total Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.00	0.01	0.01	0.01	0.00	0.00	0.15	0.06	0.09	0.00	0.03	0.05	0.01	0.01	0.05
2	0.00	0.08	0.01	0.02	0.01	0.00	0.11	0.07	0.16	0.00	0.03	0.05	0.01	0.03	0.04
3	0.00	0.06	0.02	0.02	0.05	0.07	0.07	0.07	0.16	0.00	0.03	0.05	0.07	0.03	0.06
4	0.01	0.05	0.02	0.02	0.08	0.18	0.06	0.07	0.15	0.00	0.05	0.05	0.10	0.02	0.05
5	0.02	0.05	0.02	0.02	0.10	0.20	0.05	0.09	0.15	0.00	0.06	0.05	0.10	0.02	0.05
6	0.02	0.05	0.02	0.02	0.10	0.20	0.05	0.10	0.15	0.00	0.06	0.05	0.10	0.02	0.05
7	0.02	0.05	0.02	0.02	0.10	0.20	0.05	0.09	0.14	0.00	0.06	0.05	0.10	0.02	0.05
8	0.02	0.05	0.02	0.03	0.10	0.21	0.05	0.10	0.14	0.00	0.06	0.05	0.10	0.03	0.05
9	0.02	0.05	0.03	0.03	0.11	0.22	0.06	0.10	0.14	0.00	0.06	0.05	0.10	0.03	0.05
10	0.02	0.05	0.03	0.03	0.11	0.22	0.06	0.10	0.14	0.00	0.06	0.05	0.10	0.03	0.05
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Agriculture															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.00	0.00	0.12	0.03	0.15	0.02	0.10	0.00	0.00	0.02	0.01	0.03	0.01	0.03
2	0.05	0.03	0.00	0.11	0.04	0.09	0.02	0.14	0.00	0.00	0.01	0.01	0.08	0.01	0.02
3	0.07	0.06	0.00	0.16	0.04	0.15	0.02	0.20	0.01	0.01	0.01	0.04	0.08	0.00	0.02
4	0.07	0.07	0.01	0.17	0.04	0.18	0.02	0.24	0.01	0.01	0.01	0.04	0.08	0.00	0.03
5	0.07	0.07	0.01	0.18	0.05	0.16	0.02	0.26	0.02	0.02	0.01	0.04	0.08	0.01	0.03
6	0.07	0.07	0.01	0.19	0.05	0.18	0.02	0.26	0.03	0.02	0.01	0.04	0.08	0.02	0.03
7	0.07	0.06	0.01	0.19	0.05	0.18	0.02	0.26	0.03	0.02	0.01	0.03	0.08	0.03	0.03
8	0.07	0.06	0.01	0.19	0.06	0.18	0.02	0.26	0.04	0.02	0.01	0.03	0.08	0.03	0.03
9	0.07	0.06	0.01	0.19	0.06	0.18	0.02	0.26	0.04	0.02	0.01	0.03	0.08	0.03	0.03
10	0.07	0.06	0.01	0.19	0.06	0.18	0.02	0.26	0.04	0.02	0.01	0.03	0.08	0.03	0.03
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Industry															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.00	0.03	0.00	0.01	0.00	0.03	0.09	0.00	0.03	0.00	0.03	0.20	0.03	0.01	0.01
2	0.02	0.03	0.01	0.01	0.01	0.09	0.07	0.02	0.13	0.00	0.04	0.21	0.06	0.01	0.01
3	0.02	0.08	0.03	0.01	0.03	0.09	0.05	0.07	0.14	0.00	0.04	0.22	0.09	0.01	0.04
4	0.03	0.08	0.03	0.01	0.06	0.09	0.05	0.09	0.14	0.00	0.05	0.22	0.09	0.00	0.04
5	0.03	0.08	0.02	0.01	0.06	0.09	0.05	0.08	0.14	0.00	0.06	0.21	0.09	0.00	0.04
6	0.03	0.08	0.02	0.02	0.06	0.09	0.05	0.08	0.14	0.00	0.06	0.21	0.08	0.00	0.05
7	0.03	0.08	0.02	0.03	0.06	0.09	0.06	0.08	0.15	0.00	0.06	0.21	0.09	0.01	0.05
8	0.03	0.08	0.03	0.03	0.06	0.09	0.06	0.08	0.15	0.00	0.06	0.21	0.09	0.01	0.05
9	0.03	0.08	0.04	0.03	0.06	0.09	0.06	0.08	0.15	0.00	0.06	0.21	0.09	0.01	0.05
10	0.03	0.08	0.05	0.03	0.06	0.09	0.06	0.08	0.15	0.00	0.06	0.21	0.10	0.01	0.05
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Professional and Other Services															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.07	0.02	0.00	0.12	0.00	0.00	0.01	0.00	0.09	0.00	0.01	0.02	0.00	0.00	0.04
2	0.05	0.01	0.00	0.09	0.00	0.01	0.03	0.03	0.05	0.00	0.01	0.03	0.00	0.00	0.04
3	0.05	0.01	0.01	0.08	0.00	0.02	0.03	0.04	0.04	0.00	0.01	0.02	0.07	0.01	0.04
4	0.04	0.01	0.01	0.09	0.00	0.02	0.08	0.05	0.04	0.00	0.01	0.01	0.11	0.03	0.04
5	0.05	0.01	0.02	0.13	0.01	0.03	0.13	0.06	0.04	0.00	0.01	0.01	0.11	0.04	0.04
6	0.05	0.02	0.02	0.16	0.01	0.03	0.14	0.06	0.05	0.00	0.01	0.02	0.10	0.04	0.04
7	0.05	0.02	0.02	0.16	0.01	0.04	0.14	0.06	0.05	0.00	0.01	0.02	0.10	0.05	0.04
8	0.05	0.02	0.02	0.16	0.01	0.04	0.14	0.06	0.05	0.00	0.01	0.02	0.10	0.05	0.04
9	0.05	0.02	0.02	0.17	0.01	0.04	0.15	0.06	0.05	0.00	0.01	0.02	0.10	0.05	0.04
10	0.05	0.02	0.02	0.18	0.01	0.04	0.15	0.06	0.05	0.00	0.01	0.02	0.11	0.05	0.04

Notes: FEVD: Forecast Error Variance Decomposition (Structurally Decomposed)

Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Personal Credit															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.05	0.01	0.00	0.06	0.01	0.00	0.02	0.04	0.03	0.08	0.00	0.01	0.00	0.00	0.00
2	0.05	0.01	0.00	0.09	0.01	0.02	0.02	0.06	0.03	0.08	0.00	0.01	0.00	0.02	0.01
3	0.06	0.01	0.03	0.10	0.01	0.02	0.03	0.05	0.04	0.08	0.00	0.01	0.01	0.02	0.02
4	0.07	0.01	0.03	0.10	0.01	0.06	0.04	0.05	0.05	0.08	0.00	0.01	0.01	0.03	0.02
5	0.09	0.01	0.05	0.10	0.02	0.07	0.05	0.06	0.06	0.10	0.00	0.01	0.02	0.03	0.02
6	0.10	0.02	0.05	0.10	0.02	0.07	0.05	0.06	0.06	0.11	0.01	0.01	0.02	0.03	0.02
7	0.09	0.02	0.05	0.10	0.02	0.08	0.05	0.06	0.06	0.11	0.01	0.01	0.02	0.03	0.02
8	0.09	0.02	0.05	0.10	0.02	0.08	0.05	0.06	0.06	0.11	0.01	0.01	0.02	0.03	0.02
9	0.09	0.02	0.05	0.10	0.02	0.08	0.05	0.06	0.06	0.11	0.01	0.01	0.02	0.03	0.02
10	0.10	0.02	0.05	0.10	0.02	0.08	0.05	0.06	0.06	0.11	0.01	0.01	0.02	0.03	0.02
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Trade															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.03	0.01	0.03	0.01	0.02	0.03	0.01	0.09	0.01	0.01	0.02	0.01	0.22	0.01	0.00
2	0.03	0.05	0.01	0.01	0.04	0.05	0.01	0.08	0.01	0.01	0.03	0.02	0.22	0.05	0.03
3	0.07	0.06	0.03	0.01	0.12	0.23	0.05	0.07	0.01	0.01	0.05	0.01	0.17	0.04	0.03
4	0.07	0.06	0.05	0.02	0.18	0.31	0.15	0.07	0.01	0.01	0.07	0.02	0.16	0.04	0.03
5	0.09	0.06	0.06	0.02	0.18	0.29	0.21	0.08	0.01	0.01	0.08	0.06	0.19	0.04	0.03
6	0.14	0.06	0.06	0.02	0.16	0.28	0.22	0.08	0.02	0.01	0.08	0.07	0.22	0.05	0.03
7	0.14	0.06	0.06	0.03	0.16	0.29	0.21	0.08	0.03	0.01	0.08	0.07	0.24	0.05	0.03
8	0.14	0.06	0.06	0.03	0.17	0.31	0.22	0.08	0.04	0.01	0.08	0.07	0.25	0.06	0.03
9	0.14	0.06	0.06	0.03	0.18	0.31	0.23	0.08	0.05	0.01	0.08	0.07	0.25	0.06	0.03
10	0.14	0.06	0.06	0.03	0.17	0.31	0.23	0.08	0.05	0.01	0.08	0.07	0.25	0.06	0.03
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Transport Operators															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.02	0.04	0.07	0.01	0.01	0.01	0.02	0.10	0.07	0.05	0.01	0.03	0.07	0.02
2	0.01	0.13	0.03	0.05	0.03	0.03	0.02	0.10	0.08	0.05	0.06	0.02	0.06	0.07	0.01
3	0.01	0.10	0.04	0.06	0.09	0.03	0.05	0.08	0.07	0.05	0.10	0.02	0.05	0.06	0.02
4	0.01	0.09	0.03	0.06	0.14	0.05	0.05	0.08	0.06	0.05	0.09	0.02	0.05	0.05	0.04
5	0.02	0.10	0.04	0.06	0.16	0.06	0.05	0.08	0.06	0.06	0.10	0.02	0.04	0.05	0.06
6	0.02	0.10	0.04	0.07	0.16	0.06	0.06	0.09	0.06	0.07	0.10	0.02	0.04	0.05	0.06
7	0.02	0.11	0.04	0.07	0.16	0.06	0.06	0.10	0.06	0.07	0.10	0.02	0.04	0.05	0.06
8	0.02	0.11	0.04	0.07	0.16	0.06	0.06	0.10	0.06	0.07	0.10	0.02	0.04	0.05	0.06
9	0.02	0.11	0.04	0.07	0.16	0.06	0.06	0.10	0.06	0.07	0.10	0.02	0.04	0.04	0.06
10	0.02	0.12	0.04	0.07	0.16	0.06	0.06	0.10	0.06	0.07	0.10	0.02	0.04	0.04	0.06
Forecast Error Variance Decomposition (M3 -> Credit Growth): PVBs - Credit to Finance															
Year	AP	BH	DL	GJ	HR	KR	KT	MH	MP	OR	PN	RJ	TN	UP	WB
1	0.01	0.36	0.01	0.00	0.02	0.01	0.00	0.09	0.01	0.01	0.00	0.00	0.01	0.03	0.01
2	0.01	0.45	0.02	0.01	0.05	0.01	0.04	0.15	0.01	0.09	0.00	0.02	0.08	0.03	0.01
3	0.01	0.44	0.03	0.02	0.06	0.01	0.08	0.19	0.01	0.07	0.00	0.02	0.23	0.11	0.01
4	0.01	0.44	0.02	0.02	0.07	0.01	0.10	0.19	0.02	0.08	0.01	0.02	0.30	0.13	0.02
5	0.01	0.44	0.02	0.02	0.07	0.01	0.11	0.19	0.02	0.08	0.01	0.01	0.29	0.12	0.05
6	0.01	0.43	0.03	0.02	0.07	0.02	0.10	0.21	0.02	0.09	0.01	0.01	0.30	0.13	0.05
7	0.01	0.43	0.03	0.03	0.07	0.02	0.10	0.21	0.02	0.10	0.01	0.01	0.30	0.13	0.05
8	0.01	0.43	0.03	0.03	0.07	0.02	0.10	0.21	0.02	0.10	0.01	0.01	0.30	0.13	0.06
9	0.01	0.43	0.03	0.03	0.07	0.02	0.11	0.21	0.03	0.10	0.01	0.02	0.30	0.13	0.06
10	0.01	0.43	0.03	0.03	0.07	0.02	0.11	0.21	0.03	0.11	0.01	0.02	0.30	0.13	0.06

Notes: FEVD: Forecast Error Variance Decomposition (Structurally Decomposed)

D. Spatial Autoregression Models: Estimates of Coefficients

Table E: Spatial Autoregression Models: Estimates of Coefficients – All Bank Groups and Sectors							
Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Agricultural							
SCB_AGL_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	**'ρ' or 'λ'**
SWMBANS -Lag	-5.70	35.40	1.20	19.20	0.00	1.90	-0.20
SWMBANS – Error	-14.80	41.90	-0.30	16.70	0.00	1.70	0.00
SWMBAS -Lag	-8.70	36.00	0.70	17.80	0.00	1.80	-0.40
SWMBAS – Error	-23.40	65.30	2.30	53.80	0.00	1.30	-1.60
SWMBCNS -Lag	-6.20	34.60	0.70	18.70	0.00	1.50	-0.40
SWMBCNS – Error	-11.60	45.50	0.70	22.40	0.00	1.80	0.00
SWMBCS -Lag	-5.00	31.50	0.70	18.00	0.00	1.40	-0.70
SWMBCS – Error	4.00	14.70	1.70	18.30	0.00	0.60	-1.50
SWMBFNS -Lag	-14.00	34.20	0.20	9.40	0.00	1.00	-2.80
SWMBFNS – Error	-10.80	42.20	0.50	19.80	0.00	1.80	0.00
SWMBFS -Lag	-3.20	21.70	0.50	13.20	0.00	1.10	-5.70
SWMBFS – Error	-9.00	41.80	0.80	22.90	0.00	1.70	-5.90
SWMRGNS -Lag	0.70	36.00	2.20	17.30	0.00	1.70	0.00
SWMRGNS – Error	-22.80	51.00	-0.90	18.90	0.00	1.60	0.00
SWMRGS -Lag	-5.20	44.00	1.90	16.00	0.00	1.80	-1.20
SWMRGS – Error	-2.90	37.20	2.40	21.50	0.00	0.90	-1.40
SCB_AGL_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	**'ρ' or 'λ'**
SWMBANS -Lag	-15.60	27.00	-0.10	2.70	0.00	0.30	-0.50
SWMBANS – Error	-47.00	65.70	-3.30	-7.40	0.00	1.60	-0.50
SWMBAS -Lag	-24.80	27.60	-1.40	-8.40	0.00	0.70	-0.50
SWMBAS – Error	-65.30	125.60	-2.30	6.20	0.00	2.30	-1.50
SWMBCNS -Lag	-12.30	20.10	-1.60	-7.10	0.00	0.90	-1.30
SWMBCNS – Error	-18.70	38.60	-1.70	-12.70	0.00	1.30	-1.70
SWMBCS -Lag	-19.10	23.30	-1.70	-8.90	0.00	0.90	-1.10
SWMBCS – Error	-23.60	41.60	-2.00	-8.80	0.00	1.40	-1.50
SWMBFNS -Lag	-1.60	-2.50	-0.60	-9.50	0.00	0.20	-3.90
SWMBFNS – Error	-29.30	46.10	-2.20	-6.90	0.00	1.20	-4.20
SWMBFS -Lag	-13.50	11.60	-1.10	-7.50	0.00	0.60	-5.00
SWMBFS – Error	-25.40	28.60	-1.90	-12.00	0.00	1.00	-5.70
SWMRGNS -Lag	-16.70	8.80	-1.30	-5.40	0.00	0.30	0.00
SWMRGNS – Error	-21.80	0.80	-2.80	29.90	0.00	0.00	-0.10
SWMRGS -Lag	-19.70	13.20	-1.70	-8.30	0.00	0.50	-0.70
SWMRGS – Error	-23.80	23.00	-2.00	-4.50	0.00	0.70	-0.70
SCB_AGL_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	**'ρ' or 'λ'**
SWMBANS -Lag	-18.50	32.80	-0.20	1.50	0.00	1.20	-0.10
SWMBANS – Error	-24.00	37.10	-0.90	-1.10	0.00	1.20	0.00
SWMBAS -Lag	-19.60	33.10	-0.40	0.30	0.00	1.20	-0.30
SWMBAS – Error	-50.90	100.30	-0.30	34.70	0.00	1.90	-1.60
SWMBCNS -Lag	-15.10	28.90	-0.40	0.10	0.00	1.10	-0.50
SWMBCNS – Error	-21.10	36.00	-0.50	0.70	0.00	1.30	0.00
SWMBCS -Lag	-14.70	28.20	-0.40	0.40	0.00	1.10	-0.80
SWMBCS – Error	-13.70	33.30	-0.20	2.30	0.00	1.20	-1.40
SWMBFNS -Lag	-1.60	3.60	-0.10	-3.90	0.00	0.50	-3.80
SWMBFNS – Error	-17.20	32.70	-0.20	2.00	0.00	1.30	0.10
SWMBFS -Lag	-7.40	14.10	-0.20	0.00	0.00	0.80	-5.70
SWMBFS – Error	-12.30	25.60	-0.40	1.90	0.00	1.30	-6.40
SWMRGNS -Lag	-19.40	33.30	-0.40	0.70	0.00	1.20	0.00
SWMRGNS – Error	-29.60	42.70	-1.50	-1.70	0.00	1.30	0.00
SWMRGS -Lag	-17.00	30.00	-0.20	1.10	0.00	1.10	-0.60
SWMRGS – Error	-19.10	35.30	-0.20	5.10	0.00	1.00	-0.70

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). For variable notations see next page.

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Agricultural							
PSB_AGL_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-3.00	36.40	1.00	25.10	0.00	1.80	-0.10
SWMBANS – Error	-9.60	35.00	-0.30	18.90	0.00	1.50	0.00
SWMBAS -Lag	-4.70	36.00	0.80	23.50	0.00	1.70	-0.20
SWMBAS – Error	-36.60	107.70	2.40	81.10	0.00	1.70	-1.60
SWMBCNS -Lag	0.80	31.60	0.90	24.40	0.00	1.50	-0.70
SWMBCNS – Error	-5.60	42.10	1.10	28.60	0.00	1.70	0.00
SWMBCS -Lag	-0.10	30.70	0.70	22.30	0.00	1.50	-0.70
SWMBCS – Error	12.20	12.10	1.60	23.10	0.00	0.80	-1.40
SWMBFNS -Lag	-14.30	37.50	0.10	13.70	0.00	0.90	-2.50
SWMBFNS – Error	-5.40	37.20	0.70	23.60	0.00	1.60	0.00
SWMBFS -Lag	-0.90	19.70	0.50	15.10	0.00	1.00	-6.00
SWMBFS – Error	-0.40	32.60	0.90	29.30	0.00	1.50	-6.30
SWMRGNS -Lag	-0.70	35.70	1.40	23.20	0.00	1.60	0.00
SWMRGNS – Error	-20.50	46.30	-1.20	21.10	0.00	1.40	0.00
SWMRGS -Lag	-2.00	40.20	1.60	21.70	0.00	1.70	-0.80
SWMRGS – Error	3.60	33.60	2.40	31.40	0.00	0.70	-1.30
PSB_AGL_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-15.10	36.20	0.70	7.50	0.00	1.10	-0.30
SWMBANS – Error	-19.30	23.30	-0.50	-0.50	0.00	0.90	0.00
SWMBAS -Lag	-18.50	23.80	-0.50	-0.20	0.00	0.90	-0.10
SWMBAS – Error	-57.30	138.20	-0.40	19.10	0.00	2.40	-1.50
SWMBCNS -Lag	-16.20	25.50	-0.30	0.90	0.00	1.00	-0.30
SWMBCNS – Error	-19.50	25.00	-0.40	0.40	0.00	0.90	0.10
SWMBCS -Lag	-16.00	25.10	-0.30	-0.40	0.00	1.10	-0.50
SWMBCS – Error	-11.60	38.40	-0.50	0.50	0.00	1.30	-1.50
SWMBFNS -Lag	-11.60	15.90	-0.50	-4.10	0.00	0.30	-4.00
SWMBFNS – Error	-26.20	35.60	-2.00	-4.00	0.00	1.20	-4.30
SWMBFS -Lag	-11.10	14.30	-0.30	-1.40	0.00	0.60	-5.30
SWMBFS – Error	-25.20	38.80	-0.80	-1.30	0.00	1.00	-5.90
SWMRGNS -Lag	-11.80	12.90	0.00	1.30	0.00	0.70	0.00
SWMRGNS – Error	-23.80	31.70	-0.60	0.90	0.00	0.90	0.00
SWMRGS -Lag	-15.70	18.00	-0.40	-0.40	0.00	0.80	-0.40
SWMRGS – Error	-16.30	19.00	-0.70	1.70	0.00	0.90	-0.60
PSB_AGL_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-12.60	37.70	0.70	11.50	0.00	1.50	-0.10
SWMBANS – Error	-19.20	34.00	-0.60	4.30	0.00	1.20	0.00
SWMBAS -Lag	-14.90	36.40	0.30	8.70	0.00	1.40	-0.20
SWMBAS – Error	-54.60	137.40	0.90	50.40	0.00	2.40	-1.70
SWMBCNS -Lag	-9.80	35.70	0.50	10.50	0.00	1.50	-0.60
SWMBCNS – Error	-15.70	35.60	0.10	7.20	0.00	1.30	0.00
SWMBCS -Lag	-10.90	34.10	0.40	8.30	0.00	1.40	-0.60
SWMBCS – Error	-5.90	36.20	0.60	10.50	0.00	1.30	-1.30
SWMBFNS -Lag	-15.00	27.00	-0.30	2.20	0.00	0.70	-3.10
SWMBFNS – Error	-17.30	38.10	0.00	7.70	0.00	1.30	0.00
SWMBFS -Lag	-7.90	20.70	0.10	5.00	0.00	0.90	-5.50
SWMBFS – Error	-16.70	42.10	0.00	10.80	0.00	1.40	-6.00
SWMRGNS -Lag	-16.30	37.10	0.10	8.10	0.00	1.40	0.00
SWMRGNS – Error	-26.00	42.90	-1.10	5.90	0.00	1.20	0.00
SWMRGS -Lag	-13.00	33.90	0.40	8.20	0.00	1.30	-0.40
SWMRGS – Error	-13.90	35.10	0.40	11.50	0.00	1.10	-0.70

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Agricultural							
PVB_AGL_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-120.80	-122.30	-48.60	-381.60	0.00	2.90	-0.10
SWMBANS – Error	-98.20	-80.70	-37.80	-374.60	0.00	6.50	0.00
SWMBAS -Lag	-135.40	-112.10	-48.10	-415.00	0.00	4.30	0.00
SWMBAS – Error	-214.80	138.20	-57.90	-472.50	0.00	11.20	-1.00
SWMBCNS -Lag	-136.60	-115.50	-48.30	-420.40	0.00	4.50	0.00
SWMBCNS – Error	-138.00	-99.20	-46.80	-405.10	0.00	4.70	0.00
SWMBCS -Lag	-145.70	-116.70	-46.20	-436.10	0.00	4.30	0.20
SWMBCS – Error	-130.30	-68.00	-60.80	-459.50	0.00	12.40	-1.50
SWMBFNS -Lag	31.30	-226.50	-23.80	-239.10	0.00	1.70	-2.70
SWMBFNS – Error	-167.70	-76.40	-49.30	-423.30	0.00	4.40	0.00
SWMBFS -Lag	-92.60	-123.80	-39.40	-343.50	0.00	3.50	-2.60
SWMBFS – Error	-134.80	-108.70	-49.50	-434.60	0.00	4.60	-4.30
SWMRGNS -Lag	-87.40	-206.10	-51.30	-339.80	0.00	1.20	0.00
SWMRGNS – Error	-100.70	-126.50	-43.00	-408.70	0.00	5.50	0.00
SWMRGS -Lag	-98.20	-181.00	-50.80	-375.70	0.00	2.40	-0.40
SWMRGS – Error	-85.60	-245.00	-61.00	-350.90	0.00	5.00	-1.30
PVB_AGL_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-279.30	837.80	-11.40	49.90	0.00	13.80	0.20
SWMBANS – Error	-105.80	694.80	-4.20	180.00	0.00	14.00	0.00
SWMBAS -Lag	-208.70	664.40	-20.20	61.80	0.00	11.20	0.20
SWMBAS – Error	-191.40	554.00	-34.80	73.50	0.00	12.00	-0.70
SWMBCNS -Lag	-192.60	641.00	-20.70	73.60	0.00	10.60	0.10
SWMBCNS – Error	-27.20	325.40	-34.20	71.30	0.00	13.80	-1.50
SWMBCS -Lag	-189.10	631.30	-21.30	70.70	0.00	10.50	0.10
SWMBCS – Error	56.60	-29.20	-42.60	-50.90	0.00	10.90	-1.80
SWMBFNS -Lag	78.40	-99.40	-6.90	34.80	0.00	-0.60	-4.20
SWMBFNS – Error	96.10	64.30	-18.70	97.20	0.00	2.70	-4.00
SWMBFS -Lag	-51.50	290.20	-15.60	66.10	0.00	6.10	-5.00
SWMBFS – Error	-119.60	504.50	-26.70	88.70	0.00	10.10	-6.00
SWMRGNS -Lag	-250.00	753.90	-17.50	48.30	0.00	11.90	0.00
SWMRGNS – Error	-196.80	635.60	-22.70	72.30	0.00	10.30	0.00
SWMRGS -Lag	-204.30	659.60	-21.00	64.30	0.00	11.00	0.20
SWMRGS – Error	-148.00	543.50	-33.00	167.30	0.00	9.40	-0.90
PVB_AGL_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-377.80	912.50	-8.20	-35.20	0.00	15.60	0.30
SWMBANS – Error	-550.10	934.80	-61.50	39.80	0.00	22.20	-0.60
SWMBAS -Lag	-258.10	611.80	-23.40	-18.90	0.00	9.00	0.20
SWMBAS – Error	-252.00	575.20	-36.80	-29.40	0.00	10.50	-0.60
SWMBCNS -Lag	-260.20	631.40	-21.20	-3.10	0.00	8.20	0.20
SWMBCNS – Error	-136.60	471.90	-35.20	49.10	0.00	13.80	-1.70
SWMBCS -Lag	-237.50	578.80	-24.50	-10.90	0.00	8.00	0.00
SWMBCS – Error	-74.40	125.60	-47.00	-140.20	0.00	12.00	-1.70
SWMBFNS -Lag	94.10	-102.00	-7.10	-1.80	0.00	-0.20	-3.50
SWMBFNS – Error	22.10	164.90	-10.60	36.90	0.00	-2.30	-4.30
SWMBFS -Lag	-109.80	313.50	-18.10	5.30	0.00	4.80	-4.10
SWMBFS – Error	-201.70	518.00	-28.10	-10.70	0.00	7.40	-5.50
SWMRGNS -Lag	-279.00	671.80	-21.60	-26.70	0.00	9.50	0.00
SWMRGNS – Error	30.70	-35.40	-36.80	388.30	0.00	-2.30	-0.10
SWMRGS -Lag	-235.90	575.30	-24.80	-11.30	0.00	8.10	0.00
SWMRGS – Error	-176.80	449.10	-37.70	77.60	0.00	7.00	-1.00

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Finance							
SCB_FIN_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-61.00	48.70	4.60	-1.50	0.00	1.80	-0.50
SWMBANS – Error	6.60	-44.30	5.00	-12.30	0.00	-0.30	-0.50
SWMBAS -Lag	-75.10	46.60	1.40	28.90	0.00	1.40	-1.00
SWMBAS – Error	-82.10	79.60	-0.10	53.50	0.00	1.80	-1.00
SWMBCNS -Lag	-93.20	56.30	-0.90	39.50	0.00	1.70	-0.40
SWMBCNS – Error	-56.50	-14.30	-1.50	71.70	0.00	0.30	-1.20
SWMBCS -Lag	-92.10	46.90	-1.00	36.10	0.00	1.50	-0.40
SWMBCS – Error	-100.60	61.70	-2.60	31.00	0.00	1.80	-1.20
SWMBFNS -Lag	-51.70	43.70	0.10	8.30	0.00	-1.30	-4.70
SWMBFNS – Error	-97.50	-26.80	0.10	58.30	0.00	-2.30	-3.90
SWMBFS -Lag	-72.50	40.50	-1.30	33.00	0.00	0.90	-4.40
SWMBFS – Error	-162.20	144.20	-2.60	57.00	0.00	0.90	-6.50
SWMRGNS -Lag	-59.20	-12.90	1.30	-10.50	0.00	0.80	0.00
SWMRGNS – Error	-158.50	218.80	-3.50	-89.80	0.00	5.60	-0.10
SWMRGS -Lag	-86.80	38.50	-0.70	25.50	0.00	1.70	-0.60
SWMRGS – Error	-95.50	38.70	-2.80	9.40	0.00	2.50	-0.90
SCB_FIN_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	105.30	-113.40	-5.70	73.80	0.00	0.90	-0.20
SWMBANS – Error	115.80	-157.90	-3.90	95.30	0.00	-0.80	-0.40
SWMBAS -Lag	99.50	-151.20	-5.90	44.20	0.00	-0.20	-0.20
SWMBAS – Error	78.40	-63.50	-3.80	84.30	0.00	0.80	-0.80
SWMBCNS -Lag	104.40	-176.00	-5.50	39.20	0.00	-0.80	0.00
SWMBCNS – Error	104.90	-178.60	-5.70	36.20	0.00	-0.80	0.00
SWMBCS -Lag	105.30	-181.70	-5.30	37.40	0.00	-0.90	0.00
SWMBCS – Error	111.40	-135.90	-5.90	65.40	0.00	0.70	-1.00
SWMBFNS -Lag	15.50	-14.50	-2.80	33.40	0.00	-0.30	-3.70
SWMBFNS – Error	78.90	-157.10	-7.10	27.60	0.00	-1.00	0.10
SWMBFS -Lag	68.50	-114.00	-4.30	32.10	0.00	-0.60	-3.80
SWMBFS – Error	89.80	-151.30	-6.10	41.00	0.00	-1.10	-5.40
SWMRGNS -Lag	98.30	-118.60	-5.90	62.50	0.00	0.50	0.00
SWMRGNS – Error	112.00	-193.00	-5.10	31.00	0.00	-0.70	0.00
SWMRGS -Lag	101.80	-162.00	-5.60	42.80	0.00	-0.40	-0.20
SWMRGS – Error	108.20	-137.10	-5.60	102.90	0.00	-0.20	-1.00
SCB_FIN_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	4.50	-25.00	-1.30	54.70	0.00	0.70	-0.30
SWMBANS – Error	33.50	-142.60	-3.20	110.20	0.00	-1.10	-0.50
SWMBAS -Lag	-3.10	-30.30	-0.90	56.90	0.00	0.40	-0.30
SWMBAS – Error	-1.10	-19.70	-1.00	118.70	0.00	0.10	-1.10
SWMBCNS -Lag	2.70	-33.80	-1.10	48.50	0.00	0.60	-0.90
SWMBCNS – Error	55.80	-137.50	-1.40	89.80	0.00	-0.80	-1.70
SWMBCS -Lag	-0.10	-30.30	-1.10	51.80	0.00	0.50	-0.80
SWMBCS – Error	13.70	-72.40	-2.80	62.20	0.00	0.60	-1.40
SWMBFNS -Lag	26.50	-44.20	1.10	24.10	0.00	-1.40	-5.60
SWMBFNS – Error	50.80	-29.50	-1.30	53.90	0.00	-4.30	-5.90
SWMBFS -Lag	-4.00	-32.70	-0.60	49.70	0.00	-0.20	-2.40
SWMBFS – Error	-4.60	-46.00	-0.80	66.40	0.00	-0.60	-3.60
SWMRGNS -Lag	5.20	-2.90	-1.70	44.30	0.00	0.90	0.00
SWMRGNS – Error	32.60	-96.20	-3.20	79.00	0.00	-0.50	0.00
SWMRGS -Lag	-1.80	-26.40	-0.50	53.30	0.00	0.40	-0.60
SWMRGS – Error	3.10	-23.90	-1.30	87.10	0.00	0.20	-1.10

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Finance							
PSB_FIN_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-90.30	-4.50	11.10	-49.90	0.00	12.30	-0.50
SWMBANS – Error	-135.30	-167.20	-9.00	-108.60	0.00	6.90	0.00
SWMBAS -Lag	-130.40	-49.00	0.50	-77.60	0.00	10.10	-1.30
SWMBAS – Error	-91.40	-171.50	-7.10	17.70	0.00	6.80	-1.40
SWMBCNS -Lag	-127.70	-77.40	-1.60	-85.70	0.00	8.10	-0.90
SWMBCNS – Error	-147.60	-149.30	-10.00	-92.20	0.00	6.80	0.10
SWMBCS -Lag	-128.00	-118.70	-4.00	-115.80	0.00	7.20	-1.00
SWMBCS – Error	-123.40	-190.50	-13.00	-108.50	0.00	8.50	-1.40
SWMBFNS -Lag	-190.10	52.80	-8.80	-52.90	0.00	3.30	-2.60
SWMBFNS – Error	-215.10	-86.90	-14.70	-125.30	0.00	6.30	0.10
SWMBFS -Lag	-111.40	-68.00	-6.60	-63.20	0.00	4.20	-5.60
SWMBFS – Error	-220.00	-73.60	-13.50	-57.90	0.00	5.60	-6.10
SWMRGNS -Lag	-124.30	-106.50	-4.60	-102.00	0.00	8.50	0.00
SWMRGNS – Error	-153.50	-149.40	-11.40	-104.80	0.00	6.50	0.00
SWMRGS -Lag	-147.80	-127.50	-8.90	-105.60	0.00	7.20	-0.30
SWMRGS – Error	-174.90	-90.10	-13.10	-114.40	0.00	9.80	-0.80
PSB_FIN_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	146.20	44.10	-0.40	214.80	0.00	-5.00	-0.20
SWMBANS – Error	151.80	31.50	7.20	231.90	0.00	-5.80	0.00
SWMBAS -Lag	141.70	66.10	2.80	220.90	0.00	-4.50	-0.50
SWMBAS – Error	7.70	436.30	6.20	231.10	0.00	0.60	-1.40
SWMBCNS -Lag	145.40	41.90	2.70	231.70	0.00	-4.60	-0.50
SWMBCNS – Error	148.30	10.60	5.40	208.70	0.00	-6.50	0.00
SWMBCS -Lag	143.20	49.80	4.70	233.70	0.00	-4.90	-0.30
SWMBCS – Error	127.30	173.80	6.50	264.30	0.00	-2.90	-1.50
SWMBFNS -Lag	121.40	-44.80	4.00	119.30	0.00	-3.30	-3.20
SWMBFNS – Error	124.60	59.70	5.60	225.60	0.00	-5.90	0.00
SWMBFS -Lag	101.80	26.90	4.20	163.60	0.00	-4.40	-4.60
SWMBFS – Error	133.80	76.30	6.40	209.30	0.00	-5.30	-5.60
SWMRGNS -Lag	138.90	39.50	1.60	222.60	0.00	-5.00	0.00
SWMRGNS – Error	186.60	8.60	10.70	243.60	0.00	-5.20	0.00
SWMRGS -Lag	146.20	35.10	4.20	224.90	0.00	-5.10	-0.50
SWMRGS – Error	163.10	28.60	4.70	305.20	0.00	-5.70	-1.30
PSB_FIN_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-27.40	-123.40	1.30	-24.10	0.00	8.60	-0.30
SWMBANS – Error	-25.00	-243.70	-2.90	-63.80	0.00	4.40	0.00
SWMBAS -Lag	-43.60	-175.40	-3.90	-51.70	0.00	6.30	-0.60
SWMBAS – Error	-5.20	-299.10	-8.00	106.70	0.00	3.70	-1.40
SWMBCNS -Lag	-31.40	-146.40	0.50	-50.00	0.00	6.70	-1.10
SWMBCNS – Error	-36.40	-225.60	-3.00	-42.50	0.00	4.40	0.10
SWMBCS -Lag	-34.30	-191.10	-3.10	-65.30	0.00	5.50	-0.80
SWMBCS – Error	13.60	-361.80	-10.90	-63.20	0.00	5.90	-1.60
SWMBFNS -Lag	-77.10	-20.70	-3.90	-12.30	0.00	1.60	-3.40
SWMBFNS – Error	-54.10	-220.10	-6.20	-67.10	0.00	4.00	0.00
SWMBFS -Lag	-36.80	-165.30	-4.00	-44.30	0.00	3.10	-3.60
SWMBFS – Error	-32.70	-268.70	-6.30	-30.70	0.00	2.80	-4.40
SWMRGNS -Lag	-47.10	0.10	1.20	-14.70	0.00	10.40	0.00
SWMRGNS – Error	-51.90	-223.10	-7.10	-60.70	0.00	3.80	0.00
SWMRGS -Lag	-51.40	-137.60	-2.90	-47.80	0.00	6.20	-0.80
SWMRGS – Error	-55.50	-161.20	-8.50	-8.00	0.00	6.00	-1.20

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Finance							
PVB_FIN_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	7634.70	-8924.10	450.40	12646.00	0.00	-310.70	-0.10
SWMBANS – Error	10763.60	-6938.00	1209.40	17074.10	0.00	-216.90	0.00
SWMBAS -Lag	7735.30	-10766.50	572.70	12895.50	0.00	-395.70	0.10
SWMBAS – Error	7847.00	-8278.10	419.30	14639.50	0.00	-285.50	-0.30
SWMBCNS -Lag	7505.80	-9223.10	440.30	12728.20	0.00	-317.90	-0.20
SWMBCNS – Error	7982.50	-6093.30	758.40	17112.00	0.00	-245.30	-0.10
SWMBCS -Lag	7556.90	-9937.50	526.20	12766.50	0.00	-366.90	0.10
SWMBCS – Error	10408.20	-13962.80	63.50	12936.60	0.00	-143.60	-1.30
SWMBFNS -Lag	1636.00	-1789.10	197.50	9618.80	0.00	-283.40	-2.30
SWMBFNS – Error	3138.90	-5570.60	241.50	11645.80	0.00	-381.00	-0.20
SWMBFS -Lag	6445.10	-8288.50	430.80	11599.60	0.00	-328.10	-1.70
SWMBFS – Error	7018.50	-9583.60	440.40	13805.40	0.00	-409.80	-3.40
SWMRGNS -Lag	7391.70	-8277.20	439.80	12652.50	0.00	-299.50	0.00
SWMRGNS – Error	9024.80	-10657.20	615.80	13259.10	0.00	-320.70	0.00
SWMRGS -Lag	7587.90	-9988.50	511.10	12746.50	0.00	-361.60	0.00
SWMRGS – Error	8101.00	-7684.20	295.10	16448.90	0.00	-261.70	-0.80
PVB_FIN_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	2368.10	-3273.90	84.20	3735.40	0.00	-82.20	0.00
SWMBANS – Error	3414.90	-2453.70	319.00	5149.80	0.00	-42.00	0.00
SWMBAS -Lag	2448.20	-3834.60	113.30	3775.80	0.00	-104.70	0.20
SWMBAS – Error	2415.50	-3014.70	77.40	4076.90	0.00	-70.40	-0.20
SWMBCNS -Lag	2357.30	-3293.60	83.00	3738.70	0.00	-82.70	0.00
SWMBCNS – Error	2527.10	-2336.80	159.30	5010.90	0.00	-52.70	-0.10
SWMBCS -Lag	2394.80	-3575.90	107.10	3747.80	0.00	-97.20	0.20
SWMBCS – Error	3146.90	-4189.60	-26.20	3931.70	0.00	-19.50	-1.20
SWMBFNS -Lag	471.60	-598.50	20.00	2811.60	0.00	-69.80	-2.40
SWMBFNS – Error	5007.70	-5757.00	176.90	2469.50	0.00	-309.50	-5.40
SWMBFS -Lag	1950.80	-2742.90	71.10	3350.90	0.00	-78.70	-1.90
SWMBFS – Error	2073.50	-3079.20	63.50	4110.20	0.00	-102.80	-3.90
SWMRGNS -Lag	2355.20	-3318.40	86.30	3732.80	0.00	-84.80	0.00
SWMRGNS – Error	2906.80	-3684.20	128.20	3939.00	0.00	-74.10	0.00
SWMRGS -Lag	2452.10	-3776.00	99.90	3750.00	0.00	-98.70	0.20
SWMRGS – Error	2501.40	-2915.00	58.30	4358.90	0.00	-64.20	-0.40
PVB_FIN_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	4077.00	-5144.80	200.90	6643.60	0.00	-154.10	0.00
SWMBANS – Error	5825.20	-3916.60	610.20	9063.10	0.00	-95.10	0.00
SWMBAS -Lag	4168.90	-6144.30	259.60	6744.10	0.00	-197.50	0.20
SWMBAS – Error	4172.80	-4775.30	187.30	7461.00	0.00	-138.30	-0.30
SWMBCNS -Lag	4029.50	-5243.60	195.80	6666.20	0.00	-156.50	-0.10
SWMBCNS – Error	4300.10	-3572.20	350.90	8967.70	0.00	-112.10	-0.10
SWMBCS -Lag	4070.10	-5672.80	240.10	6684.90	0.00	-182.40	0.10
SWMBCS – Error	5516.30	-7415.90	-1.80	6860.20	0.00	-57.00	-1.30
SWMBFNS -Lag	831.30	-973.20	74.20	5011.40	0.00	-137.10	-2.40
SWMBFNS – Error	8017.50	-8589.10	275.30	4182.30	0.00	-560.70	-5.60
SWMBFS -Lag	3403.70	-4568.60	183.40	6026.90	0.00	-157.10	-1.80
SWMBFS – Error	3668.40	-5216.10	181.20	7269.60	0.00	-200.40	-3.60
SWMRGNS -Lag	3994.30	-4949.50	198.80	6646.10	0.00	-151.70	0.00
SWMRGNS – Error	4912.50	-5992.60	284.10	6976.40	0.00	-151.10	0.00
SWMRGS -Lag	4132.20	-5863.30	231.90	6682.70	0.00	-182.40	0.10
SWMRGS – Error	4335.20	-4467.00	133.40	8281.50	0.00	-123.90	-0.60

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Industry							
SCB_IND_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-0.70	-6.70	-1.50	15.30	0.00	-1.70	-0.30
SWMBANS – Error	-3.60	7.50	-0.90	26.80	0.00	-1.00	0.10
SWMBAS -Lag	0.10	0.30	-0.80	23.90	0.00	-1.20	-0.30
SWMBAS – Error	-4.50	21.00	0.20	33.30	0.00	-1.10	-1.40
SWMBCNS -Lag	0.80	-2.60	-1.00	20.20	0.00	-1.30	-0.80
SWMBCNS – Error	-2.00	5.20	-0.80	25.00	0.00	-1.00	0.20
SWMBCS -Lag	-0.80	1.60	-0.80	24.20	0.00	-1.10	-0.30
SWMBCS – Error	1.30	8.40	0.10	30.90	0.00	-1.30	-1.70
SWMBFNS -Lag	1.40	-1.30	-0.60	22.50	0.00	-1.00	-0.60
SWMBFNS – Error	-19.70	27.10	-2.30	17.50	0.00	-0.40	-4.50
SWMBFS -Lag	-0.50	1.00	-0.60	21.50	0.00	-0.90	-2.20
SWMBFS – Error	-3.50	5.80	-0.80	24.70	0.00	-1.00	-3.40
SWMRGNS -Lag	-3.30	-11.10	-1.50	12.30	0.00	-1.70	0.00
SWMRGNS – Error	-2.30	5.00	-0.80	25.90	0.00	-1.00	0.00
SWMRGS -Lag	-0.50	-4.60	-0.90	19.70	0.00	-1.30	-0.70
SWMRGS – Error	-5.60	7.00	-0.60	23.50	0.00	-0.90	-1.30
SCB_IND_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	7.40	-7.60	0.00	34.50	0.00	-1.30	-0.10
SWMBANS – Error	4.70	-3.10	-0.30	36.40	0.00	-1.20	0.00
SWMBAS -Lag	7.60	-3.10	0.40	39.10	0.00	-1.10	0.10
SWMBAS – Error	13.50	-28.70	1.00	55.00	0.00	-1.90	-1.50
SWMBCNS -Lag	7.70	-4.30	0.30	38.10	0.00	-1.10	0.00
SWMBCNS – Error	7.70	-5.60	0.20	36.40	0.00	-1.20	0.00
SWMBCS -Lag	7.60	-2.80	0.40	38.80	0.00	-1.00	0.20
SWMBCS – Error	13.20	-22.40	0.80	42.50	0.00	-1.80	-1.40
SWMBFNS -Lag	11.70	-10.40	0.40	32.60	0.00	-1.00	-1.00
SWMBFNS – Error	7.40	-4.10	0.30	37.90	0.00	-1.10	0.00
SWMBFS -Lag	7.10	-5.10	0.30	32.20	0.00	-1.00	-2.70
SWMBFS – Error	7.70	-6.10	0.30	39.00	0.00	-1.20	-3.90
SWMRGNS -Lag	4.80	-4.70	-0.10	31.90	0.00	-1.30	0.00
SWMRGNS – Error	5.50	-3.10	0.00	37.50	0.00	-1.20	0.00
SWMRGS -Lag	7.70	-4.50	0.30	37.90	0.00	-1.10	0.00
SWMRGS – Error	5.00	1.90	0.80	41.90	0.00	-1.30	-1.00
SCB_IND_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	10.30	-13.20	0.00	36.00	0.00	-1.10	0.00
SWMBANS – Error	8.30	-13.30	-0.50	32.90	0.00	-1.20	0.00
SWMBAS -Lag	9.90	-14.00	0.00	35.40	0.00	-1.20	0.30
SWMBAS – Error	6.20	-9.40	0.30	60.70	0.00	-1.40	-1.70
SWMBCNS -Lag	10.10	-13.90	-0.20	34.80	0.00	-1.20	0.10
SWMBCNS – Error	10.20	-14.50	-0.20	34.50	0.00	-1.20	0.00
SWMBCS -Lag	10.10	-14.10	-0.10	34.70	0.00	-1.10	0.30
SWMBCS – Error	15.50	-26.50	0.00	38.50	0.00	-1.50	-1.30
SWMBFNS -Lag	10.10	-14.50	-0.20	34.30	0.00	-1.20	0.00
SWMBFNS – Error	14.40	-36.30	-0.70	36.80	0.00	-1.50	-3.50
SWMBFS -Lag	9.40	-13.60	-0.20	31.60	0.00	-1.10	-1.40
SWMBFS – Error	8.50	-15.40	-0.40	37.30	0.00	-1.30	-6.10
SWMRGNS -Lag	10.20	-14.60	-0.20	34.30	0.00	-1.20	0.00
SWMRGNS – Error	8.20	-14.20	-0.50	33.20	0.00	-1.30	0.00
SWMRGS -Lag	10.80	-15.30	-0.10	35.60	0.00	-1.20	0.20
SWMRGS – Error	7.30	-6.40	0.00	40.20	0.00	-1.20	-0.90

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Industry							
PSB_IND_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-14.70	14.00	0.70	1.20	0.00	-1.90	-0.40
SWMBANS – Error	-15.20	25.50	0.10	21.10	0.00	-1.10	0.10
SWMBAS -Lag	-9.30	20.90	1.00	18.40	0.00	-1.00	-0.10
SWMBAS – Error	-13.40	56.70	2.50	14.40	0.00	-0.80	-1.40
SWMBCNS -Lag	-6.20	17.10	1.50	12.60	0.00	-1.40	-1.10
SWMBCNS – Error	-10.70	23.20	0.60	16.90	0.00	-1.00	0.30
SWMBCS -Lag	-9.50	21.50	1.20	18.70	0.00	-1.00	-0.30
SWMBCS – Error	-13.70	54.80	2.60	30.40	0.00	-1.20	-1.90
SWMBFNS -Lag	-1.90	9.80	1.00	15.80	0.00	-0.80	-1.00
SWMBFNS – Error	-53.80	78.90	-2.60	-6.00	0.00	0.60	-4.40
SWMBFS -Lag	-8.40	18.60	0.80	16.40	0.00	-0.80	-2.10
SWMBFS – Error	-13.40	28.00	0.90	18.10	0.00	-0.80	-2.60
SWMRGNS -Lag	-20.30	-6.40	-0.20	-6.80	0.00	-2.00	0.00
SWMRGNS – Error	-9.60	21.80	1.00	19.10	0.00	-0.90	0.00
SWMRGS -Lag	-10.00	10.40	0.90	12.00	0.00	-1.20	-0.80
SWMRGS – Error	-18.80	24.20	0.80	9.70	0.00	-0.60	-1.20
PSB_IND_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	8.90	-15.20	0.20	25.80	0.00	-1.50	-0.30
SWMBANS – Error	9.70	-12.30	0.70	37.50	0.00	-1.40	0.00
SWMBAS -Lag	11.80	-13.60	0.70	34.00	0.00	-1.30	-0.50
SWMBAS – Error	15.30	-15.70	2.00	54.20	0.00	-1.70	-1.70
SWMBCNS -Lag	12.40	-15.40	0.90	33.50	0.00	-1.50	-0.60
SWMBCNS – Error	12.10	-14.80	0.90	35.70	0.00	-1.30	0.10
SWMBCS -Lag	11.70	-13.30	1.00	36.20	0.00	-1.40	-0.60
SWMBCS – Error	24.50	-37.00	1.70	44.50	0.00	-2.00	-1.80
SWMBFNS -Lag	13.10	-14.60	0.90	29.70	0.00	-0.90	-1.80
SWMBFNS – Error	5.20	-5.90	0.70	37.00	0.00	-1.30	-0.10
SWMBFS -Lag	8.80	-9.80	0.80	31.30	0.00	-1.10	-3.10
SWMBFS – Error	5.20	-5.50	0.90	39.90	0.00	-1.30	-5.00
SWMRGNS -Lag	4.10	-8.70	0.30	26.60	0.00	-1.30	0.00
SWMRGNS – Error	11.00	-12.90	0.90	38.10	0.00	-1.30	0.00
SWMRGS -Lag	8.30	-10.30	0.80	32.70	0.00	-1.30	-0.70
SWMRGS – Error	5.10	-6.90	1.00	39.20	0.00	-1.10	-1.20
PSB_IND_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	7.40	-14.50	-0.60	19.60	0.00	-1.50	-0.40
SWMBANS – Error	9.10	-13.80	0.40	32.10	0.00	-1.30	0.00
SWMBAS -Lag	10.40	-12.60	0.10	27.90	0.00	-1.30	-0.80
SWMBAS – Error	6.70	6.20	1.30	46.40	0.00	-1.20	-1.60
SWMBCNS -Lag	11.80	-16.90	0.20	26.70	0.00	-1.40	-0.80
SWMBCNS – Error	10.10	-14.60	0.50	30.80	0.00	-1.30	0.10
SWMBCS -Lag	9.80	-12.70	0.30	29.70	0.00	-1.30	-0.90
SWMBCS – Error	21.70	-29.50	1.00	38.00	0.00	-1.70	-1.80
SWMBFNS -Lag	12.00	-17.00	0.50	26.90	0.00	-1.00	-1.30
SWMBFNS – Error	-8.00	-2.90	-1.20	23.90	0.00	-1.00	-4.00
SWMBFS -Lag	7.40	-11.50	0.30	25.40	0.00	-1.00	-3.40
SWMBFS – Error	-1.60	0.20	0.10	32.60	0.00	-1.10	-5.80
SWMRGNS -Lag	2.90	-12.30	-0.50	20.90	0.00	-1.30	0.00
SWMRGNS – Error	10.50	-16.00	0.50	31.50	0.00	-1.20	0.00
SWMRGS -Lag	7.10	-13.70	0.20	26.20	0.00	-1.20	-0.80
SWMRGS – Error	3.60	-10.70	0.10	32.20	0.00	-1.00	-1.20

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Industry							
PVB_IND_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	238.50	-573.40	-6.20	207.20	0.00	-12.00	0.20
SWMBANS – Error	100.20	-375.50	16.00	90.10	0.00	-12.10	0.40
SWMBAS -Lag	266.90	-577.30	-4.60	227.00	0.00	-11.70	0.40
SWMBAS – Error	219.30	-572.00	-6.20	151.10	0.00	-15.70	0.70
SWMBCNS -Lag	254.50	-550.40	-5.20	217.60	0.00	-11.60	0.50
SWMBCNS – Error	189.60	-430.00	4.00	232.30	0.00	-13.70	0.70
SWMBCS -Lag	269.90	-578.50	-3.30	226.30	0.00	-12.10	0.60
SWMBCS – Error	210.90	-509.70	-1.60	189.10	0.00	-14.40	0.70
SWMBFNS -Lag	96.70	-205.20	-9.30	202.70	0.00	-6.60	-1.90
SWMBFNS – Error	159.30	-400.20	-15.70	193.20	0.00	-9.00	0.20
SWMBFS -Lag	211.80	-398.70	-8.70	219.40	0.00	-7.70	-1.80
SWMBFS – Error	219.60	-436.20	-12.80	275.70	0.00	-9.10	-4.80
SWMRGNS -Lag	279.20	-669.80	-3.10	214.50	0.00	-13.90	0.00
SWMRGNS – Error	251.60	-473.30	-9.20	238.90	0.00	-8.60	0.00
SWMRGS -Lag	285.20	-599.00	-5.40	230.30	0.00	-11.50	0.60
SWMRGS – Error	224.70	-559.30	-6.50	165.90	0.00	-14.40	0.70
PVB_IND_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-95.30	126.80	-6.50	-38.60	0.00	2.50	-0.10
SWMBANS – Error	-36.50	160.30	-16.80	42.10	0.00	7.80	0.40
SWMBAS -Lag	-111.50	215.60	-7.00	-17.40	0.00	5.30	0.30
SWMBAS – Error	-83.80	235.10	-7.30	15.30	0.00	8.60	0.70
SWMBCNS -Lag	-95.80	155.00	-5.70	-30.10	0.00	3.30	-0.30
SWMBCNS – Error	-75.00	185.10	-11.60	-13.10	0.00	8.00	0.80
SWMBCS -Lag	-104.70	195.40	-6.70	-19.60	0.00	5.00	0.20
SWMBCS – Error	-82.60	200.10	-9.50	-3.40	0.00	7.60	0.70
SWMBFNS -Lag	-15.60	47.50	-2.30	-29.00	0.00	3.10	-1.60
SWMBFNS – Error	-38.30	134.20	-1.40	12.60	0.00	4.60	0.30
SWMBFS -Lag	-58.70	106.10	-3.80	-21.80	0.00	3.10	-3.90
SWMBFS – Error	-61.70	119.20	-3.50	-35.90	0.00	4.10	-5.50
SWMRGNS -Lag	-96.90	160.70	-5.80	-26.10	0.00	3.70	0.00
SWMRGNS – Error	-55.90	175.80	-14.40	24.90	0.00	6.40	0.00
SWMRGS -Lag	-105.40	192.30	-6.40	-18.40	0.00	4.60	0.20
SWMRGS – Error	-87.60	219.20	-7.50	5.90	0.00	7.70	0.70
PVB_IND_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-60.90	54.70	-1.00	47.60	0.00	-2.00	-0.20
SWMBANS – Error	-56.00	115.40	2.30	102.70	0.00	-0.10	0.00
SWMBAS -Lag	-56.20	103.70	1.70	94.50	0.00	-0.40	-0.10
SWMBAS – Error	-27.40	-2.40	2.40	104.60	0.00	-2.80	-1.30
SWMBCNS -Lag	-57.80	107.70	1.60	95.40	0.00	-0.30	-0.10
SWMBCNS – Error	-58.80	129.40	3.10	117.50	0.00	0.10	0.00
SWMBCS -Lag	-53.20	94.00	1.90	91.60	0.00	-0.70	-0.30
SWMBCS – Error	-39.70	15.50	1.80	84.60	0.00	-2.90	-1.60
SWMBFNS -Lag	-42.20	88.50	2.00	92.80	0.00	-0.30	-0.40
SWMBFNS – Error	-63.80	119.60	1.40	98.90	0.00	-0.20	0.00
SWMBFS -Lag	-44.20	84.20	1.40	81.00	0.00	-0.40	-2.80
SWMBFS – Error	-57.80	104.50	2.20	103.20	0.00	-0.90	-4.90
SWMRGNS -Lag	-57.40	91.00	1.10	79.70	0.00	-0.90	0.00
SWMRGNS – Error	-57.30	112.70	1.80	99.80	0.00	-0.10	0.00
SWMRGS -Lag	-52.50	98.00	2.00	89.20	0.00	-0.50	-0.30
SWMRGS – Error	-47.50	97.60	3.30	90.90	0.00	-1.30	-0.90

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Personal Loans							
SCB_PER_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	6.60	28.50	0.80	19.50	0.00	0.70	-0.20
SWMBANS – Error	1.20	35.50	0.70	15.60	0.00	0.50	0.00
SWMBAS -Lag	2.30	26.40	0.00	15.20	0.00	0.50	-0.60
SWMBAS – Error	-5.40	34.10	0.60	39.00	0.00	0.40	-1.70
SWMBCNS -Lag	0.70	33.60	0.40	17.60	0.00	0.60	-0.40
SWMBCNS – Error	-0.50	38.90	0.70	18.70	0.00	0.50	0.00
SWMBCS -Lag	2.40	26.50	0.00	13.40	0.00	0.50	-0.60
SWMBCS – Error	10.80	8.90	0.30	12.70	0.00	0.20	-1.40
SWMBFNS -Lag	-6.50	38.60	0.00	12.40	0.00	0.40	-0.40
SWMBFNS – Error	-4.50	38.60	0.10	12.90	0.00	0.40	0.00
SWMBFS -Lag	0.30	20.90	0.10	10.30	0.00	0.30	-4.80
SWMBFS – Error	-0.50	33.20	0.00	17.30	0.00	0.50	-5.40
SWMRGNS -Lag	-4.30	37.20	0.00	12.60	0.00	0.30	0.00
SWMRGNS – Error	-6.80	37.00	-0.40	12.10	0.00	0.20	0.00
SWMRGS -Lag	0.20	32.60	0.30	13.20	0.00	0.50	-0.50
SWMRGS – Error	-5.10	45.50	0.50	17.70	0.00	0.50	-1.20
SCB_PER_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	1.00	27.40	0.80	10.90	0.00	0.20	-0.20
SWMBANS – Error	-2.80	31.20	0.60	6.80	0.00	0.10	0.00
SWMBAS -Lag	-1.20	25.60	0.30	8.40	0.00	0.10	-0.60
SWMBAS – Error	-3.30	30.00	0.30	16.20	0.00	0.20	-1.10
SWMBCNS -Lag	-3.50	30.60	0.40	6.00	0.00	0.10	0.00
SWMBCNS – Error	-3.50	30.30	0.40	5.60	0.00	0.10	0.00
SWMBCS -Lag	-3.00	29.30	0.40	6.10	0.00	0.10	-0.20
SWMBCS – Error	-1.40	28.90	0.40	7.10	0.00	0.20	-0.50
SWMBFNS -Lag	-9.70	34.30	0.10	5.50	0.00	0.10	-0.70
SWMBFNS – Error	-9.00	37.00	0.20	5.20	0.00	0.10	-0.10
SWMBFS -Lag	-2.00	18.20	0.10	4.90	0.00	0.10	-5.10
SWMBFS – Error	-7.10	34.70	0.00	9.00	0.00	0.30	-5.70
SWMRGNS -Lag	-4.20	31.50	0.40	5.70	0.00	0.10	0.00
SWMRGNS – Error	-7.20	32.30	0.10	5.00	0.00	-0.10	0.00
SWMRGS -Lag	-3.30	27.10	0.30	6.50	0.00	0.20	-0.70
SWMRGS – Error	-15.10	48.30	-0.20	11.70	0.00	0.60	-1.30
SCB_PER_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	5.20	18.50	0.90	11.50	0.00	0.20	-0.20
SWMBANS – Error	1.60	21.40	0.60	7.00	0.00	0.00	0.00
SWMBAS -Lag	3.90	12.00	0.20	9.70	0.00	0.00	-1.10
SWMBAS – Error	1.30	15.40	0.60	19.10	0.00	-0.10	-1.60
SWMBCNS -Lag	1.30	21.50	0.50	8.10	0.00	0.10	-0.20
SWMBCNS – Error	1.20	21.90	0.60	7.50	0.00	0.00	0.00
SWMBCS -Lag	2.70	16.10	0.30	6.80	0.00	0.00	-0.70
SWMBCS – Error	7.40	7.80	0.50	6.60	0.00	-0.10	-1.30
SWMBFNS -Lag	-3.50	24.90	0.30	6.20	0.00	0.00	-0.50
SWMBFNS – Error	-2.10	24.90	0.40	6.20	0.00	0.00	0.00
SWMBFS -Lag	0.60	13.40	0.20	5.20	0.00	0.00	-4.90
SWMBFS – Error	-0.50	22.90	0.30	8.70	0.00	0.10	-5.00
SWMRGNS -Lag	1.20	21.10	0.50	6.60	0.00	0.00	0.00
SWMRGNS – Error	-2.70	24.10	0.20	6.60	0.00	-0.10	0.00
SWMRGS -Lag	0.60	17.70	0.30	6.30	0.00	0.10	-1.10
SWMRGS – Error	-5.10	30.00	0.40	8.40	0.00	0.20	-1.40

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Personal Loans							
PSB_PER_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	17.00	13.90	0.00	20.80	0.00	1.30	-0.30
SWMBANS – Error	15.10	21.90	0.90	28.30	0.00	0.50	0.00
SWMBAS -Lag	15.60	8.60	-0.40	20.40	0.00	1.10	-1.10
SWMBAS – Error	24.90	-30.80	0.10	14.90	0.00	0.10	-1.30
SWMBCNS -Lag	11.20	24.90	0.60	29.30	0.00	0.70	-0.50
SWMBCNS – Error	13.40	22.60	0.70	28.60	0.00	0.50	0.00
SWMBCS -Lag	12.50	20.00	0.40	25.90	0.00	0.80	-1.00
SWMBCS – Error	13.40	10.60	0.80	25.10	0.00	0.30	-1.30
SWMBFNS -Lag	8.60	24.20	0.30	24.20	0.00	0.50	-0.50
SWMBFNS – Error	20.00	13.20	0.80	27.90	0.00	0.50	0.00
SWMBFS -Lag	11.10	18.50	0.40	22.60	0.00	0.50	-2.20
SWMBFS – Error	19.20	13.50	0.50	26.50	0.00	0.70	-4.90
SWMRGNS -Lag	13.00	27.10	0.30	19.20	0.00	1.50	0.00
SWMRGNS – Error	10.40	23.20	0.20	26.90	0.00	0.40	0.00
SWMRGS -Lag	9.40	29.50	0.50	22.30	0.00	1.10	-1.00
SWMRGS – Error	6.00	30.80	0.70	23.50	0.00	0.60	-1.10
PSB_PER_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	7.70	-1.10	0.10	8.80	0.00	0.00	-0.40
SWMBANS – Error	7.90	8.10	0.10	19.50	0.00	-0.30	0.00
SWMBAS -Lag	8.90	-0.60	0.10	14.50	0.00	-0.10	-0.60
SWMBAS – Error	10.60	-12.90	0.30	11.70	0.00	-0.40	-0.70
SWMBCNS -Lag	5.70	10.90	0.60	21.00	0.00	-0.10	-0.60
SWMBCNS – Error	9.00	7.10	0.30	18.90	0.00	-0.20	0.00
SWMBCS -Lag	6.40	6.50	0.50	18.50	0.00	-0.20	-1.00
SWMBCS – Error	3.90	6.70	1.00	21.60	0.00	-0.50	-1.30
SWMBFNS -Lag	1.00	14.00	0.00	13.30	0.00	-0.10	-1.40
SWMBFNS – Error	18.30	-2.30	0.90	22.10	0.00	-0.20	0.10
SWMBFS -Lag	7.10	6.00	0.20	14.70	0.00	-0.10	-3.10
SWMBFS – Error	18.60	-6.00	0.50	17.80	0.00	0.00	-5.60
SWMRGNS -Lag	3.60	14.00	0.40	9.00	0.00	0.30	0.00
SWMRGNS – Error	8.80	7.70	0.30	19.60	0.00	-0.20	0.00
SWMRGS -Lag	6.30	10.60	0.40	16.60	0.00	-0.10	-0.70
SWMRGS – Error	4.70	14.00	0.80	18.50	0.00	-0.20	-0.70
PSB_PER_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	9.10	-6.20	0.10	5.10	0.00	0.40	-0.40
SWMBANS – Error	12.70	-0.80	0.40	16.00	0.00	0.00	0.00
SWMBAS -Lag	11.30	-8.20	0.10	10.70	0.00	0.10	-0.70
SWMBAS – Error	21.70	-48.80	0.20	4.80	0.00	-0.60	-1.10
SWMBCNS -Lag	7.50	4.80	0.70	17.70	0.00	0.00	-0.70
SWMBCNS – Error	12.30	-0.20	0.40	16.40	0.00	0.00	0.00
SWMBCS -Lag	9.10	-0.60	0.60	14.90	0.00	-0.10	-1.10
SWMBCS – Error	10.30	-10.70	1.00	16.20	0.00	-0.50	-1.30
SWMBFNS -Lag	2.00	10.40	0.00	11.00	0.00	0.10	-1.50
SWMBFNS – Error	18.40	-5.70	0.80	18.60	0.00	0.00	0.10
SWMBFS -Lag	9.70	0.80	0.20	13.10	0.00	0.00	-2.50
SWMBFS – Error	16.20	-5.50	0.40	15.10	0.00	0.10	-4.10
SWMRGNS -Lag	3.10	15.90	0.50	5.30	0.00	0.80	0.00
SWMRGNS – Error	12.30	-0.10	0.40	16.30	0.00	0.00	0.00
SWMRGS -Lag	6.60	9.30	0.50	12.40	0.00	0.30	-1.00
SWMRGS – Error	6.30	8.40	0.90	13.00	0.00	-0.10	-1.00

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Personal Loans							
PVB_PER_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	30.30	-101.50	0.70	-58.60	0.00	0.10	0.00
SWMBANS – Error	12.00	-137.30	-4.70	-86.20	0.00	-1.30	0.00
SWMBAS -Lag	28.50	-101.50	0.60	-59.70	0.00	0.10	-0.10
SWMBAS – Error	33.30	-100.10	-0.80	-74.80	0.00	0.70	0.20
SWMBCNS -Lag	23.60	-82.40	3.30	-35.30	0.00	-0.50	-0.60
SWMBCNS – Error	27.20	-81.30	0.90	-53.40	0.00	1.50	0.20
SWMBCS -Lag	31.30	-105.40	1.10	-57.10	0.00	-0.40	-0.40
SWMBCS – Error	70.70	-187.50	2.60	-36.70	0.00	-3.00	-0.90
SWMBFNS -Lag	-39.50	15.50	-2.00	-26.50	0.00	0.00	-1.90
SWMBFNS – Error	17.10	-102.50	-1.40	-77.50	0.00	0.00	0.00
SWMBFS -Lag	1.60	-38.20	-0.10	-29.60	0.00	-0.20	-5.90
SWMBFS – Error	45.10	-141.30	0.70	-21.90	0.00	-1.70	-6.30
SWMRGNS -Lag	37.40	-42.10	7.70	-16.90	0.00	-0.50	0.00
SWMRGNS – Error	76.40	-125.70	5.50	15.70	0.00	-4.10	0.00
SWMRGS -Lag	23.10	-63.00	3.20	-40.60	0.00	-0.20	-0.60
SWMRGS – Error	39.00	-42.90	6.60	-1.90	0.00	-1.60	-0.70
PVB_PER_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	79.40	-228.90	0.70	-56.70	0.00	-3.90	0.20
SWMBANS – Error	60.50	-188.10	2.20	-26.40	0.00	-4.00	0.00
SWMBAS -Lag	79.50	-196.90	4.10	-26.10	0.00	-3.60	0.30
SWMBAS – Error	65.40	-179.20	3.40	-40.90	0.00	-3.20	0.40
SWMBCNS -Lag	63.50	-163.60	4.60	-12.20	0.00	-3.40	-0.10
SWMBCNS – Error	56.80	-145.30	5.80	-8.40	0.00	-2.60	0.30
SWMBCS -Lag	68.50	-178.80	4.20	-19.10	0.00	-3.50	0.20
SWMBCS – Error	54.40	-157.90	5.10	-28.30	0.00	-3.00	0.40
SWMBFNS -Lag	12.90	-80.60	1.90	-5.40	0.00	-2.80	-1.20
SWMBFNS – Error	54.10	-166.00	3.20	-25.50	0.00	-3.50	0.10
SWMBFS -Lag	36.10	-105.30	2.80	-5.90	0.00	-2.70	-4.30
SWMBFS – Error	76.80	-200.20	4.00	10.10	0.00	-4.70	-5.90
SWMRGNS -Lag	71.30	-229.40	0.90	-43.80	0.00	-3.60	0.00
SWMRGNS – Error	47.30	-158.90	2.00	-17.70	0.00	-4.20	0.00
SWMRGS -Lag	69.80	-182.70	4.10	-21.10	0.00	-3.40	0.10
SWMRGS – Error	61.00	-183.90	3.10	-34.60	0.00	-3.00	0.40
PVB_PER_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	81.00	-192.10	4.60	-8.80	0.00	-4.20	0.20
SWMBANS – Error	50.30	-114.10	7.50	-20.60	0.00	-1.40	0.30
SWMBAS -Lag	84.40	-172.60	7.10	11.10	0.00	-3.90	0.30
SWMBAS – Error	68.40	-150.60	6.70	-3.20	0.00	-3.40	0.40
SWMBCNS -Lag	62.80	-125.60	8.00	28.90	0.00	-3.30	-0.40
SWMBCNS – Error	64.20	-156.00	6.60	0.40	0.00	-3.10	0.30
SWMBCS -Lag	71.20	-149.90	7.10	16.40	0.00	-3.60	0.00
SWMBCS – Error	62.60	-135.70	7.80	10.10	0.00	-3.20	0.30
SWMBFNS -Lag	19.10	-67.20	4.40	21.60	0.00	-3.00	-1.10
SWMBFNS – Error	178.70	-353.30	12.30	88.40	0.00	-8.50	-3.80
SWMBFS -Lag	43.90	-98.80	5.20	17.60	0.00	-3.00	-3.50
SWMBFS – Error	76.70	-171.50	6.90	41.60	0.00	-4.90	-5.40
SWMRGNS -Lag	75.10	-195.70	4.60	0.20	0.00	-4.00	0.00
SWMRGNS – Error	40.40	-130.50	6.50	-20.70	0.00	0.30	0.00
SWMRGS -Lag	76.30	-164.20	6.90	12.60	0.00	-3.60	0.20
SWMRGS – Error	65.80	-157.80	6.20	2.50	0.00	-3.20	0.30

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Professional Services							
SCB_PRO_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	3.40	-54.80	-5.60	-9.70	0.00	0.60	-0.40
SWMBANS – Error	-6.90	-61.50	-6.70	-9.70	0.00	0.40	0.00
SWMBAS -Lag	8.70	-51.40	-3.80	4.00	0.00	0.90	-0.50
SWMBAS – Error	23.60	-110.70	-4.30	-3.80	0.00	-0.60	-1.00
SWMBCNS -Lag	5.80	-55.20	-3.90	-6.30	0.00	0.40	-0.70
SWMBCNS – Error	5.40	-53.70	-3.90	1.00	0.00	0.80	0.00
SWMBCS -Lag	5.10	-47.50	-3.50	0.70	0.00	0.50	-1.00
SWMBCS – Error	13.60	-100.00	-3.80	-7.60	0.00	-0.70	-1.50
SWMBFNS -Lag	21.30	-54.80	-1.40	3.90	0.00	0.70	-2.00
SWMBFNS – Error	-26.10	-5.80	-2.30	24.90	0.00	1.10	-4.40
SWMBFS -Lag	3.20	-33.50	-2.40	3.40	0.00	0.60	-4.60
SWMBFS – Error	7.20	-59.90	-3.30	5.50	0.00	0.60	-4.80
SWMRGNS -Lag	-3.70	-43.30	-4.50	-9.40	0.00	0.90	0.00
SWMRGNS – Error	-2.10	-47.20	-4.50	1.90	0.00	0.80	0.00
SWMRGS -Lag	5.10	-47.20	-3.60	0.90	0.00	1.00	-0.50
SWMRGS – Error	8.00	-69.40	-3.80	-6.70	0.00	0.40	-0.60
SCB_PRO_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-16.30	-4.70	-2.30	-17.60	0.00	0.80	-0.50
SWMBANS – Error	-18.40	17.30	-1.00	1.10	0.00	1.00	-0.50
SWMBAS -Lag	-3.10	-5.50	-0.10	9.20	0.00	0.60	-1.10
SWMBAS – Error	49.00	-143.60	-0.80	-23.10	0.00	-1.40	-1.70
SWMBCNS -Lag	-11.10	8.10	0.20	6.40	0.00	0.50	-1.10
SWMBCNS – Error	-28.20	15.70	-1.20	8.40	0.00	0.80	-1.80
SWMBCS -Lag	-4.30	1.40	0.80	13.60	0.00	0.40	-1.10
SWMBCS – Error	10.00	-59.10	-0.60	1.60	0.00	-0.50	-1.70
SWMBFNS -Lag	6.60	-3.20	0.80	8.60	0.00	0.30	-3.90
SWMBFNS – Error	-22.60	-3.10	-1.90	18.30	0.00	1.20	-4.40
SWMBFS -Lag	-7.60	15.10	0.10	16.90	0.00	0.40	-4.90
SWMBFS – Error	-11.70	21.50	0.20	28.40	0.00	0.70	-5.50
SWMRGNS -Lag	-19.20	3.90	-1.60	-12.80	0.00	0.90	0.00
SWMRGNS – Error	-9.80	23.60	0.50	29.80	0.00	0.60	0.00
SWMRGS -Lag	-10.10	9.80	0.30	5.90	0.00	0.90	-1.30
SWMRGS – Error	-3.70	-20.90	-0.50	-9.50	0.00	0.30	-1.40
SCB_PRO_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-11.40	-9.10	-2.70	-15.70	0.00	0.90	-0.40
SWMBANS – Error	-18.70	29.80	-1.10	-6.10	0.00	1.40	-0.50
SWMBAS -Lag	0.10	-9.20	-0.60	1.00	0.00	0.80	-0.90
SWMBAS – Error	52.20	-144.10	-1.50	-42.70	0.00	-1.10	-1.70
SWMBCNS -Lag	-5.80	-8.30	-0.90	-11.40	0.00	0.60	-1.20
SWMBCNS – Error	-36.50	36.30	-1.70	-2.10	0.00	1.50	-1.80
SWMBCS -Lag	-1.60	-5.90	0.10	1.80	0.00	0.70	-1.00
SWMBCS – Error	9.80	-57.50	-1.30	-10.40	0.00	-0.10	-1.70
SWMBFNS -Lag	12.70	-17.60	0.40	7.50	0.00	0.60	-1.70
SWMBFNS – Error	-28.70	16.50	-1.90	7.90	0.00	1.50	-4.30
SWMBFS -Lag	-4.70	4.00	-0.30	5.30	0.00	0.60	-4.80
SWMBFS – Error	-8.40	5.80	-0.50	9.70	0.00	0.80	-5.30
SWMRGNS -Lag	-15.30	0.20	-2.10	-9.40	0.00	1.00	0.00
SWMRGNS – Error	-14.70	16.10	-0.30	-5.60	0.00	1.10	0.00
SWMRGS -Lag	-6.40	-0.70	-0.60	-2.40	0.00	1.10	-1.20
SWMRGS – Error	0.30	-40.40	-1.60	-25.10	0.00	0.60	-1.40

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Professional Services							
PSB_PRO_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	8.30	-82.60	-7.80	-4.90	0.00	0.60	-0.10
SWMBANS – Error	-4.80	-90.30	-10.10	-17.20	0.00	0.20	0.00
SWMBAS -Lag	8.10	-72.10	-6.30	1.00	0.00	1.00	0.10
SWMBAS – Error	17.80	-124.90	-7.80	-0.30	0.00	-0.20	-0.60
SWMBCNS -Lag	9.20	-75.60	-6.60	-0.90	0.00	0.90	-0.10
SWMBCNS – Error	9.30	-68.30	-6.10	5.90	0.00	1.10	0.00
SWMBCS -Lag	9.20	-74.00	-6.50	0.70	0.00	0.80	-0.20
SWMBCS – Error	20.80	-147.60	-7.10	-8.50	0.00	-0.80	-1.30
SWMBFNS -Lag	35.90	-90.90	-3.40	1.80	0.00	0.70	-1.70
SWMBFNS – Error	36.50	-104.40	-5.10	6.90	0.00	1.00	-0.10
SWMBFS -Lag	9.10	-55.30	-4.40	1.70	0.00	0.60	-4.60
SWMBFS – Error	34.80	-129.30	-5.90	5.90	0.00	0.40	-5.90
SWMRGNS -Lag	-8.40	-57.90	-8.60	-11.80	0.00	0.50	0.00
SWMRGNS – Error	-7.00	-64.80	-8.20	-3.80	0.00	0.60	0.00
SWMRGS -Lag	6.90	-64.30	-6.50	-0.90	0.00	0.80	-0.90
SWMRGS – Error	10.60	-89.90	-6.40	-4.30	0.00	0.00	-0.80
PSB_PRO_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-20.20	-11.20	-4.20	-29.90	0.00	1.00	-0.40
SWMBANS – Error	-40.90	52.50	-2.70	-1.80	0.00	2.20	-0.50
SWMBAS -Lag	-10.50	-3.10	-1.70	-10.30	0.00	1.00	-0.70
SWMBAS – Error	51.40	-192.40	-4.90	-67.50	0.00	-0.90	-1.70
SWMBCNS -Lag	-17.50	3.80	-1.80	-15.40	0.00	1.10	-0.80
SWMBCNS – Error	-28.90	25.00	-1.60	12.10	0.00	1.50	-1.40
SWMBCS -Lag	-11.70	-1.40	-1.10	-11.30	0.00	1.10	-1.00
SWMBCS – Error	-8.70	-51.80	-3.70	-28.60	0.00	1.00	-1.60
SWMBFNS -Lag	16.00	-25.80	0.20	-4.00	0.00	0.50	-2.90
SWMBFNS – Error	-0.30	-21.00	-0.10	11.30	0.00	0.80	-4.20
SWMBFS -Lag	-8.50	6.00	-0.90	-4.20	0.00	0.60	-5.80
SWMBFS – Error	-0.30	-15.10	-1.30	-1.60	0.00	0.90	-6.20
SWMRGNS -Lag	-22.10	2.60	-3.50	-17.80	0.00	1.20	0.00
SWMRGNS – Error	-14.70	25.90	-0.70	-6.20	0.00	1.20	0.00
SWMRGS -Lag	-12.30	1.30	-1.70	-9.90	0.00	1.10	-1.10
SWMRGS – Error	-13.10	-12.20	-2.90	-22.80	0.00	1.00	-1.30
PSB_PRO_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-9.80	-30.10	-5.20	-24.40	0.00	0.80	-0.30
SWMBANS – Error	-1.70	-16.70	-2.10	-9.90	0.00	0.90	0.00
SWMBAS -Lag	-1.40	-22.40	-2.90	-11.10	0.00	0.90	-0.60
SWMBAS – Error	52.20	-194.60	-5.50	-44.50	0.00	-1.00	-1.60
SWMBCNS -Lag	-6.70	-24.20	-3.30	-22.60	0.00	0.90	-0.70
SWMBCNS – Error	-2.90	-15.50	-2.20	-7.70	0.00	0.90	0.10
SWMBCS -Lag	-2.90	-22.30	-2.60	-14.70	0.00	1.00	-1.20
SWMBCS – Error	6.50	-83.70	-4.50	-28.40	0.00	0.60	-1.60
SWMBFNS -Lag	20.40	-41.70	-0.90	-6.10	0.00	0.70	-1.80
SWMBFNS – Error	-1.80	-17.30	-1.30	19.20	0.00	1.20	-4.20
SWMBFS -Lag	-2.90	-9.90	-1.70	-7.10	0.00	0.60	-5.60
SWMBFS – Error	9.70	-45.50	-2.60	-6.00	0.00	0.80	-6.20
SWMRGNS -Lag	-17.30	-11.60	-4.90	-18.90	0.00	1.00	0.00
SWMRGNS – Error	-24.20	38.30	-2.20	2.50	0.00	1.50	0.00
SWMRGS -Lag	-6.40	-14.50	-3.10	-12.00	0.00	1.20	-1.30
SWMRGS – Error	-5.30	-33.80	-3.90	-23.80	0.00	0.80	-1.30

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Professional Services							
PVB_PRO_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-50.50	296.30	-1.10	93.90	0.00	2.60	-0.40
SWMBANS – Error	-110.50	640.40	16.80	270.70	0.00	6.60	0.00
SWMBAS -Lag	-18.10	267.80	4.00	124.30	0.00	2.20	-1.30
SWMBAS – Error	-31.50	256.60	2.90	30.20	0.00	1.90	-1.60
SWMBCNS -Lag	-50.70	325.60	0.80	151.70	0.00	2.50	-1.10
SWMBCNS – Error	-134.90	642.80	12.80	269.10	0.00	6.00	0.00
SWMBCS -Lag	-23.80	264.30	3.10	163.90	0.00	1.60	-1.60
SWMBCS – Error	-119.40	462.30	5.70	159.20	0.00	3.60	-1.50
SWMBFNS -Lag	-4.80	218.70	8.10	121.30	0.00	1.80	-2.50
SWMBFNS – Error	-120.20	595.00	11.00	240.50	0.00	5.40	0.00
SWMBFS -Lag	-44.70	323.30	7.30	156.40	0.00	3.00	-5.20
SWMBFS – Error	-111.20	579.30	11.40	222.50	0.00	5.10	-6.20
SWMRGNS -Lag	-13.20	267.00	3.10	129.20	0.00	3.30	0.00
SWMRGNS – Error	-130.00	611.20	11.00	240.90	0.00	5.50	0.00
SWMRGS -Lag	-60.60	423.60	8.30	177.80	0.00	4.50	-1.00
SWMRGS – Error	-90.90	477.30	8.70	176.10	0.00	3.10	-1.10
PVB_PRO_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-51.20	341.60	-5.80	113.50	0.00	5.00	-0.30
SWMBANS – Error	-92.10	653.40	15.50	237.40	0.00	8.90	0.00
SWMBAS -Lag	-71.50	409.60	-1.90	139.30	0.00	5.30	-0.80
SWMBAS – Error	-139.70	385.60	-10.90	116.20	0.00	7.10	-1.30
SWMBCNS -Lag	-59.50	387.10	-5.50	144.20	0.00	6.20	-0.90
SWMBCNS – Error	-137.10	672.50	8.80	249.10	0.00	8.20	-0.10
SWMBCS -Lag	-50.50	362.80	-4.50	145.40	0.00	5.50	-1.00
SWMBCS – Error	-0.20	161.20	-7.10	84.80	0.00	5.10	-1.80
SWMBFNS -Lag	-50.80	165.90	-1.60	59.10	0.00	1.10	-3.60
SWMBFNS – Error	-155.40	623.60	2.80	173.50	0.00	6.50	0.00
SWMBFS -Lag	-31.30	274.40	1.60	116.00	0.00	3.80	-5.70
SWMBFS – Error	-86.20	514.80	1.10	183.50	0.00	7.30	-6.30
SWMRGNS -Lag	-30.30	353.80	-3.20	153.20	0.00	6.10	0.00
SWMRGNS – Error	-159.60	615.60	1.40	170.00	0.00	6.00	0.00
SWMRGS -Lag	-88.30	477.50	0.40	161.10	0.00	6.10	-0.70
SWMRGS – Error	-129.90	543.50	-2.60	201.50	0.00	5.60	-1.20
PVB_PRO_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-59.60	346.80	-4.60	114.50	0.00	4.10	-0.30
SWMBANS – Error	-93.90	666.20	16.30	255.30	0.00	8.40	0.00
SWMBAS -Lag	-51.90	369.10	0.40	144.00	0.00	4.40	-1.00
SWMBAS – Error	-135.80	417.80	-5.20	124.20	0.00	6.30	-1.40
SWMBCNS -Lag	-45.60	355.80	-4.50	146.50	0.00	5.00	-1.00
SWMBCNS – Error	-132.60	679.30	10.30	261.80	0.00	7.60	0.00
SWMBCS -Lag	-21.10	302.60	-2.70	157.40	0.00	4.20	-1.30
SWMBCS – Error	-9.70	222.10	-1.60	119.20	0.00	3.50	-1.80
SWMBFNS -Lag	31.80	38.00	1.80	54.20	0.00	0.60	-4.10
SWMBFNS – Error	-154.70	650.10	5.10	201.10	0.00	6.40	0.00
SWMBFS -Lag	-34.90	301.10	3.30	131.60	0.00	3.70	-5.60
SWMBFS – Error	-100.40	574.60	4.30	203.40	0.00	7.20	-6.30
SWMRGNS -Lag	-29.00	350.80	-1.40	155.80	0.00	5.30	0.00
SWMRGNS – Error	-148.90	631.60	4.20	198.70	0.00	6.00	0.00
SWMRGS -Lag	-79.90	490.90	3.70	179.80	0.00	6.00	-0.70
SWMRGS – Error	-119.30	560.40	2.40	212.60	0.00	5.00	-1.20

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Total Credit							
SCB_TCR_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	2.30	-23.00	-1.20	-1.70	0.00	-0.50	0.20
SWMBANS – Error	-2.80	-27.60	-2.40	-7.00	0.00	-1.00	0.00
SWMBAS -Lag	2.10	-22.00	-1.10	-0.90	0.00	-0.60	0.20
SWMBAS – Error	2.10	-21.60	-1.10	-1.10	0.00	-0.70	0.20
SWMBCNS -Lag	2.20	-22.40	-1.10	-0.60	0.00	-0.70	0.20
SWMBCNS – Error	2.10	-24.00	-1.30	-2.50	0.00	-0.80	0.00
SWMBCS -Lag	2.10	-21.90	-1.10	-0.40	0.00	-0.70	0.00
SWMBCS – Error	2.60	-22.10	-1.00	0.90	0.00	-0.90	-0.80
SWMBFNS -Lag	-1.10	-12.10	-0.90	-0.20	0.00	-0.60	-1.70
SWMBFNS – Error	7.40	-28.50	-0.90	0.10	0.00	-0.70	-0.10
SWMBFS -Lag	2.30	-16.40	-0.70	0.40	0.00	-0.60	-4.50
SWMBFS – Error	6.10	-29.30	-1.00	0.70	0.00	-0.80	-6.00
SWMRGNS -Lag	2.40	-19.70	-1.20	0.40	0.00	-0.30	0.00
SWMRGNS – Error	-1.80	-20.40	-1.60	-1.90	0.00	-0.80	0.00
SWMRGS -Lag	2.20	-21.40	-1.10	-0.30	0.00	-0.70	0.20
SWMRGS – Error	2.10	-21.80	-1.10	-0.40	0.00	-0.70	0.00
SCB_TCR_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	2.90	-5.10	0.30	11.50	0.00	-0.60	0.10
SWMBANS – Error	1.40	-2.90	-0.10	10.50	0.00	-0.70	0.30
SWMBAS -Lag	2.40	-5.30	0.30	10.50	0.00	-0.60	0.20
SWMBAS – Error	2.40	-4.80	0.20	9.90	0.00	-0.60	0.30
SWMBCNS -Lag	1.50	-5.50	0.30	9.70	0.00	-0.70	-0.30
SWMBCNS – Error	2.20	-4.80	0.40	11.40	0.00	-0.60	-0.10
SWMBCS -Lag	2.10	-5.80	0.30	10.00	0.00	-0.70	-0.10
SWMBCS – Error	1.70	-5.00	0.60	14.00	0.00	-0.80	-1.60
SWMBFNS -Lag	3.40	-5.40	0.10	4.90	0.00	-0.40	-3.20
SWMBFNS – Error	6.30	-9.30	0.50	11.60	0.00	-0.60	0.30
SWMBFS -Lag	2.00	-5.00	0.20	7.70	0.00	-0.50	-3.90
SWMBFS – Error	10.40	-19.10	0.40	12.00	0.00	-0.70	-6.80
SWMRGNS -Lag	3.00	-5.80	0.20	11.50	0.00	-0.50	0.00
SWMRGNS – Error	1.80	-5.90	-0.10	9.50	0.00	-0.50	0.00
SWMRGS -Lag	2.70	-5.50	0.20	11.10	0.00	-0.50	0.50
SWMRGS – Error	1.60	2.50	0.80	16.30	0.00	-0.80	-1.30
SCB_TCR_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	3.94	-8.48	0.02	8.61	0.00	-0.51	0.09
SWMBANS – Error	1.00	-13.59	-0.80	3.99	0.00	-0.72	-0.04
SWMBAS -Lag	3.52	-8.75	-0.02	7.84	0.00	-0.55	0.26
SWMBAS – Error	3.33	-8.02	-0.11	7.12	0.00	-0.56	0.33
SWMBCNS -Lag	3.86	-9.12	-0.07	8.21	0.00	-0.55	0.25
SWMBCNS – Error	3.14	-5.93	-0.09	8.47	0.00	-0.45	0.50
SWMBCS -Lag	3.68	-9.39	-0.08	7.82	0.00	-0.56	0.25
SWMBCS – Error	3.41	-8.64	-0.15	7.30	0.00	-0.52	0.36
SWMBFNS -Lag	5.51	-10.34	0.01	5.80	0.00	-0.41	-2.15
SWMBFNS – Error	5.93	-14.29	-0.14	12.99	0.00	-0.50	-3.98
SWMBFS -Lag	3.07	-8.02	-0.07	6.52	0.00	-0.50	-3.09
SWMBFS – Error	9.46	-20.46	0.01	10.10	0.00	-0.65	-6.60
SWMRGNS -Lag	1.74	-8.61	-0.18	5.98	0.00	-0.72	-0.01
SWMRGNS – Error	-0.49	-2.72	-0.19	8.26	0.00	-0.62	-0.02
SWMRGS -Lag	3.68	-9.51	-0.08	7.86	0.00	-0.57	0.11
SWMRGS – Error	1.78	-2.42	0.32	11.64	0.00	-0.67	-1.19

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Total Credit							
PSB_TCR_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	0.30	6.30	-0.20	12.10	0.00	0.40	-0.30
SWMBANS – Error	-8.30	12.50	-1.00	12.90	0.00	0.30	0.10
SWMBAS -Lag	-2.10	4.60	-0.50	11.30	0.00	0.40	-0.30
SWMBAS – Error	-4.00	12.00	-0.10	16.40	0.00	0.30	-0.70
SWMBCNS -Lag	1.20	9.30	0.10	12.40	0.00	0.20	-1.40
SWMBCNS – Error	-4.20	8.20	-0.60	11.20	0.00	0.40	0.20
SWMBCS -Lag	-1.50	10.50	-0.10	12.30	0.00	0.30	-1.40
SWMBCS – Error	-3.60	20.10	0.40	18.70	0.00	0.10	-1.60
SWMBFNS -Lag	0.70	-1.50	-0.20	2.30	0.00	0.10	-3.90
SWMBFNS – Error	0.80	2.20	-0.30	13.20	0.00	0.40	0.10
SWMBFS -Lag	-1.90	2.70	-0.40	7.90	0.00	0.30	-4.00
SWMBFS – Error	-3.40	4.70	-0.60	11.00	0.00	0.40	-4.30
SWMRGNS -Lag	-1.00	0.90	0.00	5.00	0.00	0.20	0.00
SWMRGNS – Error	-7.30	11.20	-1.10	13.10	0.00	0.40	0.00
SWMRGS -Lag	-2.90	4.50	-0.40	8.70	0.00	0.30	-0.70
SWMRGS – Error	-4.70	4.70	-0.30	9.70	0.00	0.20	-0.80
PSB_TCR_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	0.40	3.20	0.30	11.70	0.00	-0.40	-0.20
SWMBANS – Error	-1.50	2.60	-0.10	14.60	0.00	-0.60	0.10
SWMBAS -Lag	1.50	2.60	0.40	14.70	0.00	-0.40	-0.30
SWMBAS – Error	-0.30	10.70	0.80	19.00	0.00	-0.40	-0.90
SWMBCNS -Lag	1.20	5.10	0.60	14.40	0.00	-0.40	-0.90
SWMBCNS – Error	1.10	1.00	0.20	13.30	0.00	-0.50	0.10
SWMBCS -Lag	1.10	4.50	0.50	14.90	0.00	-0.40	-0.70
SWMBCS – Error	1.10	12.90	1.00	20.00	0.00	-0.40	-1.60
SWMBFNS -Lag	3.70	-1.80	0.20	7.90	0.00	-0.20	-2.80
SWMBFNS – Error	4.00	-0.30	0.50	16.10	0.00	-0.40	0.10
SWMBFS -Lag	1.10	1.90	0.30	11.20	0.00	-0.30	-4.10
SWMBFS – Error	1.50	3.20	0.40	15.40	0.00	-0.30	-3.90
SWMRGNS -Lag	-1.40	0.60	0.30	8.40	0.00	-0.60	0.00
SWMRGNS – Error	-1.50	4.50	0.10	15.30	0.00	-0.50	0.00
SWMRGS -Lag	0.40	1.70	0.40	12.80	0.00	-0.50	-0.70
SWMRGS – Error	-0.60	4.90	0.60	15.70	0.00	-0.40	-1.00
PSB_TCR_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	2.31	-0.09	-0.23	9.19	0.00	-0.38	-0.32
SWMBANS – Error	-0.12	1.42	-0.23	12.55	0.00	-0.45	0.10
SWMBAS -Lag	3.04	-0.96	-0.02	11.83	0.00	-0.34	-0.28
SWMBAS – Error	1.92	5.93	0.32	14.94	0.00	-0.32	-0.84
SWMBCNS -Lag	2.45	3.21	0.10	10.73	0.00	-0.34	-1.43
SWMBCNS – Error	2.25	-0.19	-0.02	11.61	0.00	-0.36	0.19
SWMBCS -Lag	2.06	3.03	0.10	11.91	0.00	-0.31	-1.03
SWMBCS – Error	1.61	11.36	0.57	16.36	0.00	-0.34	-1.63
SWMBFNS -Lag	4.85	-4.74	0.07	7.28	0.00	-0.21	-2.37
SWMBFNS – Error	5.37	-3.39	0.21	13.04	0.00	-0.32	0.10
SWMBFS -Lag	2.01	-0.84	0.00	8.61	0.00	-0.24	-4.28
SWMBFS – Error	2.69	-0.76	0.03	11.82	0.00	-0.27	-4.13
SWMRGNS -Lag	-1.00	-2.82	-0.32	4.55	0.00	-0.52	-0.04
SWMRGNS – Error	0.40	1.61	-0.22	12.69	0.00	-0.40	0.01
SWMRGS -Lag	1.67	-1.88	-0.04	9.42	0.00	-0.39	-0.81
SWMRGS – Error	1.13	-0.48	0.08	11.07	0.00	-0.33	-0.84

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Total Credit							
PVB_TCR_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	61.80	-137.50	-8.00	22.40	0.00	-0.30	-0.10
SWMBANS – Error	50.50	-169.50	-10.90	-3.00	0.00	-1.10	0.00
SWMBAS -Lag	56.30	-140.20	-8.90	14.00	0.00	-0.30	-0.30
SWMBAS – Error	12.40	-36.00	-6.40	80.80	0.00	0.70	-1.40
SWMBCNS -Lag	58.70	-149.20	-8.60	13.20	0.00	-0.50	-0.20
SWMBCNS – Error	59.80	-169.00	-9.30	-0.60	0.00	-0.80	0.00
SWMBCS -Lag	57.30	-149.00	-8.90	11.30	0.00	-0.50	-0.20
SWMBCS – Error	63.60	-141.10	-7.60	29.10	0.00	-0.40	-1.00
SWMBFNS -Lag	23.70	-85.10	-7.20	8.90	0.00	-0.40	-1.50
SWMBFNS – Error	51.20	-150.30	-9.00	6.90	0.00	-0.70	0.00
SWMBFS -Lag	36.30	-98.70	-6.20	9.00	0.00	-0.40	-4.60
SWMBFS – Error	56.10	-151.40	-9.20	11.90	0.00	-0.30	-6.30
SWMRGNS -Lag	57.40	-138.80	-8.30	15.30	0.00	-0.40	0.00
SWMRGNS – Error	56.50	-158.80	-9.00	7.20	0.00	-0.70	0.00
SWMRGS -Lag	55.80	-142.40	-8.60	12.20	0.00	-0.40	-0.30
SWMRGS – Error	47.50	-111.60	-7.60	45.10	0.00	-0.20	-1.10
PVB_TCR_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	3.00	-2.20	-2.20	21.00	0.00	1.10	-0.10
SWMBANS – Error	-8.80	18.70	-3.10	24.40	0.00	1.20	0.10
SWMBAS -Lag	0.60	-0.40	-2.40	19.90	0.00	1.20	-0.30
SWMBAS – Error	-1.20	1.30	-2.50	20.00	0.00	1.10	0.00
SWMBCNS -Lag	0.60	0.80	-2.20	21.60	0.00	0.90	-0.40
SWMBCNS – Error	-1.80	5.90	-2.40	20.90	0.00	1.20	0.10
SWMBCS -Lag	-0.40	5.30	-2.20	23.50	0.00	1.00	-0.70
SWMBCS – Error	-15.70	34.80	-0.70	39.30	0.00	0.70	-1.50
SWMBFNS -Lag	8.20	-12.90	-0.70	1.50	0.00	0.40	-3.60
SWMBFNS – Error	16.30	-9.70	-1.00	29.80	0.00	1.30	0.30
SWMBFS -Lag	5.50	-7.60	-1.10	10.90	0.00	0.60	-6.50
SWMBFS – Error	22.60	-37.80	-1.50	21.00	0.00	0.80	-6.70
SWMRGNS -Lag	4.70	8.00	-1.30	23.10	0.00	1.10	0.00
SWMRGNS – Error	10.50	-24.20	-1.40	19.20	0.00	0.30	0.00
SWMRGS -Lag	0.80	6.60	-1.90	20.30	0.00	1.20	-0.60
SWMRGS – Error	-0.50	8.00	-1.30	26.10	0.00	0.80	-0.60
PVB_TCR_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-5.07	-13.67	-1.34	10.19	0.00	0.14	-0.38
SWMBANS – Error	6.34	-51.25	-0.64	38.00	0.00	-0.70	-0.52
SWMBAS -Lag	-6.40	-8.89	-1.63	12.97	0.00	0.59	-0.78
SWMBAS – Error	-10.48	-7.80	-0.10	42.69	0.00	-0.08	-1.48
SWMBCNS -Lag	-5.81	-8.45	-1.92	13.92	0.00	0.29	-0.63
SWMBCNS – Error	-19.48	2.72	-1.73	9.35	0.00	0.15	-1.18
SWMBCS -Lag	-6.22	-6.20	-1.83	16.54	0.00	0.33	-0.75
SWMBCS – Error	-9.63	-4.09	-0.68	29.00	0.00	-0.28	-1.52
SWMBFNS -Lag	9.68	-17.09	-0.54	5.53	0.00	0.32	-3.14
SWMBFNS – Error	-9.89	5.37	-2.13	12.88	0.00	1.00	-4.12
SWMBFS -Lag	-3.39	-4.85	-1.32	9.09	0.00	0.39	-5.93
SWMBFS – Error	-3.76	-12.55	-2.00	16.08	0.00	0.59	-6.04
SWMRGNS -Lag	-5.88	0.25	-1.12	12.25	0.00	0.32	-0.03
SWMRGNS – Error	-1.95	-10.02	-0.78	13.14	0.00	0.24	-0.03
SWMRGS -Lag	-4.50	1.55	-1.16	13.79	0.00	0.73	-0.93
SWMRGS – Error	-9.64	18.17	-0.16	28.91	0.00	0.35	-1.26

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Trade							
SCB_TRD_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-0.70	-1.30	-2.00	29.20	0.00	0.90	0.10
SWMBANS – Error	-0.30	-5.10	-2.70	22.10	0.00	1.10	0.20
SWMBAS -Lag	5.50	-6.30	-2.00	27.90	0.00	1.00	0.10
SWMBAS – Error	4.00	10.00	-1.10	28.70	0.00	2.00	0.60
SWMBCNS -Lag	7.40	-8.90	-2.10	27.40	0.00	0.90	-0.30
SWMBCNS – Error	6.30	-6.80	-2.10	27.30	0.00	1.10	0.00
SWMBCS -Lag	6.50	-7.80	-2.20	26.90	0.00	0.90	-0.30
SWMBCS – Error	4.00	-11.60	-2.00	26.00	0.00	0.60	-0.40
SWMBFNS -Lag	-11.90	11.20	-1.20	3.40	0.00	0.30	-3.40
SWMBFNS – Error	34.00	-30.30	-0.30	38.20	0.00	1.20	0.30
SWMBFS -Lag	11.20	-15.90	-0.90	15.00	0.00	0.50	-6.40
SWMBFS – Error	34.50	-60.60	-1.00	26.10	0.00	0.40	-6.50
SWMRGNS -Lag	6.00	-7.70	-2.10	27.50	0.00	1.00	0.00
SWMRGNS – Error	3.40	-6.40	-2.60	25.60	0.00	1.00	0.00
SWMRGS -Lag	6.60	-7.40	-2.10	26.60	0.00	1.00	-0.10
SWMRGS – Error	6.10	-3.60	-2.00	28.10	0.00	1.30	0.20
SCB_TRD_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	10.20	38.40	2.10	23.80	0.00	-0.70	-0.20
SWMBANS – Error	7.70	50.20	3.00	25.60	0.00	-0.70	0.00
SWMBAS -Lag	9.80	41.50	2.30	25.30	0.00	-0.60	-0.60
SWMBAS – Error	7.10	54.10	2.80	31.70	0.00	-0.40	-1.00
SWMBCNS -Lag	7.80	45.40	2.60	26.50	0.00	-0.60	-0.40
SWMBCNS – Error	7.70	49.70	3.00	25.10	0.00	-0.80	0.00
SWMBCS -Lag	7.90	48.20	2.80	25.80	0.00	-0.70	-0.20
SWMBCS – Error	4.80	65.60	3.10	32.20	0.00	-0.10	-1.40
SWMBFNS -Lag	6.80	8.90	0.80	13.60	0.00	-0.40	-3.50
SWMBFNS – Error	11.60	45.20	3.10	25.90	0.00	-0.70	0.00
SWMBFS -Lag	7.30	28.30	1.80	18.10	0.00	-0.50	-5.00
SWMBFS – Error	12.40	43.50	2.80	27.00	0.00	-0.50	-5.40
SWMRGNS -Lag	7.70	49.30	2.90	25.50	0.00	-0.70	0.00
SWMRGNS – Error	5.10	50.70	2.70	24.40	0.00	-0.80	0.00
SWMRGS -Lag	7.60	49.80	3.00	25.50	0.00	-0.70	-0.10
SWMRGS – Error	-0.30	68.10	2.70	32.90	0.00	-0.30	-1.10
SCB_TRD_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	11.90	24.60	1.20	33.90	0.00	-0.30	-0.10
SWMBANS – Error	3.30	24.40	0.30	29.30	0.00	-0.80	0.00
SWMBAS -Lag	10.00	28.50	1.60	35.60	0.00	-0.40	0.00
SWMBAS – Error	10.10	28.60	1.60	35.90	0.00	-0.40	-0.10
SWMBCNS -Lag	10.10	24.50	1.10	35.90	0.00	-0.30	-0.80
SWMBCNS – Error	9.90	25.00	1.30	31.70	0.00	-0.50	0.00
SWMBCS -Lag	9.50	27.20	1.10	35.60	0.00	-0.30	-0.70
SWMBCS – Error	4.20	41.80	1.80	40.30	0.00	-0.20	-1.00
SWMBFNS -Lag	6.00	2.20	0.40	13.90	0.00	-0.40	-3.40
SWMBFNS – Error	25.50	10.10	2.30	37.60	0.00	-0.40	0.10
SWMBFS -Lag	9.70	7.60	0.90	20.20	0.00	-0.30	-6.70
SWMBFS – Error	23.40	3.70	1.80	36.30	0.00	-0.50	-6.70
SWMRGNS -Lag	10.30	24.60	0.90	31.20	0.00	-0.20	0.00
SWMRGNS – Error	8.10	29.60	1.40	35.00	0.00	-0.50	0.00
SWMRGS -Lag	9.40	27.40	1.40	33.90	0.00	-0.30	-0.30
SWMRGS – Error	8.10	30.20	1.40	36.40	0.00	-0.40	-0.60

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Trade							
PSB_TRD_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	11.40	-10.40	-2.10	19.70	0.00	1.40	-0.10
SWMBANS – Error	-2.40	6.60	-2.00	21.00	0.00	1.20	0.10
SWMBAS -Lag	9.10	-9.80	-2.20	18.80	0.00	1.40	-0.20
SWMBAS – Error	7.10	-9.30	-2.10	19.40	0.00	1.20	-0.10
SWMBCNS -Lag	9.60	-9.20	-2.00	19.90	0.00	1.20	-0.40
SWMBCNS – Error	-14.30	7.10	-3.10	-1.90	0.00	1.50	-1.40
SWMBCS -Lag	7.50	-6.00	-2.20	20.20	0.00	1.30	-0.50
SWMBCS – Error	5.40	-13.10	-1.90	20.30	0.00	0.90	-0.90
SWMBFNS -Lag	-9.80	5.00	-1.10	0.30	0.00	0.40	-4.10
SWMBFNS – Error	28.60	-20.30	-0.10	31.00	0.00	1.50	0.20
SWMBFS -Lag	10.10	-14.20	-1.00	12.00	0.00	0.80	-6.00
SWMBFS – Error	27.00	-49.50	-1.50	20.60	0.00	1.00	-6.30
SWMRGNS -Lag	11.00	-1.10	-2.20	18.60	0.00	2.00	0.00
SWMRGNS – Error	0.70	6.80	-1.90	24.10	0.00	1.30	0.00
SWMRGS -Lag	5.80	-3.20	-2.20	18.00	0.00	1.50	-0.60
SWMRGS – Error	5.10	-12.80	-2.30	17.90	0.00	1.10	-0.50
PSB_TRD_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	17.10	43.50	3.00	32.30	0.00	-0.70	-0.20
SWMBANS – Error	11.10	48.70	2.70	27.60	0.00	-1.10	0.00
SWMBAS -Lag	17.10	44.20	3.10	33.60	0.00	-0.70	-0.50
SWMBAS – Error	16.50	52.40	4.00	43.70	0.00	-0.70	-0.90
SWMBCNS -Lag	15.20	52.60	3.70	33.50	0.00	-0.80	-0.10
SWMBCNS – Error	15.30	49.50	3.50	29.30	0.00	-1.00	0.00
SWMBCS -Lag	15.40	52.70	3.70	33.20	0.00	-0.90	-0.10
SWMBCS – Error	16.20	60.10	4.20	38.80	0.00	-0.60	-0.90
SWMBFNS -Lag	2.50	24.60	1.00	20.00	0.00	-0.50	-3.10
SWMBFNS – Error	20.60	46.70	4.00	33.50	0.00	-0.90	0.00
SWMBFS -Lag	11.40	33.50	2.40	24.20	0.00	-0.60	-4.70
SWMBFS – Error	18.00	49.40	3.60	35.20	0.00	-0.60	-4.40
SWMRGNS -Lag	14.60	51.60	3.50	32.00	0.00	-0.70	0.00
SWMRGNS – Error	7.20	54.70	2.70	29.40	0.00	-1.20	0.00
SWMRGS -Lag	13.50	52.40	3.60	32.30	0.00	-0.80	-0.30
SWMRGS – Error	1.00	80.10	3.70	40.10	0.00	-0.40	-1.20
PSB_TRD_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	13.90	31.10	2.20	41.00	0.00	-0.50	0.00
SWMBANS – Error	4.50	21.60	0.00	30.50	0.00	-1.20	0.10
SWMBAS -Lag	15.00	29.10	2.00	40.20	0.00	-0.40	0.00
SWMBAS – Error	15.10	29.30	1.90	40.70	0.00	-0.50	-0.10
SWMBCNS -Lag	14.90	27.30	1.50	41.10	0.00	-0.40	-0.80
SWMBCNS – Error	14.90	22.00	1.40	32.40	0.00	-0.60	0.10
SWMBCS -Lag	14.10	29.00	1.50	40.30	0.00	-0.30	-0.80
SWMBCS – Error	10.00	44.80	2.40	46.00	0.00	-0.40	-1.10
SWMBFNS -Lag	2.10	6.80	0.20	14.70	0.00	-0.30	-3.80
SWMBFNS – Error	30.90	10.00	2.60	42.10	0.00	-0.40	0.10
SWMBFS -Lag	11.30	10.60	1.10	23.90	0.00	-0.30	-6.40
SWMBFS – Error	23.20	12.70	2.10	40.80	0.00	-0.40	-6.20
SWMRGNS -Lag	14.10	26.50	1.40	35.30	0.00	-0.20	0.00
SWMRGNS – Error	8.80	31.60	1.20	38.00	0.00	-0.70	0.00
SWMRGS -Lag	13.00	28.00	1.60	36.90	0.00	-0.30	-0.50
SWMRGS – Error	12.00	29.30	1.80	38.80	0.00	-0.40	-0.50

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Trade							
PVB_TRD_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	20.20	19.40	-2.40	27.30	0.00	6.20	-0.40
SWMBANS – Error	32.40	-23.90	-0.70	-17.20	0.00	3.00	-0.60
SWMBAS -Lag	-3.10	11.50	-5.80	0.90	0.00	5.50	-0.80
SWMBAS – Error	-18.00	48.00	-3.80	-1.60	0.00	4.90	-1.40
SWMBCNS -Lag	-4.10	40.20	-4.20	28.00	0.00	5.00	-1.00
SWMBCNS – Error	-16.00	11.60	-5.50	5.90	0.00	3.90	-1.80
SWMBCS -Lag	-14.90	55.60	-4.90	22.70	0.00	5.30	-1.30
SWMBCS – Error	-85.60	194.80	-4.10	51.10	0.00	6.30	-2.00
SWMBFNS -Lag	-31.10	28.30	-4.90	-18.30	0.00	2.20	-3.40
SWMBFNS – Error	-57.00	130.10	-9.80	-25.50	0.00	6.90	-4.00
SWMBFS -Lag	-8.60	-2.00	-4.90	-11.10	0.00	2.90	-5.80
SWMBFS – Error	-19.80	7.20	-8.10	-18.10	0.00	4.90	-6.30
SWMRGNS -Lag	-4.80	2.40	-6.90	-0.10	0.00	4.80	0.00
SWMRGNS – Error	9.20	-44.90	-7.50	-17.50	0.00	4.00	0.00
SWMRGS -Lag	-8.40	1.90	-7.10	-6.40	0.00	4.80	-0.30
SWMRGS – Error	-57.50	101.50	-6.60	16.40	0.00	6.30	-1.30
PVB_TRD_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-31.10	36.60	4.50	-37.10	0.00	0.60	-0.40
SWMBANS – Error	-22.50	47.10	3.70	-64.70	0.00	1.10	-0.60
SWMBAS -Lag	-34.60	46.70	3.60	-24.40	0.00	0.40	-0.50
SWMBAS – Error	-31.70	43.00	2.20	-52.40	0.00	1.30	-1.10
SWMBCNS -Lag	-30.80	54.10	5.40	-5.80	0.00	0.70	-1.40
SWMBCNS – Error	-37.30	62.70	3.20	-13.50	0.00	0.20	0.00
SWMBCS -Lag	-36.80	58.60	4.60	-10.10	0.00	0.40	-1.10
SWMBCS – Error	-110.10	218.60	3.20	11.10	0.00	3.70	-1.80
SWMBFNS -Lag	6.00	-12.10	0.90	-23.50	0.00	0.60	-3.70
SWMBFNS – Error	-22.10	54.60	4.60	-3.30	0.00	0.30	0.10
SWMBFS -Lag	-12.30	22.20	2.00	-13.20	0.00	0.60	-5.90
SWMBFS – Error	-12.60	30.80	3.20	-23.10	0.00	1.20	-6.30
SWMRGNS -Lag	-37.70	62.20	3.20	-10.10	0.00	0.50	0.00
SWMRGNS – Error	-20.40	52.50	4.90	-9.20	0.00	0.80	0.00
SWMRGS -Lag	-37.00	59.50	3.20	-13.10	0.00	0.40	-0.40
SWMRGS – Error	-57.30	103.60	2.60	-5.80	0.00	1.60	-0.90
PVB_TRD_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	-13.00	22.40	2.70	-21.00	0.00	2.90	-0.40
SWMBANS – Error	-6.60	18.40	2.50	-51.10	0.00	1.90	-0.60
SWMBAS -Lag	-25.30	24.50	-0.10	-15.70	0.00	2.20	-0.50
SWMBAS – Error	-24.90	21.50	0.00	-39.70	0.00	2.50	-1.10
SWMBCNS -Lag	-20.10	49.70	3.00	11.00	0.00	2.20	-1.50
SWMBCNS – Error	-36.10	22.40	-1.00	-22.80	0.00	2.20	-1.50
SWMBCS -Lag	-28.80	49.20	1.70	2.80	0.00	2.10	-1.40
SWMBCS – Error	-99.90	193.70	0.90	23.40	0.00	4.30	-1.90
SWMBFNS -Lag	-7.20	6.30	-0.80	-24.70	0.00	1.30	-4.40
SWMBFNS – Error	-48.70	97.10	-4.20	-42.80	0.00	4.70	-4.00
SWMBFS -Lag	-13.30	14.20	-0.50	-10.10	0.00	1.60	-5.10
SWMBFS – Error	-15.70	20.20	-0.80	-17.80	0.00	2.80	-6.10
SWMRGNS -Lag	-28.80	24.50	-1.50	-11.10	0.00	1.40	0.00
SWMRGNS – Error	-43.30	33.80	-0.50	-41.00	0.00	4.00	-0.10
SWMRGS -Lag	-28.20	32.40	-0.80	-8.60	0.00	1.90	-0.10
SWMRGS – Error	-44.20	66.90	-0.40	-4.60	0.00	2.80	-0.80

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "SCBs" – Transport Operators							
SCB_TSP_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	12.00	-64.30	-2.90	-49.80	0.00	-0.80	0.00
SWMBANS – Error	4.00	-77.70	-5.40	-65.20	0.00	-1.20	0.00
SWMBAS -Lag	13.30	-68.00	-3.10	-54.30	0.00	-0.70	0.00
SWMBAS – Error	15.50	-68.10	-2.50	-50.40	0.00	-1.30	-0.40
SWMBCNS -Lag	12.70	-66.70	-3.00	-53.00	0.00	-0.70	0.00
SWMBCNS – Error	13.00	-71.20	-3.30	-57.10	0.00	-0.80	0.00
SWMBCS -Lag	13.10	-67.30	-3.00	-53.10	0.00	-0.70	0.00
SWMBCS – Error	13.00	-72.40	-2.10	-65.10	0.00	-2.40	-1.50
SWMBFNS -Lag	-21.20	13.20	-0.80	-12.20	0.00	-0.80	-4.00
SWMBFNS – Error	16.40	-71.20	-2.90	-52.60	0.00	-0.70	0.00
SWMBFS -Lag	3.50	-41.10	-2.10	-39.30	0.00	-0.80	-3.90
SWMBFS – Error	-0.60	-51.80	-2.10	-52.10	0.00	-1.70	-6.00
SWMRGNS -Lag	13.20	-64.60	-3.40	-52.90	0.00	-0.40	0.00
SWMRGNS – Error	9.70	-66.40	-3.40	-54.90	0.00	-0.80	0.00
SWMRGS -Lag	12.90	-64.60	-3.20	-53.20	0.00	-0.40	0.20
SWMRGS – Error	40.80	-128.30	-1.60	-90.20	0.00	-2.20	-1.20
SCB_TSP_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	12.40	-40.50	-2.50	-44.50	0.00	0.30	-0.10
SWMBANS – Error	20.90	-49.10	-1.30	-47.60	0.00	0.40	0.00
SWMBAS -Lag	14.40	-44.10	-2.40	-46.20	0.00	0.10	-0.30
SWMBAS – Error	20.80	-43.90	-2.50	-65.60	0.00	0.10	-0.90
SWMBCNS -Lag	15.70	-52.00	-2.50	-52.90	0.00	0.20	0.00
SWMBCNS – Error	15.60	-50.90	-2.40	-51.90	0.00	0.20	0.00
SWMBCS -Lag	14.70	-49.90	-2.50	-52.80	0.00	0.20	-0.10
SWMBCS – Error	26.40	-74.80	-3.30	-80.40	0.00	-0.30	-1.60
SWMBFNS -Lag	-16.00	13.00	-1.00	-14.90	0.00	0.00	-3.60
SWMBFNS – Error	2.30	-36.40	-3.10	-55.00	0.00	0.10	0.10
SWMBFS -Lag	-3.00	-12.20	-1.70	-31.90	0.00	0.00	-6.10
SWMBFS – Error	-16.60	-1.40	-2.80	-53.30	0.00	0.00	-6.70
SWMRGNS -Lag	16.90	-51.10	-2.40	-52.60	0.00	0.20	0.00
SWMRGNS – Error	11.40	-50.70	-3.10	-55.10	0.00	0.00	0.00
SWMRGS -Lag	15.90	-51.50	-2.50	-53.00	0.00	0.20	0.10
SWMRGS – Error	33.10	-118.20	-3.90	-104.40	0.00	-0.10	-1.40
SCB_TSP_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	11.80	-49.30	-3.10	-47.20	0.00	-0.60	0.00
SWMBANS – Error	13.70	-51.40	-2.90	-48.70	0.00	-0.50	0.00
SWMBAS -Lag	12.20	-49.30	-3.10	-46.70	0.00	-0.70	-0.10
SWMBAS – Error	21.20	-40.40	-2.80	-57.80	0.00	-0.80	-1.20
SWMBCNS -Lag	14.50	-56.30	-3.20	-51.10	0.00	-0.70	0.10
SWMBCNS – Error	12.60	-53.80	-3.30	-51.50	0.00	-0.60	0.00
SWMBCS -Lag	12.80	-52.90	-3.20	-50.10	0.00	-0.60	0.00
SWMBCS – Error	18.80	-60.50	-3.70	-67.40	0.00	-0.90	-1.60
SWMBFNS -Lag	-16.90	4.10	-2.00	-20.10	0.00	-0.60	-3.00
SWMBFNS – Error	4.00	-42.00	-3.50	-51.20	0.00	-0.60	0.00
SWMBFS -Lag	-1.70	-20.90	-2.30	-33.60	0.00	-0.60	-5.10
SWMBFS – Error	-12.40	-17.10	-3.20	-49.00	0.00	-1.00	-6.60
SWMRGNS -Lag	12.90	-50.40	-3.10	-50.20	0.00	-0.50	0.00
SWMRGNS – Error	9.40	-51.60	-3.60	-51.70	0.00	-0.70	0.00
SWMRGS -Lag	12.70	-51.40	-3.10	-50.30	0.00	-0.60	0.10
SWMRGS – Error	26.90	-103.30	-4.20	-86.60	0.00	-0.90	-1.30

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PSBs" – Transport Operators							
PSB_TSP_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	12.20	44.60	-0.20	23.70	0.00	-3.40	-0.30
SWMBANS – Error	-7.90	103.60	0.70	3.00	0.00	-1.40	0.00
SWMBAS -Lag	7.40	72.80	0.90	9.80	0.00	-2.10	-0.30
SWMBAS – Error	3.50	117.30	4.40	75.60	0.00	-3.10	-1.30
SWMBCNS -Lag	8.20	48.90	-0.50	-0.10	0.00	-2.50	-0.70
SWMBCNS – Error	2.30	85.40	1.10	0.20	0.00	-1.50	0.00
SWMBCS -Lag	6.50	67.70	0.50	1.80	0.00	-1.90	-0.40
SWMBCS – Error	33.00	43.30	2.90	4.90	0.00	-3.60	-1.50
SWMBFNS -Lag	12.60	-17.90	0.40	23.10	0.00	-1.70	-4.30
SWMBFNS – Error	-16.90	52.70	-0.90	9.50	0.00	-2.50	-4.00
SWMBFS -Lag	5.00	48.40	0.80	6.30	0.00	-1.50	-4.60
SWMBFS – Error	-9.80	95.20	1.30	10.50	0.00	-2.10	-5.70
SWMRGNS -Lag	6.60	67.40	1.00	-0.10	0.00	-2.00	0.00
SWMRGNS – Error	-18.10	110.50	-1.00	6.10	0.00	-1.50	0.00
SWMRGS -Lag	5.20	69.50	0.90	0.40	0.00	-2.00	-0.30
SWMRGS – Error	10.60	63.90	2.40	-7.60	0.00	-2.60	-1.00
PSB_TSP_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	31.10	37.60	0.20	3.30	0.00	-1.40	0.00
SWMBANS – Error	35.60	38.60	0.60	4.90	0.00	-1.20	0.00
SWMBAS -Lag	29.80	36.30	0.00	0.90	0.00	-1.40	0.20
SWMBAS – Error	31.40	33.20	-0.30	4.10	0.00	-1.50	0.10
SWMBCNS -Lag	31.00	33.50	-0.50	3.20	0.00	-1.50	-0.10
SWMBCNS – Error	34.40	28.80	-0.60	6.70	0.00	-1.60	0.40
SWMBCS -Lag	31.60	35.40	-0.10	3.90	0.00	-1.40	0.00
SWMBCS – Error	33.50	31.00	-0.70	8.10	0.00	-1.40	0.40
SWMBFNS -Lag	31.00	7.00	0.50	11.20	0.00	-1.20	-2.00
SWMBFNS – Error	-41.80	124.40	-2.90	-17.00	0.00	-0.90	-3.60
SWMBFS -Lag	16.90	30.20	-0.30	5.60	0.00	-1.20	-4.50
SWMBFS – Error	-26.30	130.20	-0.70	-2.80	0.00	-1.10	-6.60
SWMRGNS -Lag	26.60	-9.70	-4.00	-17.10	0.00	-1.90	0.00
SWMRGNS – Error	-11.40	119.30	0.00	-58.60	0.00	0.50	0.00
SWMRGS -Lag	32.70	5.80	-1.80	-5.70	0.00	-1.50	-1.10
SWMRGS – Error	34.90	-22.20	-2.10	-68.50	0.00	-0.80	-1.40
PSB_TSP_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	17.50	48.60	0.80	-3.80	0.00	-1.40	0.10
SWMBANS – Error	17.10	40.90	-0.10	0.10	0.00	-1.80	0.00
SWMBAS -Lag	15.10	44.60	0.20	-7.70	0.00	-1.40	0.30
SWMBAS – Error	18.20	35.70	-0.30	-2.20	0.00	-1.80	0.20
SWMBCNS -Lag	19.20	48.20	0.80	0.70	0.00	-1.70	0.40
SWMBCNS – Error	18.50	41.40	0.00	3.10	0.00	-2.00	0.40
SWMBCS -Lag	18.90	44.90	0.40	-1.60	0.00	-1.70	0.30
SWMBCS – Error	19.40	36.50	-0.40	0.70	0.00	-1.80	0.30
SWMBFNS -Lag	21.50	22.70	0.20	4.30	0.00	-1.50	-1.20
SWMBFNS – Error	-49.50	129.90	-2.90	-14.60	0.00	-1.10	-3.60
SWMBFS -Lag	12.40	36.50	-0.20	1.40	0.00	-1.50	-2.90
SWMBFS – Error	-35.80	131.50	-0.90	-6.00	0.00	-1.30	-6.60
SWMRGNS -Lag	17.60	-25.20	-4.60	-17.60	0.00	-2.80	0.00
SWMRGNS – Error	-10.20	88.00	-0.60	-28.10	0.00	-0.50	0.00
SWMRGS -Lag	22.30	3.20	-1.90	-6.80	0.00	-2.20	-1.10
SWMRGS – Error	18.40	-0.30	-2.20	-49.90	0.00	-1.10	-1.30

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

Spatial Autoregression Models – Coefficient Estimates, Significance and Sign for "PVBs" – Transport Operators							
PVB_TSP_2	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	363.40	-601.90	-36.20	57.30	0.00	15.20	-0.30
SWMBANS – Error	307.20	-1096.70	-56.70	-278.80	0.00	1.60	0.00
SWMBAS -Lag	301.40	-909.30	-52.40	-196.20	0.00	6.50	-0.30
SWMBAS – Error	171.50	-456.20	-47.80	-2.80	0.00	14.20	-1.20
SWMBCNS -Lag	322.80	-1058.70	-51.60	-247.50	0.00	2.90	0.00
SWMBCNS – Error	326.40	-1128.20	-56.00	-307.20	0.00	1.60	0.00
SWMBCS -Lag	310.50	-1006.10	-52.30	-236.60	0.00	4.10	-0.10
SWMBCS – Error	271.40	-655.50	-50.50	-92.80	0.00	15.10	-1.40
SWMBFNS -Lag	139.50	-695.50	-47.30	-206.00	0.00	2.80	-1.10
SWMBFNS – Error	302.50	-1051.10	-52.80	-259.30	0.00	2.40	0.00
SWMBFS -Lag	215.60	-758.50	-41.10	-193.70	0.00	3.00	-3.40
SWMBFS – Error	316.80	-1056.90	-55.30	-238.90	0.00	4.20	-5.00
SWMRGNS -Lag	307.70	-845.30	-48.50	-141.90	0.00	8.20	0.00
SWMRGNS – Error	334.40	-1083.90	-50.70	-254.60	0.00	2.70	0.00
SWMRGS -Lag	315.60	-1036.50	-52.00	-242.70	0.00	3.40	-0.10
SWMRGS – Error	196.70	-732.50	-58.50	-42.60	0.00	11.30	-1.20
PVB_TSP_6	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	505.90	-478.60	18.00	717.90	0.00	-2.90	-0.30
SWMBANS – Error	992.90	-1830.30	11.20	822.50	0.00	-23.60	-0.40
SWMBAS -Lag	444.70	-821.70	19.50	650.70	0.00	-18.80	-0.20
SWMBAS – Error	478.60	-599.70	13.10	974.90	0.00	-10.70	-0.70
SWMBCNS -Lag	431.80	-645.10	16.10	708.90	0.00	-8.80	-0.70
SWMBCNS – Error	1222.00	-2065.80	3.00	1004.80	0.00	-18.70	-1.80
SWMBCS -Lag	446.30	-836.40	18.90	643.70	0.00	-18.20	-0.20
SWMBCS – Error	628.40	-1085.70	-10.40	654.70	0.00	-1.50	-1.30
SWMBFNS -Lag	-4.40	-184.50	4.70	529.80	0.00	-18.70	-2.10
SWMBFNS – Error	1066.20	-1013.20	26.40	571.40	0.00	-72.90	-5.90
SWMBFS -Lag	362.50	-736.20	19.20	579.90	0.00	-20.20	-2.20
SWMBFS – Error	426.00	-910.50	19.70	734.60	0.00	-26.30	-3.30
SWMRGNS -Lag	444.50	-480.80	13.30	674.00	0.00	-5.30	0.00
SWMRGNS – Error	784.60	-1479.90	-24.20	901.20	0.00	-17.60	0.00
SWMRGS -Lag	420.00	-761.00	18.20	645.50	0.00	-17.70	-0.30
SWMRGS – Error	482.70	-728.70	1.60	943.20	0.00	-11.70	-0.90
PVB_TSP_10	Export	Industry	Population	Br-CR5	PC Bank	PC NBFC	'ρ' or 'λ'
SWMBANS -Lag	643.00	-800.30	-0.80	708.00	0.00	0.30	-0.20
SWMBANS – Error	1127.60	-2050.90	3.20	969.80	0.00	-21.40	-0.40
SWMBAS -Lag	596.80	-1316.70	-1.50	538.70	0.00	-19.60	-0.10
SWMBAS – Error	615.60	-1005.70	-9.00	873.90	0.00	-8.10	-0.70
SWMBCNS -Lag	572.60	-1118.40	-3.30	605.60	0.00	-11.30	-0.40
SWMBCNS – Error	561.20	-1467.80	9.90	472.20	0.00	-28.20	0.30
SWMBCS -Lag	609.30	-1381.30	0.80	534.00	0.00	-21.90	0.00
SWMBCS – Error	770.80	-1436.50	-32.60	597.80	0.00	2.50	-1.30
SWMBFNS -Lag	93.30	-496.20	-12.50	469.40	0.00	-17.80	-1.70
SWMBFNS – Error	381.80	-1284.70	-22.40	344.10	0.00	-22.80	0.20
SWMBFS -Lag	466.80	-1079.80	-1.80	477.30	0.00	-18.70	-2.30
SWMBFS – Error	570.80	-1353.00	-5.00	621.40	0.00	-24.50	-3.30
SWMRGNS -Lag	575.50	-907.60	-6.30	615.00	0.00	-5.70	0.00
SWMRGNS – Error	798.50	-1513.20	-42.70	1046.60	0.00	-13.00	0.00
SWMRGS -Lag	581.50	-1271.00	-2.30	541.00	0.00	-18.70	-0.10
SWMRGS – Error	598.90	-1082.10	-21.70	879.60	0.00	-8.70	-0.90

Notes: Green, yellow, red shades indicate significance at 1%, 5%,10% levels respectively, red font indicates negative values (directional). Variables notations: Industry – Industrialization; Export – Export Orientation; Population – Population Density; Br-CR5 – Branch Concentration; PC Bank – Per Capita Bank Credit; PC NBFC – Per Capita NBFC Credit; 'ρ' / 'λ' – measures of spatial spill-overs from SAR lag and error models respectively

References

Adams, R. M. M., and Amel, D. F. (2007). The Effects of Past Entry, Market Consolidation, and Expansion by Incumbents on the Probability of Entry. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1037961

Aguirregabiria, V., and Ho, C.-Y. (2012). A dynamic oligopoly game of the US airline industry: Estimation and policy experiments. *Journal of Econometrics*, *168*(1), 156–173. https://doi.org/10.1016/j.jeconom.2011.09.013

Aguirregabiria, V., Clark, R., and Wang, H. (2016). Diversification of geographic risk in retail bank networks: evidence from bank expansion after the Riegle-Neal Act. *The RAND Journal of Economics*, *47*(3), 529–572. https://doi.org/10.1111/1756-2171.12136

Aleem, A. (2010). Transmission mechanism of monetary policy in India. *Journal of Asian Economics*, *21*(2), 186–197. https://doi.org/10.1016/j.asieco.2009.10.001

Anagnostou, A. and Papadamou, S. (2014) The impact of monetary shocks on regional output: evidence from four South Eurozone countries. *R´egion et D´eveloppement* 39: 106–130.

Anagnostou, A. and Papadamou, S. (2016) Regional asymmetries in monetary policy transmission: the case of the Greek regions. *Environment and Planning C: Government and Policy* 34: 795–815

Ansari, J., and Ghosh, S. (2021). Monetary Policy Pass-through, Ownership and Crisis: How Robust is the Indian Evidence? *Margin: The Journal of Applied Economic Research*, *15*(4), 456–483. https://doi.org/10.1177/09738010211036276

Anselin, L. (1988). *Spatial econometrics: methods and models* (Vol. 4). Springer Science & Business Media.

Anselin, L. (2001). Spatial Econometrics. IN BALTAGI, BH (Eds.) Theoretical Econometrics. *Blackwell Publishing*, *6*, 244-268.

Anselin, L. (2003). Spatial Externalities, Spatial Multipliers, And Spatial Econometrics. *International Regional Science Review*, *26*(2), 153–166. https://doi.org/10.1177/0160017602250972

Anselin, L., and Bera, A. K. (1998). Spatial dependence in linear regression models with an introduction to spatial econometrics. *Statistics textbooks and monographs*, *155*, 237-290.

Arnold, I.J.M. and Vrugt, E.B. (2002) Regional effects of monetary policy in the Netherlands. *International Journal of Business & Economics* 1(2): 123–134.

Arnold, I.J.M., and Vrugt, E.B. (2004) Firm size, industry mix and the regional transmission of monetary policy in Germany. *German Economic Review* 5(1): 35–39.

Avery, C., and Zemsky, P. (1998). Multidimensional Uncertainty and Herd Behavior in Financial Markets. *The American Economic Review*, *88*(4), 724–748. http://www.jstor.org/stable/117003

Bajaj, P., and Suresh, A. K (2020). Distributional Impact of Monetary Policy Through the Commercial Banks'borrower Preferences: The Empirical Evidence For India, In Maria Teresa Punzi (Eds.), *The Distributional Impact of Monetary Policy in SEACEN Member Economies* (Chapter 3). The SEACEN Center, https://www.seacen.org/publication-research.php?pid=702001-100467

Banerjee S., Behera H., Bordoloi S., and Kumar R. (2018). *Role of financial frictions in monetary policy transmission in India* (Development Research Group Study No. 44). Reserve Bank of India. https://rbidocs.rbi.org.in/rdocs/publications/pdfs/drgs4470ae46002fda4f78a421d228239767f4.pdf

Banerjee, A. v. (1992). A Simple Model of Herd Behavior. *The Quarterly Journal of Economics*, *107*(3), 797–817. https://doi.org/10.2307/2118364

Bapat, D., and Mazumdar, D. (2015). Assessment of business strategy: implication for Indian banks. *Journal of Strategy and Management*, *8*(4), 306–325. https://doi.org/10.1108/JSMA-06-2014-0047

Bardhan, S., and Sharma, R. (2022). *Sectoral Growth and Sectoral Credit: Panel Evidence from Indian States*. 121–147. https://doi.org/10.1007/978-981-16-7668-0_7

Barigozzi, M., Conti, A. M., and Luciani, M. (2014). Do Euro Area Countries Respond Asymmetrically to the Common Monetary Policy? *Oxford Bulletin of Economics and Statistics*, *76*(5), 693–714. https://doi.org/10.1111/obes.12038

Barron, J. M., and Valev, N. T. (2000). International Lending by U.S. Banks. *Journal of Money, Credit and Banking*, *32*(3), 357. https://doi.org/10.2307/2601170

Beare, J. B. (1976). A Monetarist Model of Regional Business Cycles. *Journal of Regional Science*, *16*(1), 57–64. https://doi.org/10.1111/J.1467-9787.1976.TB00947.X

Beckworth, D. (2010). One nation under the fed? The asymmetric effects of US monetary policy and its implications for the United States as an optimal currency area. *Journal of Macroeconomics*, *32*(3), 732–746. https://doi.org/10.1016/j.jmacro.2009.12.001

Behera, H. K., and Ranjan, R. (2009). Dynamics of Financial Globalization and Growth: Some Evidence from Emerging Market Economics. *Reserve Bank of India Occasional Papers*, *30*(2), 1-36.

Berger, A.N., DeYoung, R., Genay, H., and Udell, G.F. (2000). Globalization of Financial Institutions: Evidence from Cross-Border Banking Performance. *Brookings-Wharton Papers on Financial Services 2000*, 23-120. doi:10.1353/pfs.2000.0001.

Bernanke, B.S., 1986. Alternative explanations of the money–income correlation. In: Brunner, K., Meltzer, A. (Eds.), *Real Business Cycles, Real Exchange Rates, and Actual Policies. Carnegie-Rochester Conference Series on Public Policy*, vol. 25. North-Holland, Amsterdam https://doi.org/10.3386/w1842

Bertanha, M., and Haddad, E. A. (2008). Regional impacts of monetary policy in Brazil: a spatial SVAR approach. In *World integration, emerging countries, lagging regions and sustainability*. São Paulo: FEA/USP

Bhatt, V., and Kishor, N. K. (2013). Bank lending channel in India: evidence from state-level analysis. *Empirical Economics*, *45*(3), 1307–1331. https://doi.org/10.1007/s00181-012-0657-2

Bhaumik, S. K., Dang, V., and Kutan, A. M. (2011). Implications of bank ownership for the credit channel of monetary policy transmission: Evidence from India. *Journal of Banking & Finance*, *35*(9), 2418–2428. https://doi.org/10.1016/j.jbankfin.2011.02.003

Bhuyan, Pradip. (2022), Concentration, Competition and Soundness of the Banking System in India, *Reserve Bank of India Working Paper*, RBI WPS (DEPR): 07/2022, https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/WPSNO07202298FE7A0279114B8EBE2822C49B780D92.PDF

Bikhchandani, S., Hirshleifer, D., and Welch, I. (1992). A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades. *Journal of Political Economy*, *100*(5), 992–1026. https://doi.org/10.1086/261849

Bikhchandani, S., Hirshleifer, D., and Welch, I. (1998). Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades. *Journal of Economic Perspectives*, *12*(3), 151–170. https://doi.org/10.1257/jep.12.3.151

Blanchard, O. J., and Quah, D. (1989). The Dynamic Effects of Aggregate Demand and Supply Disturbances. *The American Economic Review*, *79*(4), 655–673.

Blanchard, O. J., and Watson, M. W. (1986). Are business cycles all alike?. In R.J. Gordon (Ed.) *The American business cycle: Continuity and change* (pp. 123-180). University of Chicago Press.

Boeckx, J., de Sola Perea, M., and Peersman, G. (2020). The transmission mechanism of credit support policies in the euro area. *European Economic Review*, *124*, 103403.

Burriel, P., and Galesi, A. (2018). Uncovering the heterogeneous effects of ECB unconventional monetary policies across euro area countries. *European Economic Review*, *101*, 210–229.

Capera Romero, Laura. (2020). Essays on competition, regulation and innovation in the banking industry. CentER, Center for Economic Research. https://doi.org/10.26116/center-lis-2015

Carlino, G., and Defina, R. (1998). The Differential Regional Effects of Monetary Policy. *The Review of Economics and Statistics*, *80*(4), 572–587. http://www.jstor.org/stable/2646839

Carlino, G., and DeFina, R. (1999). The Differential Regional Effects of Monetary Policy: Evidence from the U.S. States. *Journal of Regional Science*, *39*(2), 339–358. https://doi.org/10.1111/1467-9787.00137

Chang, Y., and Peter C. B. Phillips. (1995). Time Series Regression with Mixtures of Integrated Processes. *Econometric Theory*, *11*(5), 1033–1094. http://www.jstor.org/stable/3532601

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). *Chapter 2 Monetary policy shocks: What have we learned and to what end?* (pp. 65–148). https://doi.org/10.1016/S1574-0048(99)01005-8

Cleeren, K., Verboven, F., Dekimpe, M. G., and Gielens, K. (2010). Intra- and inter format competition among discounters and supermarkets. *Marketing Science*, *29*(3), 456–473.

Cliff, A.D., and Ord, J.K. 1973: Spatial autocorrelation. In Getis, A. (1995) (Eds.), *Progress in Human Geography*, *19*(2), 245–249. London: Pion https://doi.org/10.1177/030913259501900205

Cortes, B. S., and Kong, D. (2007). Regional Effects of Chinese Monetary Policy. *International Journal of Economic Policy Studies 2007 2:1*, *2*(1), 15–28. https://doi.org/10.1007/BF03405696

Crone, T. M. (2005). An alternative definition of economic regions in the United States based on similarities in state business cycles. *Review of Economics and Statistics*, *87*(4), 617-626.

Dai, M., and Yuan, Y. (2013). Product differentiation and efficiencies in the retail banking industry. *Journal of Banking & Finance*, *37*(12), 4907-4919.

Darmofal, D. (2015). *Spatial Analysis for the Social Sciences*. Cambridge University Press. https://doi.org/10.1017/CBO9781139051293

de Lucio, J.J. and Izquierdo, M. (2002), Local responses to a global monetary policy: The regional structure of financial systems, *Journal of Economic Studies*, Vol. 29 No. 3, pp. 205-221. https://doi.org/10.1108/01443580210433589

Devenow, A., and Welch, I. (1996). Rational herding in financial economics. *European Economic Review*, *40*(3–5), 603–615. https://doi.org/10.1016/0014-2921(95)00073-9

Dhal, S. (2012). A Disaggregated Analysis of Monetary Transmission. *Regional Economy of India: Growth and Finance*, 247.

Dominguez-Torres, H., and Hierro, L. A. (2019). The Regional Effects of Monetary Policy: A Survey of The Empirical Literature. *Journal of Economic Surveys*, *33*(2), 604–638. https://doi.org/10.1111/joes.12288

Duran, H. E., and Erdem, U. (2014). Regional Effects of Monetary Policy: Turkey Case. *Regional and Sectoral Economic Studies*, *14*(1), 133–144,

Fang, H., Lu, Y.-C., Shieh, Joseph. C. P., and Lee, Y.-H. (2021). The existence and motivations of irrational loan herding and its impact on bank performance when considering different market periods. *International Review of Economics & Finance*, *73*, 420–443.

Fernandez, R. (2016, November). Spillovers Effects and City Development. Job Market Paper - Tilburg University 1 (1).

Fraser, P., Macdonald, G. A., and Mullineux, A. W. (2014). Regional Monetary Policy: An Australian Perspective. *Regional Studies*, *48*(8), 1419–1433. https://doi.org/10.1080/00343404.2012.714897

Georgiadis, G. (2015). Examining asymmetries in the transmission of monetary policy in the euro area: Evidence from a mixed cross-section global VAR model. *European Economic Review*, *75*, 195–215. https://doi.org/10.1016/j.euroecorev.2014.12.007

Georgopoulos, G. (2009). Measuring regional effects of monetary policy in Canada. *Applied Economics*, *41*(16), 2093–2113. https://doi.org/10.1080/00036840701604362

Gerlach, S., and Smets, F. (1995). The Monetary Transmission Mechanism: Evidence from the G-7 Countries. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.868427

GFSR, (2016), "Fostering Stability in a Low-Growth, Low-Rate Era", *Global Financial Stability Report, October 2016,* International Monetary Fund.

Ghosh, T. (2019). The Sectoral Impact of Monetary Policy Transmission in India: A Panel VAR Approach. *Emerging Economy Studies*, *5*(1), 63–77. https://doi.org/10.1177/2394901519826705

Gill Hammond. (2012). *State of the art of inflation targeting*. Centre for Central Banking Studies, Bank of England. https://www.bankofengland.co.uk/ccbs/state-of-the-art-of-inflation-targeting

Guo, X. and Tajul, A.M. (2014) Regional effects of monetary policy in China: the role of spillover effects. Asian Academy of Management Journal 19(1): 113–146.

Guo, X., and Masron, T. A. (2017). Regional Effects of Monetary Policy in China: Evidence from China's Provinces. *Bulletin of Economic Research*, *69*(2), 178–208.

Haveman, H. A. (1993). Follow the Leader: Mimetic Isomorphism and Entry into New Markets. *Administrative Science Quarterly*, *38*(4), 593–627. https://doi.org/10.2307/2393338

Heo, Y. (2019). The Impact of Bank Herding on Systemic Risk. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3366128

Ho, K., and Ishii, J. (2011). Location and competition in retail banking. *International Journal of Industrial Organization*, *29*(5), 537–546. https://doi.org/10.1016/j.ijindorg.2010.11.004

Huysentruyt, M., Lefevere, E., and Menon, C. (2013). Dynamics of retail-bank branching in Antwerp (Belgium) 1991–2006: Evidence from micro-geographic data. *Journal of Banking & Finance*, *37*(2), 291–304. https://doi.org/10.1016/j.jbankfin.2012.08.023

Inoue, T., and Hamori, S. (2014). Market efficiency of commodity futures in India. *Applied Economics Letters*, *21*(8), 522–527. https://doi.org/10.1080/13504851.2013.872751

Isard, W. (1954). Location Theory and Trade Theory: Short-Run Analysis. *The Quarterly Journal of Economics*, *68*(2), 305. https://doi.org/10.2307/1884452

Jain, A. K., and Gupta, S. (1987). Some Evidence on "Herding" Behavior of U. S. Banks. *Journal of Money, Credit and Banking*, *19*(1), 78–89. https://doi.org/10.2307/1992247

Kannan, R., Sanyal, S., and Bhoi, B. B. (2007). Monetary conditions index for India. *RBI Occasional Papers*, *27*(3), 57-86. https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/80593.pdf

Kao, Y-H., Bera, A. K. (2016) Spatial regression: the curious case of negative spatial dependence, working paper, University of Illinois, Urbana-Champaign.

Kapur, M., and Behera, H. K. (2012). Monetary transmission mechanism in India: A quarterly model. *Reserve Bank of India Working Paper*, (09). https://doi.org/10.2139/ssrn.2120792

Khundrakpam, Jeevan Kumar (2011). Credit channel of monetary transmission in India - how effective and long is the lag?, *RBI Working Paper No. WPS (DEPR):* 20/ 2011, https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/CCMTIR51211.PDF

Kletzer, K. (2012). Financial Frictions and Monetary Policy Transmission in India. In *The Oxford Handbook of the Indian Economy* (pp. 656–682). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199734580.013.0022

Kondo, K. (2021). *MORANSI: Stata module to compute Moran's I*. https://EconPapers.repec.org/RePEc:boc:bocode:s458473

Kumar, S., and Gulati, R. (2014). *Deregulation and Efficiency of Indian Banks*. Springer India. https://doi.org/10.1007/978-81-322-1545-5

Lakonishok, J., Shleifer, A., and Vishny, R. W. (1992). The impact of institutional trading on stock prices. *Journal of Financial Economics*, *32*(1), 23–43.

Lütkepohl, H. (2007). General-to-specific or specific-to-general modelling? An opinion on current econometric terminology. *Journal of Econometrics*, *136*(1), 319–324.

Mandalinci, Z. (2015). *Effects of monetary policy shocks on UK regional activity: A constrained MFVAR approach* (Issue 758). Queen Mary University of London, School of Economics and Finance. http://hdl.handle.net/10419/122059

Mazzi, G., Mitchell, J., and Moauro, F. (2016). Structural vector autoregressive (SVAR) based estimates of the euro area output gap: theoretical considerations and empirical evidence. *Publications Office of the European Union.*

Miller SR, Parkhe A (2002) Is there a liability of foreignness in global banking? An empirical test of banks X-efficiency. *Strategic Management Journal* 23(1):55–5. https://doi.org/10.1002/smj.212

Mishkin, Frederic S, (1996).“The Channels of Monetary Transmission: Lessons for Monetary Policy.”NBER Working Paper No. 5464, National Bureau of Economic Research, February 1996; www.nber.org/papers/w5464.pdf?new_window=1.

Mishra, P., Montiel, P. J., and Spilimbergo, A. (2012). Monetary Transmission in Low-Income Countries: Effectiveness and Policy Implications. *IMF Economic Review*, *60*(2), 270–302. https://doi.org/10.1057/imfer.2012.7

Mishra, P., Montiel, P., and Sengupta, R. (2016). Monetary Transmission in Developing Countries: Evidence from India. In *Monetary Policy in India* (pp. 59–110). Springer India.

Mondschean, T. S., and Pecchenino, R. A. (1995). Herd Behavior or Animal Spirits: A Possible Explanation of Credit Crunches and Bubbles. In *The Causes and Costs of Depository Institution Failures* (pp. 233–245). Springer Netherlands. https://doi.org/10.1007/978-94-011-0663-4_10

Moran, P. A. P. (1950). Notes on Continuous Stochastic Phenomena. *Biometrika*, *37*(1/2), 17. https://doi.org/10.2307/2332142

Muduli, S., and Behera, H. (2021). Bank capital and monetary policy transmission in India. *Macroeconomics and Finance in Emerging Market Economies*, 1–25. https://doi.org/10.1080/17520843.2021.1918461

Myrdal, G. (1957), Economic Theory of Underdeveloped Regions, London: Gerard Dicksworth

Nachane, D. M., Ray, P., and Ghosh, S. (2002). Does Monetary Policy Have Differential State-Level Effects?: An Empirical Evaluation. *Economic and Political Weekly*, *37*(47), 4723–4728. http://www.jstor.org/stable/4412873

Nakagawa, R. (2022). Bank herding in loan markets: Evidence from geographical data in Japan. *International Review of Finance*, *22*(1), 72–89. https://doi.org/10.1111/irfi.12341

Narayan, S., and Narayan, P. K. (2004). Determinants Of Demand For Fiji's Exports: An Empirical Investigation. *The Developing Economies*, *42*(1), 95–112. https://doi.org/10.1111/j.1746-1049.2004.tb01017.x

Owyang, M. T., and Wall, H. J. (2009). Regional VARs and the channels of monetary policy. *Applied Economics Letters*, *16*(12), 1191–1194. https://doi.org/10.1080/13504850701367247

Pal, M. (2020). Rational Herding and Financial Fragility: Lessons for the Indian Banking System. *Prajnan*, *49*(1), 67–90. https://www.proquest.com/scholarly-journals/rational-herding-financial-fragility-lessons/docview/2668447222/se-2?accountid=45975

Pandit, B.L. Ajit Mittal, Mohua Roy and Saibal Ghose (2006), Transmission of Monetary Policy and the Bank Lending Channel: Analysis and Evidence for India, *Reserve Bank of India, Development Research Group Study No. 25*,https://www.researchgate.net/publication/255652255

Pedroni, P. (2001). Purchasing Power Parity Tests in Cointegrated Panels. *The Review of Economics and Statistics*, *83*(4), 727–731. http://www.jstor.org/stable/3211767

Peersman, G. (2004). The Transmission of Monetary Policy in the Euro Area: Are the Effects Different Across Countries?. *Oxford Bulletin of Economics and Statistics*, *66*(3), 285–308. https://doi.org/10.1111/j.1468-0084.2004.00080.x

Persons, J. C., and Warther, V. A. (1997). Boom and bust patterns in the adoption of financial innovations. *The Review of Financial Studies*, *10*(4), 939-967.

Peter C. B. Phillips. (1995). Fully Modified Least Squares and Vector Autoregression. *Econometrica*, *63*(5), 1023–1078. https://doi.org/10.2307/2171721

Pizzuto, P. (2020). Regional effects of monetary policy in the U.S.: An empirical re-assessment. *Economics Letters*, *190*, 109062. https://doi.org/10.1016/j.econlet.2020.109062

Potts, T., and Yerger, D. (2010). Variations Across Canadian Regions in the Sensitivity to U.S. Monetary Policy. *Atlantic Economic Journal*, *38*(4), 443–454. https://doi.org/10.1007/s11293-010-9248-9

Raj, J., Rath, D. P., Mitra, P., and John, J. (2020). Asset Quality and Credit Channel of Monetary Policy Transmission in India: Some Evidence from Bank-level Data. *RBI Working Paper Series No. 14*,

RBI (2014). Report of the expert committee to revise and strengthen the monetary policy framework. *Reserve Bank of India, Mumbai*.

Ridhwan, M. M., de Groot, H. L. F., Rietveld, P., and Nijkamp, P. (2011). The Regional Impact of Monetary Policy in Indonesia. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1844246

Ridhwan, M. M., de Groot, H. L. F., Rietveld, P., and Nijkamp, P. (2014). The Regional Impact of Monetary Policy in Indonesia. *Growth and Change*, *45*(2), 240–262. https://doi.org/10.1111/grow.12045

Rocha, R. de M., Silva, M. E. A. da, and Gomes, S. M. F. P. O. (2011), Why do Brazilian states have asymmetric reactions to shocks in monetary policy? *Brazilian Journal of Economics* [online]. 2011, v. 65, no. 4*65*(4), 413–441. https://doi.org/10.1590/S0034-71402011000400006

Rodríguez Fuentes, C. J., Padrón Marrero, D. and Olivera Herrera, A. 2004. Estructura financiera regional y política monetaria. Una aproximación al caso español. *Papeles de Economía Española*, 101: 252–265.http://hdl.handle.net/10419/117069

Rötheli, T. F. (2001). Competition, herd behavior, and credit cycles: evidence from major Swiss Banks. *Journal of Economics and Business*, *53*(6), 585–592. https://doi.org/10.1016/S0148-6195(01)00050-9

Sarkar, S. (2020). Testing the Presence and Efficacy of the Bank Lending Channel in India: The Role of Ownership, Economic Period and Size. *Prajnan*, *49*(1), 29-44.

Saumitra, B. and Toto, G. (2012). The bank lending channel of monetary policy transmission: evidence from an emerging market, India. *Munich Personel Repec Archieve*, *1-27*., https://mpra.ub.uni-muenchen.de/37997/1/MPRA_paper_37997.pdf

Sengupta, N. (2014). Changes in Transmission Channels of Monetary Policy in India. *Economic and Political Weekly*, *49*(49), 62–71. http://www.jstor.org/stable/24481055

Sharma, M., Jha, A. K., Suresh, A. K., and Maji, B. (2021). Monetary Policy Transmission Through the Lens of Monetary Conditions Index for India. *Reserve Bank of India Occasional Papers*, *42*(1).

Sims, C. A. (1980). Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered. *The American Economic Review*, *70*(2), 250–257. http://www.jstor.org/stable/1815476

Singh, B., and Pattanaik, S. (2012). Monetary Policy and Asset Price Interactions in India: Should Financial Stability Concerns from Asset Prices be Addressed Through Monetary Policy? *Journal of Economic Integration*, *27*(1), 167–194. http://www.jstor.org/stable/41473736

Singh, C., Pemmaraju, S., and Das, R. (2016). Economic Growth and Banking Credit in India. *SSRN Electronic Journal*. https://doi.org/10.2139/SSRN.2882398

Sood, P. (2018). Bank Lending Channel-A Literature Review. *Asian Journal of Research in Banking and Finance*, *8*(4), 80. https://doi.org/10.5958/2249-7323.2018.00029.9

Stock, J. H., and Watson, M. W. (2001). Vector Autoregressions. *Journal of Economic Perspectives*, *15*(4), 101–115. https://doi.org/10.1257/jep.15.4.101

Subbarao, D. (2013). Banking Structure in India – Looking Ahead by Looking Back - Duvvuri Subbarao- *Reserve Bank of India - Monthly Bulletin*, September 2013.

Svensson, E. (2013). Regional Effects of Monetary Policy in Sweden). *Lund University, School of Economics and Management, Department of Economics*, Issue 2012:9, http://hdl.handle.net/10419/260036

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, *46*(sup1), 234–240. https://doi.org/10.2307/143141

Torres-Preciado, V. H. (2021). Monetary policy and regional economic performance in Mexico: A structural panel VAR approach. *Growth and Change*, *52*(1), 195–223.

Tran, V. T., Nguyen, H., and Lin, C. T. (2017). Herding behaviour in the Australian loan market and its impact on bank loan quality. *Accounting & Finance*, *57*(4), 1149–1176.

Tremosa-Balcells, R., and Pons-Novell, J. (2001). Measuring monetary policy shocks in the European Monetary Union. *Applied Economics Letters*, *8*(5), 299–303.

Tsang, Andrew, (2021). Uncovering Heterogeneous Regional Impacts of Chinese Monetary Policy Available at SSRN: https://ssrn.com/abstract=3964320 or http://dx.doi.org/10.2139/ssrn.3964320

Ucal M, Bilgin MH, (2009). Income Inequality and FDI in Turkey: FM-OLS (Phillips-Hansen) Estimation and ARDL Approach to Cointegration.

Uchida, H., and Nakagawa, R. (2007). Herd behavior in the Japanese loan market: Evidence from bank panel data. *Journal of Financial Intermediation*, *16*(4), 555–583.

Vespignani, Joaquin L., 2015. "On the differential impact of monetary policy across states/territories and its determinants in Australia: Evidence and new methodology from a small open economy," *Journal of International Financial Markets, Institutions and Money*, Elsevier, vol. 34(C), pages 1-13. https://doi.org/10.1016/j.intfin.2014.10.001

Watson, Mark W. 1994. "Vector Autoregres- sions and Cointegration," in *Handbook of Econo- metrics, Volume IV*. Robert Engle and Daniel Mc- Fadden, eds. Amsterdam: Elsevier Science Ltd., pp. 2844-915

Weber, E. J. (2006). Monetary policy in a heterogeneous monetary union: the Australian experience. *Applied Economics*, *38*(21), 2487-2495.

Zhang, J., and Liu, P. (2012). Rational Herding in Microloan Markets. *Management Science*, *58*(5), 892–912. https://doi.org/10.1287/mnsc.1110.1459

Journal of Social and Economic Development
https://doi.org/10.1007/s40847-022-00195-z

RESEARCH PAPER

Does ownership matter in bank herding behavior? Evidence from India

A. C. V. Subrahmanyam[1] · **S. Raja Sethu Durai**[1]

Accepted: 26 June 2022

Abstract
Competitive pressures in the post-liberalization period necessitated Indian banks to exhibit plausible herding tendencies in garnering new clientele to optimize informational and operational costs. The empirical analysis finds herding behavior among Indian banks nuanced by bank ownership categories. While macroeconomic factors have a sparing impact, the bank-specific-industry factors exert a greater influence on the bank herding measures across credit segments. The analysis from this study provides new evidence: first, banks with highly concentrated branch networks exhibit lower herding tendencies across all ownership categories; second, banks' asset quality is negatively associated with herding, more specifically in the case of public and private sector banks, suggesting risk aversion on the part of the banks. Besides augmenting the literature, the results have policy relevance from an emerging market perspective with imperatives to promote credit access and inclusive growth while improving bank efficiency and financial stability.

Keywords Herding · Bank stability · Branch concentration · Competition · Asset quality

JEL Classification E44 · G21 · G28 · G41

Introduction

Ensuring stable finance is one of the key requirements for meeting the sustainable development goals (SDGs) globally and, more specifically, in the emerging economies. The efforts to reach sustainable development goals require participation both from the public and private sectors, and the crucial role of private/blended finance in this regard is well established (FSDR 2021). Furthermore, in bank-dependent economies like India, the banks have a more significant role in channelizing investments to activities that promote achievement of SDGs credibly and complement public investments. However, the Indian economy embraced liberalization policies in the early 1990s, resulting in structural changes in key economic sectors, including financial/banking sector. Further, from an emerging market perspective, banks have a crucial role in alleviating poverty by enhancing credit access and

✉ A. C. V. Subrahmanyam
acvsmanyam@gmail.com

[1] School of Economics, University of Hyderabad, Hyderabad 500046, India

Published online: 08 August 2022

promoting inclusive development (Singh et al. 2016). Hence, given their crucial role in the Indian context, it is important to understand the transformation of the banking sector in post-liberalization and its implications on bank stability and credit delivery.

Besides, preserving the stability of the banking system is crucial for providing financial support to sectors/entities geared to achieving SDGs. Rightly so, the Financing for Sustainable Development Report (FSDR) recognizes debt and debt sustainability as one of the key dimensions for achieving sustainable development finance (FSDR 2021). Ensuring debt sustainability requires creditors/banks to have efficient access to the information for making prudent decisions with optimal risk taking. However, if the information access is inefficient or costly, prudent decision making may be hindered, leading to sub-optimal risk taking. Further, in the post-liberalization era, all banks, including the state-led banks, were required to strategically re-orient their business models to face increased competition, capture growth opportunities, and improve the return to their stakeholders. The strategic re-orientation of banks' business models to face competitive pressures was conditioned by the ownership of the banks. The state-led banks had to factor in the government's social equity and financial inclusion objectives in their business strategies (Kumar and Gulati 2014). Their counterparts had to improve market shares to entrench and broaden their clientele base (Bapat and Mazumdar 2015). Further, to garner new growth opportunities, banks across ownership types have pursued massive branch expansion strategies leveraging the liberalized branch licensing guidelines of the Reserve Bank of India (RBI). However, studies indicate that as banks foray into new domains, they face increased operational and informational costs in terms of branch expansion, monitoring, staff costs, entry barriers due to local factors like language, culture, and market structure (Berger et al. 2000; Miller and Parkhe 2002).

In pursuing their growth and profitability objectives, given the information asymmetries in extending loans to new customers across sectors, the banks could follow the decisions made by leader banks with better information to optimize their information costs. The literature has well established (Haveman 1993; Uchida and Nakagawa 2007; Nakagawa and Uchida 2011) that following the liberalization or deregulation policies, the banks follow 'herd behavior' in pursuing high growth strategies, especially in the face of informational asymmetries. The herd behavior can also be observed in banks opening branches in similar areas, imitating competitors' products to garner higher market share (Persons and Warther 1997). However, the herding behavior can lead to sub-optimal decisions by the banks, impacting their performance, especially the asset quality (Banerjee 1992; Bikhchandani et al. 1992; Tran et al. 2017; Fang et al. 2021). Such herding tendencies can increase the vulnerabilities at the level of individual banks and can lead to systemic crises impacting financial stability (Haiss 2010). Furthermore, such herding tendencies, affecting bank stability, can impede stable access to sustainable finance required to meet the SDGs in emerging economies like India.

Despite its potential to impact bank performance and financial stability, few studies have analyzed bank herding in the Indian context (Pal 2020). However, a comprehensive analysis and quantification of herding behavior among Indian banks is not undertaken to the best of our knowledge. The examination of herding behavior is very important in the Indian context for the following reasons. First, by very nature, banking is prone to issues of informational asymmetry, increasing the scope for herding behavior with banks minimizing risk and cost of credit provisions (Calem and LaCour-Little 2004; Ambrose et al. 2005; Acharya et al. 2013). Second, given the differential development and maturity of various sectors of the Indian economy, herding by banks can further accentuate credit inequalities as banks follow the existing borrower selection criterion or prefer select sectors. Third, the recent

episodes of asset quality deterioration in the Indian banking sector are well known (Thota and Subrahmanyam 2020). Yet, the quantitative analysis of the impact of the bank herding on asset quality is not undertaken. Therefore, through this study, we address this gap in the literature by analyzing the 'herding behavior' of Indian banks in the post-liberalization period and its implications on the asset quality of banks and the larger implications on providing access to sustainable finance.

Our analysis contributes to the literature in three ways. First, leveraging the Lakonishok et al. (1992) (henceforth LSV) herding measure and a unique bank-level data set, we show the evidence of 'herding behavior' among Indian banks in the post-liberalization. Second, we also show that the herding behavior of Indian banks is influenced more by bank-specific factors than by macroeconomic factors. Third, by analyzing the impact of bank herding on asset quality, our study complements the literature and presents empirical evidence from an emerging country perspective. The rest of the paper is organized as follows. Section 2 provides the review of relevant literature. Section 3 discusses the data and methodology and presents the empirical strategy. Section 4 presents the results and a discussion, and the final section concludes with policy implications.

Literature review

Unlike the abundant literature on the herding behavior in the capital markets, only a limited number of studies examined the herding behavior in the banking industry. Herding behavior in the banking industry is examined under three different types of hypotheses: information cascade, regulatory arbitrage, and the reputational or compensation view (Liu 2014; Pal 2020). When banks possess uncertain (or lack of) information about the borrowers, they are likely to follow the decision of other banks in their lending decisions. In this process termed informational cascading, the herding banks are essentially free riding on the information possessed by other banks, ignoring their private information (Banerjee 1992; Bikhchandani et al. 1992, 1998; Avery and Zemsky 1998; and Barron and Valev 2000).

Further, in the case of emerging markets, the borrower information is not complete and is often costly, leading to informational cascading type herding behavior. Acharya and Yorulmazer (2008) popularized the regulatory arbitrage herding hypothesis and argued that banks find it optimal to herd to survive or fail along with the other banks during the banking crisis period. If the number of bank failures is high, the regulator bails out the failed banks. On the contrary, if the bank failures are low, the surviving banks take over the failed banks, which eventually could lead to failure and loss of franchise value, and precisely for this reason, the banks resort to herding. The reputational or the compensation view argues that the performance-based compensation limits the blame in the case of collective failures as compared to individual failures, thus making the bank management herd more (Scharfstein and Stein 1990; Devenow and Welch 1996; Borio et al. 2001; and Kirkpatrick 2009).

However, the regulatory arbitrage and compensatory herding hypothesis are less relevant in the Indian context. The bank failures in India have been relatively smaller and sporadic, leaving ample time for the markets to absorb the shocks. Similarly, the compensatory hypothesis of herding is also not suitable for the Indian banking system, as the size of the private and foreign banks is small, and their compensation practices are not

at par with the large international banks to trigger herding behavior. Further, the public sector banks have a fixed pay structure, which might lead to working the informational cascade hypothesis, and is more suitable from the emerging country perspective. Hence, we present the review of studies focusing on the informational cascade hypothesis of herding behavior.

Jain and Gupta (1987) presented weak herding among the US banks in lending to other countries, and the small banks followed the large banks. Similarly, significant herding behavior is observed among the largest banks competing internationally (Bonfim and Kim 2012). In the case of Japan, Uchida and Nakagawa (2007) found evidence of herding among the Japanese banks and found that city banks followed cyclical herding. Also, Nakagawa (2022) finds evidence of herding by regional banks in Japan.

Studies also focused on drivers of herding behavior like the principal-agent problems or information learning (Devenow and Welch 1996); the role of competitors' lending decisions (Rotheli 2001). The borrowers in US micro loan markets followed herding behavior, reckoning peer lending decisions and public information to assess the creditworthiness of the borrowers (Zhang and Liu 2012). In the case of US banks, Liu (2014) observed that the declining bank performance leads to herding behavior, especially in the case of small banks. In the case of Chinese banks, herding behavior is driven by information asymmetry, manager reputation and remuneration, administrative interference, and policy orientation (He 2016). Fang et al. (2019) found evidence that herding occurred among the joint-stock commercial banks (JCBs) due to investigative motivation, whereas in the case of city commercial banks (CCBs), due to informational cascades.

Notwithstanding the drivers of bank herding behavior, evidence suggests herding affects bank asset quality and real economic activity, often leading to cyclical fluctuations. Mondschean and Pecchenino (1995) observe that herd behavior leads to cyclical fluctuations in bank lending due to aggregate shocks such as changes in the monetary regime, tax, or regulatory policy. Similarly, the herding behavior of the Japanese banks has led to a deterioration of the real economy in Japan, affecting GDP and land prices in the later periods (Nakagawa et al. 2012). Further, studies also observe that the herding behavior also varied across loan categories and bank ownership types. In the case of Australian banks, Tran et al. (2017) found that herding in the case of housing and credit card loan segments impacts bank asset quality. Likewise, Heo (2019) observed that in the case of US banks, herding by the big banks is higher for real estate loans than commercial, industrial, or consumer loans during the boom period. Fang et al. (2021) assessed the role of bank ownership on herding behavior and observed that loan herding in the Taiwanese banks, except in the case of government-owned banks.

The informational cascading hypothesis of bank herding finds ample support in the literature, with evidence indicating herding behavior by banks in major economies with implications for bank asset quality. Besides the macroeconomic factors, the bank-specific factors drive the herding behavior with varied impacts across sectors and bank ownership types. Further, in the Indian context, the trends in the banking sector in the post-liberalization period with banks facing heightened competition and undertaking massive branch expansion suggest the possibility of bank herding across sectors/bank ownership types. Hence, there is a need to examine the herding behavior among the Indian banks across the ownership groups and loan segments, reckoning the macroeconomic and bank-specific factors.

Data and methodology

Data

We have collected the bank-level annual data (such as total credit, profits (return on assets), capital adequacy, non-performing assets, number of branches, the cost to income ratio, and ownership details) of 28 public sector, 34 private sector, and 45 foreign sector banks[1] and the macro-economic data (such as GDP, inflation, broad money (M3), monetary policy rates, and deposit rate) from the RBI. Unemployment rates have been extracted from the world bank database. Based on the data availability, our sample period spans between 1995 and 2020, coinciding with the post-liberalization period of the Indian economy.

Herd measure

Following the literature (Uchida and Nakagawa 2007; Tran et al. 2017), we employed the LSV methodology to calculate the level of herding among Indian banks. The LSV herd measure is defined as below:

$$\mathrm{LSV}_{\mathrm{it}} = \left|p_{\mathrm{it}} - p_t\right| - E\left|p_{\mathrm{it}} - p_t\right| \tag{1}$$

where i denotes a particular credit sub-segment ($i = 1,..k$) and p_{it} denotes the proportion of banks that are registering growth in year t.[2] Further p_t denotes the average proportion of banks registering growth across k credit sub-segments in the year t. The average proportion of banks can be considered as the expected credit behavior of all the banks in year t, reflecting the overall lending policy reckoning the macroeconomic and sector-specific conditions. Therefore, the absolute difference $\left|p_{it} - p_t\right|$ denotes the share of banks extending loans over and above the expected levels to a particular credit sub-segment k quantifying the 'herding portion.' In the second term $E\left|p_{it} - p_t\right|$ is subtracted to normalize the LSV herding measure to zero under the null hypothesis of no herding.[3] The mean of LSV_{it} across k credit sub-segments give the herding measure for the credit segment in the year t. Further, the significance of the 'herding measures' is tested using a Chi-square test and the Zi scores defined below (Uchida and Nakagawa 2007).

$$Z_{it} = \frac{p_{it} - p_t}{\sqrt{\frac{p_t(1-p_t)}{N_i}}}$$

where N_i is the number of banks in the kth credit sub-segment for the year t.

The LSV herd measure captures the herding exhibited by banks in lending to a particular industry/sector over and above the expected average trend after factoring in the macroeconomic and sector-specific constraints. However, the long-term bank-level data on the

[1] Following Uchida and Nakagawa (2007), in a given year only the banks with defined growth rate are considered. Thus, in a given year, the banks that are newly established or acquired are excluded.

[2] We use credit sub-segments than industry sectors used in literature to generalize the use of LSV 'herd measure'.

[3] LSV measure follows a binomial distribution with a probability p_t, for details, please see the adjustment factor in Tran et al., (2017) for calculating the second term in Eq. 1.

sectoral distribution of credit are not available for the Indian banks.[4] Hence, we consider the following three credit segments and their distribution to analyze the herding behavior of Indian banks.

The first credit segment is based on the distribution of total credit by type of loan accounts, viz., bills, cash credit, term loans (BCTL) capturing the nature of business and risks to the bank. To illustrate, loans against bills (Bills) include short-term financing extended by banks against the payments due to the borrowers. Similarly, cash credit is akin to an overdraft facility provided to borrowers based on operational/financial parameters to manage routine business operations. In contrast, term loans are long-term commitments given to borrowers by the banks to finance investment projects of the borrowers.

Further from an operational standpoint, the bank requires higher domain expertise to assess the risks in a term loan, like financing an infrastructure project. On the contrary, the bank requires a strong branch network and personnel to cater to borrowers availing cash credit/bill financing. As banks enter new domains, the credit distribution based on the type of loan account reflects the relative preference of the banks in balancing risks and growth associated with each type of loan account, optimizing the associated monitoring costs and benefits.

The second credit segment is based on the distribution of total credit by type of security (SECU), viz., secured by tangible assets, secured by government guarantees, and unsecured advances, reflecting the extent of collateral security available to the banks. In the event of default by the borrower, the banks' recovery from a secured advance is expected to be higher than the unsecured advance. Also, the risk weights used in computing capital adequacy for secured advances are lower. Thus, a higher preference toward secured advances reflects greater risk aversion on the part of the bank in extending new loans across sectors. Further, in new areas/product domains, the banks may demand higher collateral to extend loans to mitigate the associated information costs and improve recovery in case of defaults.

The third credit segment is based on the distribution of total credit by priority and non-priority sector advances (PNPL), i.e., advances to the priority sector, public companies, banks, and other advances, reflecting the strategic focus on the banks in balancing the regulatory requirements and business objectives. The RBI, to achieve the objective of inclusive development by enhancing credit access, mandates Indian banks to meet a prescribed level of credit disbursement to designated sectors of the economy, viz., agriculture, small and micro enterprises, retail housing, educational loans, etc., together called priority sector. Banks in India are mandated to lend a minimum of 40% of their advances to the priority sector, with specific sub-targets for loans to women borrowers, weaker sections, etc. Further, to reach these regulatory requirements, the banks must lend to borrowers in select sectors, locations (rural centers), ticket size (small/medium size loans), etc. Hence, to meet these targets, the bank must venture into new areas with potential (primarily rural and semi-urban) by opening branches and building the necessary infrastructure to handle the operations.

The distribution trends of the credit segments mentioned above reflect the strategic choices of the banks to optimize operational and informational costs capturing the plausible herding tendencies. Hence, based on the LSV_{it} measures of the individual credit subsegments in year t, the mean LSV values were computed for each of these three credit

[4] The bank level data on sectoral credit distribution for Indian banks is available only from 2015.

segments and bank groups. The time series of mean LSV values of the credit segments and bank groups are then analyzed to capture the herding behavior within the bank groups.

Determinants of bank herding

Herding behavior is influenced by macroeconomic and bank-specific factors (Tran et al. 2017). From the LSV specification (Eq. 1), p_t represents the overall lending policy of banks reckoning the macroeconomic and bank industry-specific factors. Hence, we examine the macroeconomic and bank industry-specific determinants of the bank herding using the following equation.

$$\mathrm{LSV}_t = \alpha + \sum_{e=1}^{n} \beta_e \mathrm{Macro}_{\mathrm{et}} + \sum_{j=1}^{m} \gamma_j \mathrm{Bank}_{\mathrm{jt}} + \varepsilon_t \tag{2}$$

where LSV_t is the mean annual herd measure for a given credit segment; $Macro_{et}$ refer to macroeconomic variables including real GDP growth, inflation rate, change in unemployment rate, treasury bill rate, broad money supply (M3) growth, and monetary conditions index. Bank-specific variables include weighted average lending rate, deposit rate, profits, return on equity, risk-adjusted capital adequacy ratio, branch concentration (Hirschman and Herfindahl Index HHI), growth in the number of branches. The monetary conditions index (MCI) indicates the stance of monetary policy and evolving monetary conditions, which have a bearing on credit growth. Using the methodology specified by Kannan et al. (2006), the MCI was developed for the period from 1995 to 2020, and the monetary phases (easy and tight) were identified accordingly.

However, most of the independent variables specified above are stationary at 1st difference, barring a few, which are level stationary, viz., real GDP, monetary phase, branch growth, and return on equity for FSBs. Also, there is a long-term relationship (cointegration) between the LSV values and the independent variables (both the macro and bank-specific variables).[5]In such cases, using ordinary least squares may not yield optimal estimates. This study uses fully modified ordinary least squares (FMOLS) developed by Phillips (1995) as it accommodates an unknown mixture of I (0) and I (1) variables with an unknown cointegrating rank. FMOLS is a modified version of the ordinary least square technique to account for serial correlation in the independent variables. Furthermore, it also considers the endogeneity among the regressors due to a cointegrating relationship (Chang and Philips 1995). Pedroni (2001) also establishes that the FMOLS method produces reliable estimates even in small samples.

There are a good number of studies that leverage the FMOLS method to arrive at consistent estimates with small samples and to overcome the endogeneity in the regressors due to the presence of cointegration (Narayan and Narayan 2004; Behera and Ranjan 2009; Ucal and Bilgin 2009; Takeshi and Shigeyuki 2014). Our sample is relatively small, with 26 observations (1995–2020). There is a cointegration relationship between the herd measures and the regressors with mixed order of integration among the variables; we estimated Eq. (2) using the FMOLS methodology to derive reliable and consistent estimates.

[5] The co-integration between the LSV measures and independent variables is examined using Johansen. co-integration test.

Table 1 Summary statistics of LSV herd measures across bank groups & credit segments

	BCTL			SECU			PNPL		
	PSBs	PVBs	FSBs	PSBs	PVBs	FSBs	PSBs	PVBs	FSBs
Mean	0.11	0.10	0.07	0.13	0.15	0.11	0.19	0.26	0.24
Min	0.03	0.01	0.00	0.00	0.09	0.02	0.09	0.17	0.12
Max	0.20	0.26	0.16	0.27	0.23	0.18	0.30	0.34	0.37
Std	0.05	0.05	0.04	0.07	0.04	0.04	0.05	0.05	0.06

In addition, we also examine the impact of bank herding on the non-performing assets, as herding results in sub-optimal decisions, which plausibly leads to higher delinquencies. Following Tran et al. (2017), we regress the non-performing assets of banks on the herding measure, using the OLS estimator to examine the effect of herding on the loan quality using the following equation.[6]

$$\mathrm{NPA}_t = \alpha + \beta_1 \mathrm{LSV}_t + \sum_{j=1}^{m} \gamma_j \mathrm{Controls}_{jt} + v_t \tag{3}$$

where NPA is the Gross NPA ratio defined as the share of non-performing advances to the outstanding gross advances on the bank, LSV is the mean herding measure of the credit segment, and the control variables include credit growth, the efficiency ratio (cost to income ratio), capital adequacy ratio, and real GDP growth.

Results and discussion

LSV herd measure

The results indicate that the mean LSV herd measures for all bank groups and credit segments are significant, indicating 'herd behavior' among Indian banks. The year-wise mean LSV values and the p values from the Chi-square test are given in Annexure. The time series analysis of the herd measuring indicates significant herding across credit segments and bank groups for a major portion of the sample period. However, there is a difference in herding levels among bank groups and across credit segments (Table 1).

Compared to PSBs and FSBs, the PVBs show a higher level of herding across all credit segments, except for the BCTL credit segment, where PSBs exhibit a marginally higher herding level. The values of herd measures for individual credit segments reflect the business approaches undertaken by different bank groups. In the BCTL credit segment, the FSBs exhibited a lower herd measure than PSBs and PVBs. The lower value of the herding measure of FSBs can be attributed to their limited presence in select cities, whereas PSBs and PVBs have expanded their reach and branch networks, thus facing higher informational problems resulting in higher values of herd measures.

[6] We do not find cointegration between Gross NPA ratio and the herd measures across bank groups. Hence, we estimate Eq. (3) using OLS framework duly accounting for stationarity of the regressors.

Similarly, in the secured and unsecured credit segment, the herd measures of FSBs are lower than that of other banking groups, with PVBs exhibiting marginally higher herding than PSBs. Here too, given their limited client base, the FSBs may face lower informational costs than PSBs and PVBs. Further, within PSBs and PVBs, the higher value of herding in the secured/unsecured credit segment for PVBs can be attributed to their recent growth in branch networks and their ability to provide them with better domain knowledge.

Interestingly, in the case of priority and non-priority credit segment (PNPL) credit segment, both PVBs and FSBs exhibit higher levels of herding than PSBs. As mentioned earlier, in this credit segment, the banks are required to achieve mandatory targets in lending to agriculture, small and medium enterprises. Besides lending to retail customers for housing loans and educational loans qualify for meeting the regulatory requirements. These loans require a strong branch network and operational connect to establish a stable credit portfolio. Hence, in finding such potential borrowers to meet the priority sector targets, the PVBs and FSBs, given their limited footprint in the rural and semi-urban areas, may have faced higher informational and operational costs, resulting in higher levels of herding behavior in this credit segment. It also underscores that the information and business expansion benefit that PSBs derive from extending loans to priority sectors is attributable to their extensive branch networks in the rural and semi-urban areas, resulting in lower herding values. Furthermore, as a business strategy, the PVBs and FSBs may focus on meeting regulatory requirements and hence try to achieve the set targets by following existing lending patterns in established locations, thus exhibiting higher herding behavior than the PSBs.

Herding determinants

The time series of herd measures of different credit segments presented in Fig. 1 indicates a cyclical herding behavior, suggesting the influence of macroeconomic and banking industry variables.

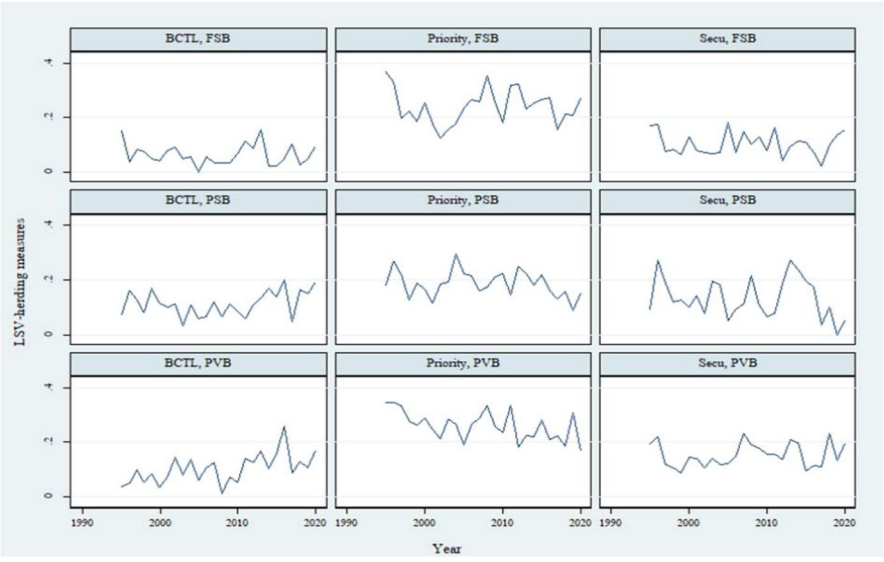


Fig. 1 Bank group and credit segment wise—mean LSV herd measure

Table 2 Macroeconomic and industry determinants of bills, cash credit, term loan segment's herding

BCTL	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.1221***	0.2602***	0.0944**	0.3528*	0.4820***	0.0394
	(0.0083)	(0.0002)	(0.0221)	(0.0998)	(0.0097)	(0.7767)
GDPG	0.0010	0.0013	−0.0096**			
	(0.8175)	(0.8150)	(0.0201)			
Unem-Change	0.0021*	−0.0009	0.0002			
	(0.0934)	(0.5547)	(0.8317)			
Inflation	0.0044*	0.0053	0.0017			
	(0.0956)	(0.1290)	(0.4675)			
T-bill rate	0.0046	−0.0113*	0.0052			
	(0.2836)	(0.0586)	(0.1878)			
M3 Growth	−0.0055***	−0.0078***	−0.0005			
	(0.0031)	(0.0020)	(0.7351)			
MCI-Phase	0.0063	0.0079	−0.0103			
	(0.6284)	(0.6507)	(0.3875)			
Deposit rate				−0.0022	−0.0096	0.0092
				(0.7133)	(0.2333)	(0.2077)
WALR				−0.0011	0.0323**	−0.0125
				(0.8687)	(0.0313)	(0.2262)
Profit				0.5108**	0.1001	−0.0678
				(0.0111)	(0.3860)	(0.1507)
Equity				−0.0333***	−0.0101	0.0083
				(0.0050)	(0.3233)	(0.2419)
CRAR				−0.0479**	−0.0319**	0.0077
				(0.0381)	(0.0180)	(0.1811)
HHI				0.0001	−0.0004***	0.0000
				(0.7151)	(0.0018)	(0.9171)
Branch Growth				0.4913*	−0.1413	0.0954
				(0.0723)	(0.5281)	(0.4866)
R^2	0.36	0.26	0.22	0.52	0.45	0.05
Obs	25	25	25	25	25	25

*, **, ***indicate significance at 10%, 5%, and 1% confidence levels, respectively. Values in the parentheses indicate p-values

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-Phase*: Monetary Conditions Index; *WALR*: weighted average lending rate of loans/advances; *Deposit*: interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: risk-adjusted capital ratio; *HHI*: branch concentration—Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches

Impact of macroeconomic factors on bank herding measures

Table 2—Panel A reports the impact of macroeconomic determinants of loan herding for the bill, cash, and term-loans credit segment (BCTL). In the case of PSBs, the unemployment change and inflation are positively related to loan herding, while the M3 growth

Table 3 Macroeconomic and industry determinants of secured & unsecured loan segment's herding

SECU	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.0936	0.1214**	−0.0016	0.6781**	0.2281	0.0862
	(0.3524)	(0.0229)	(0.9571)	(0.0334)	(0.1408)	(0.4368)
GDPG	−0.0035	0.0034	0.0093***			
	(0.7291)	(0.4936)	(0.0049)			
Unem-Change	−0.0031	0.0022	0.0041***			
	(0.2842)	(0.1274)	(0.0001)			
Inflation	0.0065	0.0002	−0.0008			
	(0.2875)	(0.9464)	(0.6392)			
T-bill rate	0.0111	−0.0042	−0.0003			
	(0.2781)	(0.4030)	(0.9107)			
M3 Growth	−0.0024	0.0009	0.0015			
	(0.5421)	(0.6446)	(0.2133)			
MCI-Phase	−0.0326	0.0436***	0.0396***			
	(0.2950)	(0.0097)	(0.0003)			
Deposit rate				−0.0155*	0.0177**	0.0016
				(0.0914)	(0.0210)	(0.7800)
WALR				0.0543***	−0.0267**	−0.0136
				(0.0000)	(0.0439)	(0.1035)
Profit				0.5415*	−0.1229	0.0346
				(0.0520)	(0.2377)	(0.3460)
Equity				−0.0326**	0.0115	0.0023
				(0.0429)	(0.2115)	(0.6757)
CRAR				−0.0496	0.0058	−0.0019
				(0.1256)	(0.5979)	(0.6765)
HHI				−0.0013**	0.0001	0.0001*
				(0.0192)	(0.5921)	(0.0822)
Branch Growth				1.7924***	0.1541	0.2836*
				(0.0002)	(0.4418)	(0.0161)
R^2	0.25	0.26	0.41	0.67	0.28	0.28
Obs	25	25	25	25	25	25

*, **, ***indicate significance at 10%, 5%, and 1% confidence levels, respectively. Values in the parentheses indicate p-values

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-Phase*: Monetary Conditions Index; *WALR*: weighted average lending rate of loans/advances; *Deposit*: interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: risk-adjusted capital ratio; *HHI*: branch concentration—Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches

rate is negatively related. The T-bill rate and M3 growth negatively influence the herding measure for PVBs, while for FSBs, GDP growth is negatively associated with this herding measure. Similarly, panel A of Table 3 reports the macroeconomic determinants of the loan herding in the secured and unsecured credit segment (SECU). In the case of FSBs, both GDP growth and unemployment change positively influence these herd measures. Further,

tight monetary conditions led to higher herding for PVBs and FSBs, reflected by the positive association of the monetary phase with this herding measure. In the case of the priority and non-priority (PNPL) credit segment (Table 4-Panel A), GDP growth, unemployment change, and monetary phase positively impact FSBs. While in the case of PVBs, the T-bill rate and M3 growth have a positive influence, and the monetary phase negatively impacts this herding measure. Surprisingly for PSBs, in general, the impact of the macroeconomic factors on this herding measure seems muted.

Impact of bank-specific factors on bank herding measures

Similarly, we also examined the impact of the bank-specific determinants on the herding measures across bank ownership categories. Panel B of Table 2 indicates that in the case of the BCTL credit segment, for PSBs, profits are influencing the herding measure positively, while equity and risk-adjusted capital ratio are exerting a negative influence. For PVBs', the risk-adjusted capital ratio has a negative influence, and the lending rate (WALR) positively influences this herding measure. Interestingly, the branch growth increases the herding in the case of PSBs, while the increase in branch concentration reduces herd measures for PVBs. The bank-specific factors have no impact on the BCTL herd measure for FSBs. In case of herding in SECU segment, it is evident from panel B of Table 3 that the deposit rate has a negative influence on herding measures for PSBs, while it has a positive impact on PVBs herding. The lending rate (WALR) has a positive influence on herd measure in the case of PSBs, while it has a negative influence in the case of PVBs. Further, for PSBs, profit has a positive influence, and equity has negative influence on the herd measures in this SECU credit segment. Interestingly, branch growth increases herding for PSBs and FSBs, while branch concentration (HHI) lowers herding in PSBs and increase herding in FSBs.

Similarly, panel B of Table 4 indicates that in the PNPL credit segment, the deposit rate negatively influences herd measures for PSBs. In contrast, it has a positive influence on PVBs and FSBs herding. The lending rate (WALR) yields a positive impact for PSBs and a negative effect on herding measures for PVBs. Further, in the case of PVBs, equity and risk-adjusted capital ratios are positively related, while profits are negatively related to this herding measure. Interestingly, in PVBs, the branch growth reduces herding while increasing it for PSBs.

Impact of macroeconomic and bank-specific factors on bank herding measures

We can infer that both the macroeconomic and bank-specific factors impact the herding behavior of the banks across credit segments. However, interesting insights emerge when their effects are seen in conjunction, i.e., the combined impact of macroeconomic and bank-specific factors on herd measures. From Table 5, the macroeconomic factors generally have a sporadic influence on the bank herding measures, while bank-specific factors yield a more significant effect across credit segments.

In the BCTL segment, of the macroeconomic factors, GDP growth negatively influences herding in FSBs, and unemployment change positively impacts PSBs herding. The T-bill rate lowers the herding in PSBs, while it positively influences FSBs. On the contrary, the monetary phase positively influences BCTL herd measures for PSBs and negatively affects herding in FSBs. Among the bank-specific variables, for PSBs, the

Table 4 Macroeconomic and industry determinants of priority and non-priority loan segment's herding

PNPL	Panel A: Macroeconomic			Panel B: Bank-specific		
	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.1404*	0.0502	0.0630	−0.0090	−0.0989	−0.0129
	(0.0534)	(0.2478)	(0.3225)	(0.9688)	(0.4228)	(0.9278)
GDPG	0.0014	0.0072	0.0151**			
	(0.8308)	(0.1027)	(0.0254)			
Unem-Change	−0.0006	−0.0001	0.0036*			
	(0.7420)	(0.9102)	(0.05170)			
Inflation	0.0050	0.0000	0.0029			
	(0.2365)	(0.9787)	(0.4461)			
T-bill rate	−0.0030	0.0119**	0.0021			
	(0.6589)	(0.01160)	(0.7320)			
M3 Growth	0.0018	0.0051***	0.0009			
	(0.5035)	(0.0055)	(0.6942)			
MCI-Phase	0.0024	−0.0267**	0.0398**			
	(0.9099)	(0.0544)	(0.0522)			
Deposit rate				−0.0123*	0.0222***	0.0133*
				(0.0844)	(0.0011)	(0.0829)
WALR				0.0216**	−0.0183*	−0.0057
				(0.0108)	(0.0838)	(0.5833)
Profit				−0.1408	−0.2806***	0.0315
				(0.4931)	(0.0032)	(0.5047)
Equity				0.0089	0.0261***	0.0088
				(0.4526)	(0.0020)	(0.2227)
CRAR				0.0181	0.0361***	0.0066
				(0.4576)	(0.0008)	(0.2566)
HHI				−0.0001	0.0001	−0.0000
				(0.6997)	(0.1362)	(0.7548)
Branch Growth				0.5687*	−0.3511**	0.1938
				(0.0644)	(0.0420)	(0.1774)
R^2	0.08	0.42	0.32	0.36	0.63	0.57
Obs	25	25	25	25	25	25

*, **, ***indicate significance at 10%, 5%, and 1% confidence levels, respectively. Values in the parentheses indicate p-values

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-Phase*: Monetary Conditions Index; *WALR*: weighted average lending rate of loans/advances; *Deposit*: interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: risk-adjusted capital ratio; *HHI*: branch concentration—Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches

lending rate (WALR), profit, and branch growth have a positive influence, while equity and capital have a negative impact on herding measures. In the case of PVBs, only risk-adjusted capital ratio, and branch concentration negatively influence herd measures. For FSBs, the deposit rate has a negative influence, while risk-adjusted capital ratio and branch growth positively impact this herding measure.

Table 5 Macroeconomic and industry determinants of BCTL, SECU, and PNPL loan segments herding

MACRO & BANK	Panel A: BCTL			Panel B: SECU			Panel C: PNPL		
	PSB	PVB	FSB	PSB	PVB	FSB	PSB	PVB	FSB
Constant	0.4495***	0.6724***	−0.0948	0.6648**	0.0114	0.2105	0.2256	−0.0913	−0.0450
	(0.0095)	(0.0006)	(0.4093)	(0.0418)	(0.9025)	(0.1207)	(0.2872)	(0.5246)	(0.7276)
GDPG	−0.0006	0.0046	−0.0127***	0.0069	−0.0100***	0.0117***	0.0120***	0.0067	0.0080**
	(0.8313)	(0.3054)	(0.0014)	(0.2117)	(0.0039)	(0.0055)	(0.0073)	(0.1433)	(0.0389)
Unem	0.0022***	0.0015	0.0004	0.0017	0.0047***	0.0027**	0.0009	−0.0022*	0.0075***
	(0.0069)	(0.2481)	(0.6926)	(0.2288)	(0.0001)	(0.0314)	(0.3360)	(0.0998)	(0.0000)
Inflation	0.0028	0.0054	0.0020	0.0003	−0.0002	0.0015	0.0095***	0.0035	−0.0094***
	(0.1431)	(0.1201)	(0.3686)	(0.9422)	(0.9113)	(0.5641)	(0.0029)	(0.3018)	(0.0028)
T-bill	−0.0190***	−0.0090	0.0203***	−0.0137	0.0164***	−0.0110	−0.0101	0.0040	0.0137*
	(0.0043)	(0.2892)	(0.0051)	(0.2265)	(0.0094)	(0.1237)	(0.2046)	(0.6237)	(0.0637)
M3	0.0006	−0.0036	0.0029	0.0039	−0.0007	−0.0041*	−0.0001	0.0034	0.0038*
	(0.6941)	(0.1934)	(0.1286)	(0.1978)	(0.6679)	(0.0614)	(0.9595)	(0.2185)	(0.0824)
MCI	0.0340***	−0.0113	−0.0318**	0.0168	0.0288**	0.0513***	0.0211	−0.0095	0.0360**
	(0.0027)	(0.4801)	(0.0295)	(0.3663)	(0.0150)	(0.0044)	(0.1179)	(0.5458)	(0.0301)
Deposit	−0.0053	0.0044	−0.0149**	−0.0197**	0.0166***	0.0168**	−0.0166**	0.0110	0.0249***
	(0.2298)	(0.5829)	(0.0445)	(0.0401)	(0.0068)	(0.0455)	(0.0167)	(0.1805)	(0.0067)
WALR	0.0176**	0.0184	−0.0059	0.0726***	−0.0380***	−0.0143*	0.0459***	−0.0014	−0.0013
	(0.0130)	(0.2215)	(0.3667)	(0.0001)	(0.0016)	(0.0673)	(0.0002)	(0.9245)	(0.8591)
Profit	0.7445***	0.1220	−0.0185	0.4632*	−0.3099***	−0.0596	−0.3440*	−0.3346**	−0.0932**
	(0.0001)	(0.2984)	(0.5514)	(0.0963)	(0.0012)	(0.1082)	(0.0794)	(0.0113)	(0.0201)
Equity	−0.0477***	−0.0081	0.0053	−0.0306*	0.0330***	0.0108**	0.0202*	0.0253**	0.0158***
	(0.0000)	(0.4567)	(0.2069)	(0.0597)	(0.0005)	(0.0332)	(0.0729)	(0.0323)	(0.0047)
CRAR	−0.0793***	−0.0462***	0.0089*	−0.0558*	0.0332***	−0.0014	0.0292	0.0320***	0.0153**
	(0.0001)	(0.0008)	(0.0661)	(0.0732)	(0.0003)	(0.7865)	(0.1663)	(0.0080)	(0.0106)
HHI	0.0001	−0.0004***	0.0001	−0.0016**	0.0001**	0.0000	−0.0012**	−0.0001	−0.0002***

Table 5 (continued)

MACRO & BANK	Panel A: BCTL			Panel B: SECU			Panel C: PNPL		
	PSB	PVB	FSB	PSB	PVB	FSB	PSB	PVB	FSB
	(0.8348)	(0.0022)	(0.2001)	(0.0302)	(0.0497)	(0.4387)	(0.0252)	(0.4881)	(0.0015)
Branch	1.0064***	−0.3572	0.1543*	2.4877****	−0.4020*	0.1770*	0.4614	−0.1562	0.0965
	(0.0014)	(0.1913)	(0.0817)	(0.0003)	(0.0333)	(0.0784)	(0.1937)	(0.5497)	(0.3154)
R^2	0.74	0.57	0.38	0.71	0.62	0.63	0.54	0.73	0.81
Obs	25	25	25	25	25	25	25	25	25

*, **, ***indicate significance at 10%, 5%, and 1% confidence levels, respectively. Values in the parentheses indicate p-values

GDPG: annual growth in real GDP; *Unem-Change*: change in the unemployment rate; *Inflation*: annual growth of consumer inflation; *T-bill rate*: 1-year treasury bill rate; *M3 Growth*: broad money growth; *MCI-Phase*: Monetary Conditions Index; *WALR*: weighted average lending rate of loans/advances; *Deposit*: interest rate on 1-year term deposits; *Profit*: return on assets; *Equity*: return on equity; *CRAR*: risk-adjusted capital ratio; *HHI*: branch concentration—Hirschman and Herfindahl Index; *Branch Growth*: annual growth in the number of branches

In the SECU segment, the macroeconomic factors only influence herd measures of PVBs and FSBs. The GDP growth has a negative influence on PVBs and a positive influence on FSBs herding. The unemployment change and monetary phase have a positive impact on both PVBs and FSBs herding. T-bill rate has a positive impact on PVBs, while M3 growth has a negative impact on FSBs herding. On the contrary, bank-specific factors yield a more significant impact on herding in this segment across bank ownership types. The deposit rate negatively influences PSBs herding, while it has a positive influence on both PVBs and FSBs. The lending rate positively influences the herding of PSBs, while it has a negative impact on PVBs and FSBs. For PSBs, while profit yields a positive influence, equity and risk-adjusted capital ratios have a negative influence. In contrast, for PVBs, profit yields a negative influence, while equity and risk-adjusted capital have a positive influence. In the case of FSBs, only equity positively influences herd measures. Branch concentration (HHI) negatively impacts PSBs and has a positive impact on PVBs herd measures. Interestingly, branch growth has a positive influence on the herding of PSBs and FSBs, while it impacts herding negatively for PVBs.

In the PNPL segment, for PSBs, GDP growth, inflation, equity, and risk-adjusted capital ratio exert a positive influence, while deposit rate, profits, and branch concentration have a negative impact on herding measure. For PVBs, unemployment change and profits have a negative effect, while equity and risk-adjusted capital ratio positively influence herd measures. For FSBs, both macro and bank-specific factors are showing an impact on herding measures. Of the macroeconomic factors, GDP growth, unemployment change, T-bill rate, M3 growth, and monetary phase have a positive effect, while the inflation rate has a negative impact. Among the bank-specific factors, deposit rate, equity, and risk-adjusted capital ratio positively impact the herding measures, while profit and branch concentration have a negative impact.

Influence of herding on asset quality

Table 6 presents the impact of herding measures across credit segments on the bank asset quality after controlling for the macroeconomic and bank-level factors which potentially impact bank asset quality. The regression results indicate that bank herding negatively impacts bank asset quality across credit segments. However, the impact is significant only for PSBs and PVBs. The herd measures of PSBs and PVBs in the SECU segment are negatively associated with asset quality. While in the case of BCTL and PNPL segments, only the herd measures of PSBs are negatively associated with asset quality. Of the controlling variables, GDP growth has a negative impact on bank asset quality for PVBs (SECU) and FSBs (PNPL). At the same time, the bank level factors like credit growth have a negative influence on asset quality across credit segments for PSBs and FSBs, while cost to income ratio (inefficiency) has a positive impact only for PSBs. Further, the capital ratio influences the asset quality negatively only in the case of FSBs.

Discussion

The results from empirical analysis indicate 'herding behavior' among Indian banks across the ownership groups. However, the varied impact of macroeconomic and bank-specific-industry factors on herding measures across credit segments should be contextualized in

Table 6 Impact of herding on non-performing assets

MACRO & BANK	Panel A: BCTL			Panel B: SECU			Panel C: PNPL		
	PSB	PVB	FSB	PSB	PVB	FSB	PSB	PVB	FSB
Constant	23.7384***	9.2795***	8.1579***	28.2521***	12.0879***	7.8797***	28.5754***	9.0208**	8.3810***
	(0.0000)	(0.0050)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0430)	(0.0000)
GDPG	−0.5492	−0.4873	0.0356	−0.4036	−0.5589**	0.0538	−0.2815	−0.5039*	0.0701
	(0.3310)	(0.1190)	(0.8520)	(0.4140)	(0.0480)	(0.7710)	(0.5610)	(0.0980)	(0.7020)
Herd Measure	−20.7624*	−2.0712	−2.1828	−30.0719**	−17.3278*	0.1988	−37.4694***	1.3461	−4.6825
	(0.0600)	(0.8510)	(0.6650)	(0.0040)	(0.0620)	(0.9760)	(0.0080)	(0.8930)	(0.2580)
CRAR	−0.1580	−0.3598	−0.3152**	3.0727	−0.2733	−0.3213**	2.3747	−0.3026	−0.3284**
	(0.9510)	(0.5470)	(0.0360)	(0.2050)	(0.3380)	(0.0360)	(0.3820)	(0.4750)	(0.0350)
CIR	0.3013	0.0037	−0.0176	0.3839	−0.0328	−0.0158	0.2134	0.0024	−0.0161
	(0.1540)	(0.9740)	(0.7820)	(0.0390)	(0.7690)	(0.8130)	(0.2640)	(0.9840)	(0.7960)
Credit	−0.2817***	0.0200	−0.1176***	−0.3000***	0.0055	−0.1174***	−0.2462**	0.0155	−0.0989**
	(0.0050)	(0.7270)	(0.0000)	(0.0000)	(0.8740)	(0.0040)	(0.0130)	(0.7390)	(0.0120)
Trend	−0.5178***	−0.1411	−0.1888***	−0.6178***	−0.1165*	−0.1892***	−0.5501***	−0.1482*	-0.1706***
	(0.0000)	(0.1690)	(0.0000)	(0.0000)	(0.0780)	(0.0000)	(0.0000)	(0.0790)	(0.0000)
R^2	0.63	0.39	0.72	0.72	0.48	0.72	0.68	0.39	0.73
Obs	24	24	24	24	24	24	24	24	24

*, **, ***indicate significance at 10%, 5%, and 1% confidence levels, respectively. Values in the parentheses indicate p-values

GDPG: annual growth in real GDP; *Herd Measures*: LSV herd measure for the respective credit segment; *CRAR*: change in risk-adjusted capital ratio; CIR: change in cost to income ratio; *Credit Growth:* annual growth in credit outstanding

terms of the business models of the bank groups. Banks facing uncertain informational costs try to optimize potential losses (credit delinquencies) by following herding behavior.[7] Further, it is observed that the macroeconomic factors impact herding sparingly while the bank-specific-industry factors exert a greater significant influence. Of the macroeconomic factors, unemployment change has a more significant effect on bank herding, likely impacting the borrowers' repayment capacity. Further, the monetary policy variables like M3 growth and monetary policy phase (MCI), and T-bill rate are more relevant for banks owing to their impact on bank interest rates. This may also explain the sparing impact of inflation and GDP growth, as the other bank-specific-industry factors plausibly internalize the impact of macroeconomic variables on bank herding.

Interestingly, the role of bank-specific factors changes across credit segments and bank groups. It may be on account of the business models adopted by these banks in each of these segments. A rise in deposit and lending rates is expected to lower herding tendencies as they point to a contractionary economic cycle. On the contrary, the positive influence of deposit and interest rates may also suggest a very high demand for bank credit, and banks can pass on the prices. Similarly, the profit ratios yield both positive and negative influences, suggesting both risk-on risk-off tendencies on the part of the banks. Equity and risk-adjusted capital ratio also reflect the underlying risk appetite for the banks, albeit conditioned by the overall availability of growth capital. To illustrate, the PSBs, which typically face capital adequacy concerns, may be cautious with the growth capital, therefore exhibiting lower herding tendencies.

Another interesting observation, hitherto not discussed in the literature, is the impact of branch concentration and branch growth on bank herding. The branch concentration measured by HHI generally exerts a negative influence on the herding across bank groups and credit segments, except in a few cases. This implies that a rise in branch concentration has a beneficial impact on 'bank herding.' It is also corroborated by the positive sign of the coefficient for branch growth, especially for PSBs and FSBs. While, for PVBs, branch growth reduces bank herding. As evidenced in the literature, as banks venture into new domains, they face heightened informational costs, and they optimize the same by resorting to herding behavior. While PSBs have a widespread branch network, their new branches may be adopting aggressive business expansion strategies in highly competitive markets and may follow the incumbent for faster results. On the contrary, the PVBs, which relatively have lower footprints, may gain informationally by opening branches, resulting in lower herding values. Hence, comparatively, a bank with a more concentrated branch network is less likely to exhibit a herding tendency due to more excellent domain knowledge about local economic conditions and growth possibilities.

In general, the 'bank herding' implies sub-optimal decisions by banks leading to delinquencies. However, results suggest 'bank herding' affects the asset quality of Indian banks albeit negatively as opposed to the positive influence found in the literature. The 'herd measures' of the Indian banks possibly suggest that the NPA ratio falls as 'herding' rises. The negative impact of 'bank herding' on asset quality is observed in the secured and unsecured credit segment for PSBs and PVBs. In the bill, cash, and term loan segments, priority and non-priority credit segments for PSBs. The negative impact of herding can be on account of the 'credit shyness/capital conservation behavior' exhibited by the banks in the wake of macroeconomic uncertainty/heightened informational costs, preferring to cater to

[7] Thus 'herding' may be justified/ rational for the banks. Following Tran et al., (2017), in this study we do not separate the rational and irrational herding part but analyse the impact of macroeconomic and bank specific-industry factors on bank herding.

well-known borrowers/credit segments with higher security coverage and lower delinquencies. More importantly, the PSBs that hold the dominant share both in branches and assets show a negative response, suggesting that they supply lesser credit in the wake of uncertainty. The risk aversion tendencies may partly drive such behavior in the absence of proper risk-reward frameworks for the employees of PSBs. This is further corroborated by the sign and significance of the control variables like credit growth, cost to income ratio, and capital ratio. Credit growth has a negative and significant impact on asset quality across bank groups and credit segments, indicating that the delinquencies tend to be lower during the high growth phase.

Further, the cost to income ratio, which indicates inefficiency, has a positive and significant impact on the asset quality and is in line with the expectation that inefficient banks tend to have a higher share of bad assets. The capital ratio proxied by the capital to risk-weighted assets ratio has a negative and significant impact only in the case of FSBs, suggesting that foreign banks with higher capital adequacy are likely to be more risk averse than their domestic counterparts.

Conclusion

It is well established in the literature that banks constrained by information asymmetries tend to follow (herd) credit disbursement strategies of other banks to enhance their profits (or to survive). Given that the market-oriented reforms in the post-liberalization period posed varied challenges for the Indian banks of different ownership types in pursuing their growth strategies in terms of borrowers' information across the sectors resulting in plausible herding behavior over time. Therefore, this study examined whether the Indian banks across different ownership categories exhibited herding behavior in various credit segments for the sample period from 1995 to 2020. Further, we have examined the determinants of bank herding behavior by analyzing the influence of bank industry-specific and macroeconomic factors on herding measures. We also examined the influence of bank herding on bank asset quality.

Our findings based on the LSV herd measure indicate significant herding across credit segments and bank ownership types in the post-liberalization period. We also found that macroeconomic factors like GDP growth inflation had little impact on bank herding. On the contrary, the variables like change in the unemployment rate, M3 growth, T-bill rate, and monetary phase impact bank herding owing to their close association with bank interest rates. We also find that branch growth increases herding behavior, and banks with concentrated branch networks are likely to exhibit lower herding tendencies. Further, bank herding is negatively impacting asset quality, reflecting risk aversion on the part of the banks, specifically in public and private sector banks. Thus, in the Indian context, banks are likely to exhibit herding tendencies to avoid credit delinquencies and opt to concentrate branch networks in specific geographies. Such behavioral tendencies may result in banks attuning their strategies to limit risk taking and credit access.

Further, in the Indian context, credit delivery and ensuring inclusive credit access are still dependent on the physical branch networks. Hence, the geographical expanse of the branches provides the banks with requisite domain knowledge and aids in optimal risk taking, ensuring a stable flow of credit to the productive/focus sectors on a sustainable basis. Therefore, policy formulation for sustainable finance should internalize bank herding tendencies to promote inclusive development and protect the banks' financial stability.

Appendix I

Bank group-wise and credit segments wise—yearly mean LSV herding measures and *p* values from Chi-square test (95% confidence).

Year	BCTL PSB	Chi-test p value	BCTL PVB	Chi-test p value	BCTL FSB	Chi-test p value	SECU PSB	Chi-test p value	SECU PVB	Chi-test p value	SECU FSB	Chi-test p value	PNPL PSB	Chi-test p value	PNPL PVB	Chi-test p value	PNPL FSB	Chi-test p value
1995	0.07	0.01	0.04	0.53	0.15	0.02	0.10	0.05	0.19	0.00	0.17	0.01	0.18	0.00	0.34	0.00	0.37	0.00
1996	0.16	0.00	0.05	0.49	0.04	0.80	0.27	0.00	0.22	0.00	0.17	0.01	0.27	0.00	0.34	0.00	0.33	0.00
1997	0.13	0.03	0.10	0.04	0.08	0.31	0.19	0.00	0.12	0.03	0.08	0.43	0.22	0.00	0.33	0.00	0.20	0.00
1998	0.08	0.07	0.05	0.36	0.08	0.23	0.12	0.03	0.11	0.08	0.08	0.24	0.13	0.00	0.28	0.00	0.22	0.00
1999	0.17	0.00	0.08	0.18	0.05	0.69	0.13	0.02	0.09	0.19	0.07	0.42	0.19	0.00	0.26	0.00	0.18	0.00
2000	0.12	0.00	0.04	0.53	0.04	0.78	0.10	0.05	0.15	0.00	0.13	0.03	0.17	0.00	0.29	0.00	0.26	0.00
2001	0.10	0.03	0.07	0.20	0.08	0.23	0.14	0.00	0.14	0.00	0.08	0.22	0.12	0.00	0.25	0.00	0.18	0.00
2002	0.11	0.01	0.14	0.02	0.09	0.22	0.08	0.18	0.11	0.13	0.07	0.42	0.18	0.00	0.21	0.00	0.12	0.03
2003	0.03	0.53	0.08	0.29	0.05	0.64	0.20	0.00	0.14	0.03	0.07	0.32	0.19	0.00	0.28	0.00	0.16	0.00
2004	0.11	0.03	0.14	0.00	0.06	0.59	0.18	0.00	0.12	0.07	0.07	0.34	0.30	0.00	0.27	0.00	0.18	0.00
2005	0.06	0.22	0.06	0.50	0.00	1.00	0.05	0.40	0.12	0.19	0.18	0.13	0.22	0.00	0.19	0.03	0.24	0.01
2006	0.07	0.01	0.11	0.09	0.06	0.62	0.09	0.01	0.15	0.01	0.07	0.51	0.21	0.00	0.27	0.00	0.27	0.00
2007	0.12	0.00	0.13	0.02	0.04	0.88	0.11	0.01	0.23	0.00	0.15	0.03	0.16	0.00	0.29	0.00	0.26	0.00
2008	0.07	0.08	0.01	0.93	0.04	0.86	0.21	0.00	0.19	0.00	0.10	0.22	0.17	0.00	0.34	0.00	0.35	0.00
2009	0.11	0.00	0.07	0.41	0.04	0.88	0.11	0.02	0.18	0.00	0.13	0.07	0.21	0.00	0.26	0.00	0.26	0.00
2010	0.09	0.03	0.05	0.67	0.07	0.49	0.07	0.25	0.16	0.03	0.08	0.33	0.22	0.00	0.24	0.00	0.18	0.00
2011	0.06	0.11	0.14	0.01	0.12	0.07	0.08	0.09	0.16	0.00	0.16	0.01	0.15	0.00	0.33	0.00	0.32	0.00
2012	0.11	0.00	0.12	0.00	0.09	0.22	0.19	0.00	0.14	0.06	0.04	0.79	0.25	0.00	0.18	0.00	0.32	0.00
2013	0.14	0.00	0.17	0.00	0.16	0.00	0.27	0.00	0.21	0.00	0.09	0.14	0.22	0.00	0.22	0.00	0.23	0.00
2014	0.17	0.00	0.10	0.20	0.02	0.93	0.24	0.00	0.20	0.00	0.11	0.02	0.18	0.00	0.22	0.00	0.26	0.00
2015	0.14	0.02	0.16	0.01	0.02	0.93	0.20	0.00	0.09	0.19	0.11	0.05	0.22	0.00	0.28	0.00	0.27	0.00

Year	BCTL PSB	Chi-test p value	BCTL PVB	Chi-test p value	BCTL FSB	Chi-test p value	SECU PSB	Chi-test p value	SECU PVB	Chi-test p value	SECU FSB	Chi-test p value	PNPL PSB	Chi-test p value	PNPL PVB	Chi-test p value	PNPL FSB	Chi-test p value
2016	0.20	0.00	0.26	0.02	0.05	0.72	0.17	0.01	0.12	0.46	0.07	0.46	0.16	0.00	0.21	0.09	0.27	0.00
2017	0.05	0.71	0.09	0.14	0.10	0.05	0.04	0.86	0.11	0.23	0.02	0.93	0.13	0.01	0.22	0.00	0.16	0.00
2018	0.16	0.04	0.13	0.02	0.03	0.91	0.10	0.31	0.23	0.00	0.10	0.08	0.16	0.05	0.19	0.00	0.21	0.00
2019	0.15	0.07	0.11	0.11	0.05	0.53	0.00	1.00	0.13	0.05	0.14	0.01	0.09	0.28	0.31	0.00	0.21	0.00
2020	0.19	0.01	0.17	0.01	0.09	0.08	0.06	0.77	0.20	0.01	0.16	0.00	0.16	0.03	0.17	0.01	0.27	0.00

Chi-square test is conducted using Zi statistics specified in the methodology section.

Funding The authors have no relevant financial or non-financial interests to disclose.

Declarations

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

References

Acharya VV, Yorulmazer T (2008) Information contagion and bank herding. J Money Credit Bank 40(1):215–231. https://doi.org/10.1111/j.1538-4616.2008.00110.x

Acharya VV, Schnabl P, Suarez G (2013) Securitization without risk transfer. J Financ Econ 107(3):515–536. https://doi.org/10.1016/j.jfineco.2012.09.004

Ambrose BW, LaCour-Little M, Sanders AB (2005) Does regulatory capital arbitrage, reputation, or asymmetric information drive securitization? J Financ Serv Res 28(1):113–133. https://doi.org/10.1007/s10693-005-4358-2

Avery C, Zemsky P (1998) Multidimensional uncertainty and herd behavior in financial markets. Am Econ Rev 88(4):724–748

Banerjee AV (1992) A simple model of herd behavior. Q J Econ 107(3):797–817. https://doi.org/10.2307/2118364

Bapat D, Mazumdar D (2015) Assessment of business strategy: implication for Indian banks. J Strateg Manag 8(4):306–325. https://doi.org/10.1108/JSMA-06-2014-0047

Barron JM, Valev NT (2000) International lending by US banks. J Money Credit Bank 32:357–381

Behera HK, Ranjan R (2009) Dynamics of financial globalization and growth: some evidence from emerging market economics. Reser Bank India Occas Pap 30(2):1–36

Berger AN, DeYoung R, Genay H, Udell GF (2000) Globalization of financial institutions: evidence from cross-border banking performance. Brook Whart Pap Financ Serv 2000:23–120. https://doi.org/10.1353/pfs.2000.0001

Bikhchandani S, Hirshleifer D, Welch I (1992) A theory of fads, fashion, custom, and cultural change as informational cascades. J Polit Econ 100(5):992–1026. https://doi.org/10.1086/261849

Bikhchandani S, Hirshleifer D, Welch I (1998) Learning from the behavior of others: Conformity, fads, and informational cascades. J Econ Perspect 12(3):151–170. https://doi.org/10.1257/jep.12.3.151

Bonfim D, Kim M (2012) Liquidity risk in banking: is there herding. Eur Bank Center Discuss Paper 24:1–31. https://doi.org/10.2139/ssrn.2163547

Borio C, Furfine C, Lowe P (2001) Procyclicality of the financial system and financial stability: issues and policy options. BIS Papers 1(3):1–57. https://doi.org/10.2139/ssrn.1165494

Calem PS, LaCour-Little M (2004) Risk-based capital requirements for mortgage loans. J Bank Financ 28(3):647–672. https://doi.org/10.1016/S0378-4266(03)00039-6

Chang Y, Phillips PCB (1995) Time series regression with mixtures of integrated processes. Econom Theor 11(5):1033–1094

Devenow A, Welch I (1996) Rational herding in financial economics. Eur Econ Rev 40:603–615. https://doi.org/10.1016/0014-2921(95)00073-9

Fang H, Lee YH, Shen CH, Chung CP (2019) Motivations for loan herding by Chinese banks and its impact on bank performance. Chin World Econ 27(4):29–52. https://doi.org/10.1111/cwe.12285

Fang H, Lu YC, Shieh JC, Lee YH (2021) The existence and motivations of irrational loan herding and its impact on bank performance when considering different market periods. Int Rev Econ Financ 73:420–443. https://doi.org/10.1016/j.iref.2021.01.015

FSDR (2021) United nations, inter-agency task force on financing for development, financing for sustainable development report 2021. New York: United Nations, 2021. Available from: https://developmentfinance.un.org/sites/developmentfinance.un.org/files/FSDR_2021.pdf

Haiss P (2010) Bank herding and incentive systems as catalysts for the financial crisis. IUP J Behav Financ 7(1/2):30

Haveman H (1993) Follow the leader: mimetic isomorphism and entry into new markets. Adm Sci Quart. https://doi.org/10.2307/2393338

He D (2016) "Herd Behavior" in the Commercial Bank Credit Market. In: Dexu H (ed) Financial Security in China. Springer, Singapore, pp 33–45. https://doi.org/10.1007/978-981-10-0969-3_3

Heo Y (2019) The impact of bank herding on systemic risk. SSRN. https://doi.org/10.2139/ssrn.3366128

Inoue T, Hamori S (2014) Market efficiency of commodity futures in India. Appl Econ Lett 21(8):522–527. https://doi.org/10.1080/13504851.2013.872751
Jain AK, Gupta S (1987) Some evidence on" herding" behavior of US banks. J Money Credit Bank 19(1):78–89
Kannan R, Sanyal S, Bhoi B (2006) Monetary conditions index for India. Reserve Bank of India occasional papers 27(3)
Kirkpatrick G (2009) The corporate governance lessons from the financial crisis. OECD J Financ Mark Trends 2009(1):61–87. https://doi.org/10.1787/fmt-v2009-art3-en
Kumar S, Gulati R (2014) Deregulation and efficiency of Indian banks, Springer, New Delhi. https://doi.org/10.1007/978-81-322-1545-5
Lakonishok J, Shleifer A, Vishny RW (1992) The impact of institutional trading on stock prices. J Financ Econ 32(1):23–43. https://doi.org/10.1016/0304-405X(92)90023-Q
Liu C (2014) Herding behavior in bank lending: Evidence from us commercial banks. Available at SSRN 1917552. https://doi.org/10.2139/ssrn.1917552
Miller SR, Parkhe A (2002) Is there a liability of foreignness in global banking? An empirical test of banks X-efficiency. Strateg Manage J 23(1):55–75. https://doi.org/10.1002/smj.212
Mondschean TS, Pecchenino RA (1995) Herd behavior or animal spirits: a possible explanation of credit crunches and bubbles. In: Cottrell AF, Lawlor MS, Wood JH (eds) The causes and costs of depository institution failures. Springer, Dordrecht, pp 233–245. https://doi.org/10.1007/978-94-011-0663-4_10
Nakagawa R (2022) Bank herding in loan markets: Evidence from geographical data in Japan. Int Rev Financ. https://doi.org/10.1111/irfi.12341
Nakagawa R, Uchida H (2011) Herd behaviour by Japanese banks after financial deregulation. Economica 78(312):618–636. https://doi.org/10.1111/j.1468-0335.2010.00870.x
Nakagawa R, Oiwa H, Takeda F (2012) The economic impact of herd behavior in the Japanese loan market. Pac Basin Financ J 20(4):600–613. https://doi.org/10.1016/j.pacfin.2012.01.002
Narayan S, Narayan PK (2004) Determinants of demand for Fiji's exports: an empirical investigation. Dev Econ 42:95–112. https://doi.org/10.1111/j.1746-1049.2004.tb01017.x
Pal M (2020) Rational herding and financial fragility: lessons for the Indian banking system. Prajnan, 49(1)
Pedroni P (2001) Fully modified OLS for heterogeneous cointegrated panels. In: Baltagi BH, Fomby TB, Carter Hill R (eds) Nonstationary panels panel cointegration and dynamic panels advances in econometrics, vol 15. Emerald Group Publishing Limited, Bingley, pp 93–130. https://doi.org/10.1016/S0731-9053(00)15004-2
Persons JC, Warther VA (1997) Boom and bust patterns in the adoption of financial innovations. Rev Financ Stud 10(4):939–967. https://doi.org/10.1093/rfs/10.4.939
Phillips PCB (1995) Fully modified least squares and vector autoregression. Econometrica 63(5):1023–1078. https://doi.org/10.2307/2171721
Rötheli TF (2001) Competition, herd behavior, and credit cycles: evidence from major Swiss Banks. J Econ Bus 53(6):585–592. https://doi.org/10.1016/S0148-6195(01)00050-9
Scharfstein DS, Stein JC (1990) Herd behavior and investment. Am Econ Rev, 465–479. http://www.jstor.org/stable/2006678
Singh C, Pemmaraju S, Das R (2016) Economic growth and banking credit in India. IIM Bangalore Res Paper. https://doi.org/10.2139/ssrn.2882398
Thota N, Subrahmanyam ACV (2020) Bank total factor productivity convergence: evidence from India. Financ Res Lett 37:101357. https://doi.org/10.1016/j.frl.2019.101357
Tran VT, Nguyen H, Lin CT (2017) Herding behaviour in an Australian loan market and its impact on bank loan quality. Account Financ 57(4):1149–1176. https://doi.org/10.1111/acfi.12183
Ucal M, Bilgin MH (2009) Income Inequality and FDI in Turkey: FM-OLS (Phillips-Hansen) Estimation and ARDL Approach to Cointegration. https://mpra.ub.uni-muenchen.de/id/eprint/48765
Uchida H, Nakagawa R (2007) Herd behavior in the Japanese loan market: evidence from bank panel data. J Financ Intermed 16(4):555–583. https://doi.org/10.1016/j.jfi.2007.03.007
Zhang J, Liu P (2012) Rational herding in microloan markets. Manage Sci 58(5):892–912. https://doi.org/10.1287/mnsc.1110.1459

National Symposium on

BIG-BANG ECONOMIC REFORMS: OPPORTUNITIES & CHALLENGES

organized by

Department of Economics, Loyola College,

Nungambakkam, Chennai - 600 034.

LOYOLA ECONOMICS ASSOCIATION FOR DEVELOPMENT

CERTIFICATE

This is to Certify that ~~Dr.~~ / Mr. /~~Mrs.~~ /~~Ms.~~ ACV SUBRAHMANYAM, PH.D SCHOLAR,

of SCHOOL OF ECONOMICS, UNIVERSITY OF HYDERABAD

has participated in the National Symposium on Big-Bang Economic Reforms: Opportunities & Challenges held on 19th February 2020 and presented a paper entitled AMALGAMATION OF PUBLIC SECTOR BANKS - AN OVERVIEW AND ASSESSMENT

Rev. Dr. A. Thomas, S.J.
Principal, Loyola College

Dr. Melchias Gabriel
Deputy Principal , Loyola College

Dr. Elango J Parimalam
Head of the Department

Dr. Selvarani Micheal
Coordinator

Prof. S. Neeta
President - LEAD, Shift I

Dr. K. Rashi
President - LEAD, Shift II

56th ANNUAL CONFERENCE OF THE INDIAN econometric SOCIETY (TIES)

Madurai Kamaraj University

8 - 10 January 2020

CERTIFICATE

This is to certify that Mr/Ms/Dr. Subrahmanyam ACV ..... of University of Hyderabad, Hyderabad, Telangana ..... presented a research paper entitled. Effect of Bank Ownership on Transmission of Monetary Policy and Credit Growth in the post-reform period in the **56th Annual Conference of The Indian Econometric Society (TIES)** held during **08 – 10 January 2020,** organized by School of Economics, Madurai Kamaraj University, Madurai, Tamil Nadu, India.

Prof. N.R. Bhanumurthy
Secretary, TIES

Prof. D. Swamikannan
Local President

Dr. S. Pushparaj
Local Organising Secretary

Monetary Policy Transmission in India: Some Issues and New Evidence

by Acv Subrahmanyam

Submission date: 11-Nov-2022 10:04AM (UTC+0530)
Submission ID: 1950853690
File name: ACV_Subrahmanyam.pdf (2.05M)
Word count: 39968
Character count: 188465

Monetary Policy Transmission in India: Some Issues and New Evidence

ORIGINALITY REPORT

19%	4%	18%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	A. C. V. Subrahmanyam, S. Raja Sethu Durai. "Does ownership matter in bank herding behavior? Evidence from India", Journal of Social and Economic Development, 2022 Publication	15%
2	www.imf.org Internet Source	<1%
3	idus.us.es Internet Source	<1%
4	Olivero, M.P.. "Competition in banking and the lending channel: Evidence from bank-level data in Asia and Latin America", Journal of Banking and Finance, 201103 Publication	<1%
5	m.rbi.org.in Internet Source	<1%
6	ideas.repec.org Internet Source	<1%
7	rbidocs.rbi.org.in	

S. Rajasekhar 11/11/2022
SUPERVISOR
SCHOOL OF ECONOMICS
UNIVERSITY OF HYDERABAD
Hyderabad-500 046 (INDIA

	Internet Source	<1%
8	www.nibmindia.org Internet Source	<1%
9	www.congreso.gob.pe Internet Source	<1%
10	dyuthi.cusat.ac.in Internet Source	<1%
11	"Monetary Policy in India", Springer Nature, 2016 Publication	<1%
12	csep.org Internet Source	<1%
13	Leroy, Aurélien. "Competition and the bank lending channel in Eurozone", Journal of International Financial Markets Institutions and Money, 2014. Publication	<1%
14	mpra.ub.uni-muenchen.de Internet Source	<1%
15	bura.brunel.ac.uk Internet Source	<1%
16	ebin.pub Internet Source	<1%

17	Taniya Ghosh. "The Sectoral Impact of Monetary Policy Transmission in India: A Panel VAR Approach", Emerging Economy Studies, 2019 Publication	<1 %
18	pure.iiasa.ac.at Internet Source	<1 %
19	www.tandfonline.com Internet Source	<1 %
20	Yang, Jun, and Hanhua Shao. "Impact of bank competition on the bank lending channel of monetary transmission: Evidence from China", International Review of Economics & Finance, 2016. Publication	<1 %
21	"The Monetary Transmission Process", Springer Science and Business Media LLC, 2001 Publication	<1 %
22	Fungáčová, Zuzana, Riikka Nuutilainen, and Laurent Weill. "Reserve requirements and the bank lending channel in China", Journal of Macroeconomics, 2016. Publication	<1 %
23	www.bis.org Internet Source	<1 %

24	www.microfinancegateway.org Internet Source	<1 %
25	Submitted to American Intercontinental University Online Student Paper	<1 %
26	Shoukun Wang. "China's interregional capital mobility: A spatial econometric estimation", China Economic Review, 2016 Publication	<1 %
27	Submitted to University of Sydney Student Paper	<1 %
28	docs.iza.org Internet Source	<1 %
29	farmrelationship.dwperform.co Internet Source	<1 %
30	www.seacen.org Internet Source	<1 %
31	Perera, Anil, and J. Wickramanayake. "Determinants of commercial bank retail interest rate adjustments: Evidence from a panel data model", Journal of International Financial Markets Institutions and Money, 2016. Publication	<1 %
32	RANJAN KUMAR MOHANTY. "DOES FISCAL DEFICIT CROWD OUT PRIVATE CORPORATE	<1 %

SECTOR INVESTMENT IN INDIA?", The Singapore Economic Review, 2016
Publication

33	taxguru.in Internet Source	<1 %
34	Bienvenido S. Cortes, Danfeng Kong. "Regional Effects of Chinese Monetary Policy", International Journal of Economic Policy Studies, 2007 Publication	<1 %
35	Janak Raj, Joice John. "Steering interest rates amidst large structural surplus liquidity: a tale of three central banks", Indian Economic Review, 2020 Publication	<1 %
36	Jugnu Ansari, Saibal Ghosh. "Monetary Policy Pass-through, Ownership and Crisis: How Robust is the Indian Evidence?", Margin: The Journal of Applied Economic Research, 2021 Publication	<1 %
37	web.iima.ac.in Internet Source	<1 %
38	Ankit Kumar, Pradyumna Dash. "Changing transmission of monetary policy on disaggregate inflation in India", Economic Modelling, 2020 Publication	<1 %

39	Ben S Bernanke, Mark Gertler. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", Journal of Economic Perspectives, 1995 Publication	<1 %
40	Harry Aginta, Masakazu Someya. "Regional economic structure and heterogeneous effects of monetary policy: evidence from Indonesian provinces", Journal of Economic Structures, 2022 Publication	<1 %
41	pure.uvt.nl Internet Source	<1 %
42	research.aston.ac.uk Internet Source	<1 %
43	www.hindawi.com Internet Source	<1 %
44	Dang, Vinh Quang(Bhaumik, SK and Fidrmuc, J). "Efficiency, investment and bank lending in transition and emerging economies", School of Social Sciences Theses, 2010. Publication	<1 %
45	Submitted to M S Ramaiah University of Applied Sciences Student Paper	<1 %
46	repository.aust.edu.ng Internet Source	<1 %

47	Rakesh Arrawatia, Varun Dawar, Debasish Maitra, Saumya Ranjan Dash. "Asset quality determinants of Indian banks: Empirical evidence and policy issues", Journal of Public Affairs, 2019 Publication	<1 %
48	Robert W. Kling, T. Scott Findley, Emin Gahramanov, David M. Theobald. "Hedonic valuation of land protection methods: implications for cluster development", Journal of Economics and Finance, 2014 Publication	<1 %
49	Submitted to University of Dhaka Student Paper	<1 %
50	orca.cardiff.ac.uk Internet Source	<1 %

Exclude quotes	On	Exclude matches	< 14 words
Exclude bibliography	On		