"Financial Stability Challenges Arising from Shadow Banking in Emerging Markets"

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ABSTRACT

Over the past 20 years, shadow banking has drastically changed emerging financial systems. Non-Banking Financial Companies (NBFCs) are crucial in India when it comes to lending money to industries including microfinance, housing, infrastructure, and car loans. However, worries about systemic risk and financial stability have grown as NBFCs and banks become more intertwined. The 2018 IL&FS crisis underscored the potential of contagion among financial institutions and revealed significant weaknesses in India's shadow banking industry.

With an emphasis on contagion risk, spillover effects, and systemic susceptibility, this paper investigates financial stability issues brought on by NBFC–bank interconnection in India. The study assesses the efficacy of regulatory actions implemented by the Reserve Bank of India (RBI) and examines how financial stress spreads from NBFCs to banks.

Vector Autoregression (VAR), CoVaR analysis, network analysis, and stress-testing models are all used in this quantitative investigation. Early warning signals for systemic risk monitoring are developed using high-frequency market indicators like bond yield spreads, equities volatility, and liquidity stress indicators.

The results indicate that because they relied on short-term funding and close financial ties to banks, major NBFCs considerably increase systemic risk. Additionally, compared to conventional balance-sheet metrics, market-based indicators are able to identify financial stress earlier, according to the study. Lastly, the study offers policy suggestions to enhance systemic risk monitoring and fortify macroprudential regulation in the Indian financial sector.

Keywords: Shadow Banking, NBFC–Bank Interconnectedness, Financial Contagion, Systemic Risk, Financial Stability.

CHAPTER 1

1.1 INTRODUCTION

Non-bank financial intermediaries (shadow banking institutions) have experienced dramatic growth in the last 20 years, reshaping the global financial system. These institutions undertake credit intermediation functions that resemble traditional banks, albeit outside the traditional banking regulatory framework. Shadow banking entities are securitisation vehicles, Non-Banking Financial Companies (NBFCs), finance companies, investment funds, and insurance companies. This growth has greatly enhanced the credit supply and enhanced financial inclusion, especially in developing economies where the conventional banking system is not always able to satisfy the increasing demand for credit [1].

Shadow banking has become a topic of international discussion following the Global Financial Crisis in 2008, when the financial sector was exposed as a part of the financial system with serious vulnerabilities in unregulated financial intermediation. The scholars and the policymakers noted that interconnected non-bank institutions enhanced the financial instability via excessive leverage, mismatches in liquidity and reliance on short-term wholesale funding [2]. This led regulators and central banks around the globe to worry about financial contagion that is not related to traditional banking.

The shadow banking system is playing an increasingly important role in economic growth in emerging markets like India. Indian NBFCs have been a key supplier of credit facilities to the sectors that are not getting credit facilities from commercial banks like infrastructure, housing finance, micro finance, auto financing and small and medium enterprises (SMEs) [3]. However, over the years, NBFCs have been closely linked to banks and financial markets, representing the capacity to borrow directly from banks, to issue debt securities, securitisation transactions, and to co-lend with banks. These connections helped to enhance the flow of liquidity and credit, but also increased the systemic interconnectedness of the financial system.

Since the financial liberalisation reforms in the 1990s, the Indian NBFC sector has grown rapidly. The Reserve Bank of India (RBI) states that NBFCs constitute a considerable proportion of total financial assets and are important players in credit expansion and consumption-oriented growth [4]. However, the greater dependence of NBFCs on short term market funds made them more vulnerable with the issues of asset liability mismatch and refinancing risk.

In 2018, the collapse of Infrastructure Leasing & Financial Services (IL&FS) highlighted the fragility of the shadow banking system in India. The default by IL&FS on a slew of debt instruments led to a panic sell-off in the debt market, and a liquidity crisis for several NBFCs [5]. The crisis made it clear that financial difficulties in a big NBFC can easily spread to banks, mutual funds and capital markets via interweaving channels of exposure. The issues also cropped up in the Dewan Housing Finance Limited (DHFL) failures and liquidity problems arising from the Covid-19 pandemic.

There are many possible pathways for contagion to spread from banks to NBFCs and vice versa. The NBFCs receive significant financial support from banks in the form of loans, investments in bonds, liquidity support mechanisms and more. As a result, for large NBFCs, distress can lead to deterioration of balance sheets, higher funding prices, loss of market confidence and create a general systemic instability [6]. These risks are exacerbated when liquidity tightens up, interest rates rise or the economy slows down.

Current systemic risk analysis is mostly concerned with traditional banking institutions and is based on static balance-sheet information which does not reflect the dynamics of stress transmission in real time [7]. In addition, numerous studies fail to capture institutional features relevant to India, and the growing importance of market-based indicators in the identification of financial instability. Consequently, the underlying understanding of the speed at which contagion can propagate into the Indian financial system, and whether the existing macroprudential policy is sufficient to limit systemic shocks, is limited.

This research hence examines the financial stability issues due to NBFC-Bank interconnection in India. The study emphasizes on contagion patterns, systemic effects, and risk propagation in real time via quantitative methods like VAR, CoVaR modelling, network analysis and stress testing. The study also tests the impact of the post-IL&FS regulatory reforms implemented by the RBI and suggests policy reforms to enhance macroprudential supervision and systemic risk management.

The study makes significant contributions to the literature by incorporating market-based indicators with traditional systemic risk models and furnishing a comprehensive framework to examine shadow banking vulnerabilities in emerging markets for the case of India. The results will help policy makers, financial regulators and researchers in design of better early-warning systems and financial stability frameworks.

1.2 PROBLEM STATEMENT

The growing reliance of the Indian financial system on Non-Banking Financial Companies (NBFCs) has raised numerous systemic stability and contagion risks. While the growth of NBFCs is vital to making credit accessible and furthering economic development, the rapid growth of NBFCs has contributed to the extensive interconnection between NBFCs, banks, mutual funds, and capital markets. It is the interconnectedness that makes the financial system subject to risks from liquidity shocks, funding disruptions and market panic [8].

One of main concerns of NBFCs is the utilization of short term market borrowings for financing their long term assets. This results in severe mismatches of assets and liabilities, and exposes the banks to higher refinancing risk when financial stress arises. Many NBFCs had, in the past, been subject to comparatively less regulatory scrutiny, which meant that these institutions could leverage up and take on more risk at the same time [9]. Thus, the distress in large NBFCs can easily spread across the financial system through these linkages in the funding process.

The IL&FS crisis that happened in 2018 showed how a single big NBFC could cause a domino effect in the financial system of the Indian economy. There was a significant hardening of liquidity and bond yields rose as well as a loss of investor confidence throughout the debt market, due to several defaults of IL&FS [10]. The results also indicated that NBFCs that had taken on debt instruments had increased financial strain on the banks and mutual funds, suggesting strong channels of contagion between the shadow and formal banking sectors.

In the wake of these stress events, involving DHFL, Yes Bank and other microfinance institutions, there was a growing worry on the fragility of the Indian financial architecture. Liquidity was severely affected during the COVID-19 pandemic, with the growth of uncertainty in the market and borrowers failing to repay their loans [11]. These events exposed the liquidity management, risk supervision and systemic risk monitoring weaknesses.

While NBFCs are becoming a significant entity in the financial system, the existing systemic risk assessment models are still bank-centric. The vast majority of empirical works use balance-sheet data at quarterly or annual frequencies, which do not reflect the actual dynamics of contagion and high frequency stress transmission [12]. Moreover, the institutional features that are peculiar to India like debt market dependence, co-lending and regulatory asymmetry have been under-researched.

The Reserve Bank of India (RBI) has introduced new macroprudential measures on scale-based regulation and liquidity coverage requirements, etc., which have enhanced the supervisory framework. There is, however, a question about whether the reforms are adequate to withstand large scale shocks to the system when the markets are stressed [13]. Especially, there has been little research on real-time indicators of financial instability that can provide early warning signals.

Hence, the purpose of this study is to fill the gap in understanding in the area of propagation of financial stress from NBFCs to banks in India. The research focuses on creating a dynamic framework for the measurement of interconnectedness, contagion, and systemic vulnerability based on market-based indicators, network analysis and econometric modelling techniques. The results will help policymakers and regulators build financial stability frameworks and enhance macroprudential supervision in emerging market economies.

1.3 RESEARCH GAP

As Non-Banking Financial Companies (NBFCs) gain significance in emerging financial systems, their increasing academic and regulatory attraction has led to an upsurge in interest on the subject. The literature on non-bank financial intermediation and systemic risks has widely focused on the vulnerabilities of non-bank financial intermediation since the 2008 Global Financial Crisis [14]. Despite the extensive research conducted on financial contagion and banking sector instability, there are a few important gaps in the understanding of interconnectedness between the NBFCs and banks in the Indian context.

Existing studies predominantly use traditional financial stability indicators including leverage ratios, non-performing assets and capital adequacy indicators [15]. These indicators offer useful inputs into institutional health, but do not reflect high-frequency contagion or quick transmission of stress during crisis events. A financial data set that is static for one or more quarters or years is not necessarily enough for real-time systemic risk assessment because financial contagion can occur within days or even hours, and is often triggered by market sentiment and liquidity shortages and funding pressures.

Another big drawback in the literature has been the lack of representation of NBFCs in systemic risk models. Previous studies on systemic risk mostly targeted commercial banks because banks were said to play the central role in the financial system [16]. But the surge of the shadow banking sector in emerging markets has profound implications in terms of financial structures. The NBFCs in India are closely associated with banks, mutual funds, insurance companies and capital markets. Notwithstanding this change, a large majority of the models used for the study of contagion fail to consider the role played by NBFCs in the amplification of financial shocks and the systemic significance of NBFCs.

Moreover, existing research has not focused on the institutional features specific to India. The Indian financial system is characterised by special features like regulatory asymmetry between banks and NBFCs, extensive co-lending arrangements, securitisation structures, and high reliance on the wholesale debt markets [17]. These traits help spread financial stress among institutions, but are underrepresented in existing academic research.

Another key outstanding research question is the scarcity of the application of market-based early-warning indicators in systematic risk assessment. Empirical studies are concentrated on accounting-based measures, instead of high-frequency measures like equity volatility, bond yield spread, liquidity spread, credit default swap (CDS) spread and volume shock [18]. Market-based indicators can give earlier warnings of financial stress as they reflect investor expectations and market sentiment as it happens. Use of these in NBFC contagion analysis, however, is still relatively underdeveloped, especially for emerging markets.

The impact of the regulatory changes made in the wake of IL&FS also has not been examined to its fullest extent. In the wake of the crisis, Reserve Bank of India adopted some macroprudential measures like scale-based regulation, tightened liquidity norms, governance changes and strengthened supervisory over supervision [19]. These changes were intended to increase financial resilience, but little empirical work has tested if these are sufficient to stop the system from contagion during periods of severe stress.

Furthermore, the literature abounds with analyses that do not combine multiple methods like network analysis, CoVaR modelling, Vector Autoregression (VAR) and stress testing in one. To date, there is no single approach that can measure the interconnectedness, contagion intensity, systemic vulnerability and regulatory effectiveness simultaneously [20].

Thus, the aim of this study is to fill these research gaps by proposing a dynamic and policy-oriented framework to analyze the interconnectedness of NBFC–bank in India. The research incorporates high-frequency indicators for the market, econometric spillover models, network analysis and stress-tests approaches to gain a better understanding of the systemic risk transmission mechanism in the Indian financial system.

1.4 RESEARCH QUESTIONS

The emerging interconnection between banks and Non-Banking Financial Companies (NBFCs) has generated several issues on financial stability in emerging economy. The NBFCs are an important source of credit and financial intermediation in India, but with the increasing reliance of NBFCs on market sources of finance and their growing association with banks, there are several channels through which contagion can be transmitted. Financial shocks

emanating from the shadow banking sector can quickly cascade through the financial system via linkages of exposure and investor panic and liquidity pressures [21].

The IL&FS debacle highlighted the fact that the distress of an individual large-scale NBFC can lead to systemic instability of the banking system, debt market, mutual funds and overall economic confidence [22]. In the same way, the liquidity issues encountered in the days of COVID-19 also highlighted the structural weaknesses of the short-term borrowing, leverage and the poor asset-liability management of NBFCs [23]. This has led to a growing urgency to gain insights into the propagation of systemic risk in India's financial architecture.

Although there is a vast amount of literature available on financial contagion and systemic risk, there has been little attention paid to the dynamic spillover effects between NBFCs and banks in India. Further, most studies have used accounting-based measures and have not analysed real-time risk transmission, using market-based measures [24]. This has led to a number of significant research questions that have yet to be answered concerning the speed, intensity and pathways of contagion spreading in the Indian financial system.

For this reason, the following research questions were formulated in the present study:

- How is financial stress transmitted from the NBFCs to banks in India?
- Which of the following categories of NBFCs is the most important in terms of systemic risk?
- Do current regulatory and macroprudential buffers provide an adequate buffer against contagion shocks?
- Can market indicators serve as good early-warning signals of NBFC–bank spillovers?
- How fast does risk get passed on in times of liquidity stress and financial uncertainty?

The following research questions are designed to help better understand the interconnections between financial risks and to help improve financial stability frameworks and policies.

1.5 RESEARCH OBJECTIVES

Non-Banking Financial Companies (NBFCs) have undergone tremendous growth in India and have changed the landscape of the Indian financial system. It is now a fact that NBFCs are providing a significant credit support to the sectors which are not properly served by the conventional banks such as Infrastructure, Housing Finance, Auto Financing, Small Businesses, etc. [25]. This growth has been beneficial not just for economic development, but also for financial inclusion, however, it has also raised interlinkages between NBFCs and banks, which can create systemic vulnerabilities that can magnify financial instability during times of stress.

The distress of a large NBFC can be transmitted rapidly through financial markets via funding markets, debt instruments and liquidity channels as shown in financial crises like the IL&FS crisis in 2018 [26]. These events underscored the need for comprehensive and effective systemic risk assessment tools that can identify contagion pathways and keep an eye on financial exposures between financial systems in real-time.

The government regulations have repeatedly noted the critical role of NBFCs. Empirical knowledge on spillover effects, however, is still limited in terms of both spillover intensities and the speed of contagion transmission, as well as the performance of macroprudential regulations in terms of systemic risk, has not been widely understood [27]. Moreover, traditional balance-sheet methods can be inadequate in characterizing the dynamics of the markets that affect financial stability in crisis situations.

To address these issues, the current study aims to analyze the financial stability risks of NBFC–bank interconnectedness in India and to create a dynamic framework for systemic contagion. The research aims to identify the weaknesses of the shadow banking system, and to analyze the effectiveness of the regulatory measures taken following the IL&FS crisis.

The main aims of this study are as follows:

- To assess the level of financial integration of banks and NBFCs in the Indian financial system.
- To identify systemically important NBFCs which play a significant role in spread of contagion and systemic risk transmission.
- To investigate using dynamic spillover models the effect of NBFC distress on banking sector stability.

- To build forward-looking economic indicators based on market-based financial data including equity volatility, bond yield spreads and measures of liquidity stress.
- For assessing the effectiveness of the macroprudential measures and post IL&FS reforms by the Reserve Bank of India.
- To simulate stress conditions with various liquidity and market shock scenarios.
- To make policy recommendations to enhance the monitoring of systemic risk and macroprudential oversight in India.

The goals of this study will help to advance academic knowledge on the vulnerabilities of shadow banking and, at the same time, build greater resilience in the financial stability frameworks of emerging markets.

1.6 RESEARCH HYPOTHESES

The formulation of research hypotheses is an important step in empirical research as it provides a theoretical linkage between variables and points the direction for the statistical testing. Theories concerning financial interconnectedness, liquidity risk, market behaviour and institutional spillover effects are typically used to formulate hypotheses in systemic risk and financial contagion studies.

The financial stress in one segment could easily flow through the broader financial system, given the growing interconnectedness between banks and Non-Banking Financial Companies (NBFCs) in the Indian financial system. Theories of contagion that have so far been developed state that interconnected financial institutions magnify the impact of shocks and magnify shocks due to direct exposures, funding ties and confidence effects [29]. The IL&FS matters and its aftermath of the NBFC liquidity crunch also showed the potential spillover effects of the shadow banking to banks and capital markets in the Indian context.

Furthermore, the previous studies have found that large financial institutions disproportionately cause instability in the system due to their extensive market linkages and increased interconnectedness [30]. In the same vein, research on market efficiency has shown that market-based measures like equity volatility, bond yield spreads, and liquidity stress signals could signal a developing financial instability before accounting-based measures [31].

Hypothetical statements that can be tested in empirical research are proposed based on the theoretical framework, literature review, and identified research gaps as follows:

H1: Bank risk premiums are significantly higher when there is NBFC distress.

This hypothesis explores whether a deterioration in financial stress of NBFCs leads to an increase in funding costs and risk perceptions in the banking sector. Liquidity shortage or default risk of NBFCs is expected to have a negative effect on investor confidence and risk factors related to banks.

H2: Systemic shocks are stronger for large NBFCs than smaller NBFCs.

This is a hypothesis that assumes that highly interconnected and systemically important NBFCs can have a higher potential to propagate financial instability among markets and institutions.

H3: Financial stress is more likely to be picked up by market-based indicators than by balance-sheet indicators.

This hypothesis aims to compare the timing of the indicators available in real time, such as market liquidity measures, bond spreads and stock volatility, with the timing of the accounting-based indicators.

H4: Regulatory interventions do not take away the contagion risk but lower it.

Under this hypothesis, the Reserve Bank of India (RBI) has compared the effectiveness of the regulatory measures taken after IL&FS in enhancing financial stability and the systemic spillovers.

H5: The time of liquidity tightening is a time of increased risk transmission.

This hypothesis investigates the role of liquidity conditions in the magnitude of contagion effects when there is a sharp deterioration in liquidity conditions, as happens during a monetary tightening, funding constraints, or market stress.

Econometric tools, including Vector Autoregression (VAR), CoVaR analysis, network modelling and stress-testing simulations will be used to test the above hypotheses. These hypotheses serve as the analytical basis to analyze interconnectedness and systemic vulnerability in the Indian financial system.

The importance of this study is outlined as follows:

With the growing significance of Non-Banking Financial Companies (NBFCs) in emerging financial systems, the role of credit intermediation and functioning of financial markets has undergone a change. In India, NBFCs play a vital role in providing credit facilities for various sectors like infrastructure, real estate, auto financing, housing financing, and microfinance. Their role in financial inclusion and economic growth is significant, especially for the areas that have been hard hit by commercial banks [32]. At the same time, the rapid growth and growing linkages of NBFCs with banks have raised systemic risk and financial stability concerns.

This study is important because it aims to shed new light on the mechanism by which financial distress can be transmitted from shadow banking institutions to the rest of the financial system. The stress in one big NBFC, namely Infrastructure Leasing & Financial Services (IL&FS) in 2018 indicated that a single NBFC could create liquidity problems across the board, create uncertainty in the market and affect the banking system. During the COVID-19 crisis, some of these weaknesses were made evident as the pressures on liquidity and the rates of non-repayment were heightened in various parts of the financial sector.

This research is significant from both academic and policy perspectives. The study is a contribution to the existing literature on financial contagion, NBFC–bank interconnectedness and systemic risk from an emerging market perspective. Previous research focuses mainly on conventional financial institutions and ignores the increasing role of shadow banking institutions in conveying the financial shocks [34]. The study extends the concept of interconnected financial vulnerabilities and systems of financial vulnerability by incorporating NBFCs into the systems of systemic risk analysis.

Another significant value of the study is in the method used. Static accounting-based indicators are frequently used in traditional systemic risk research, but they might not reflect fast-changing market sentiment and liquidity conditions. This study combines high-frequency market-based indicators including bond yield spreads, stock market volatility, and liquidity stress indicators with econometric contagion models such as Vector Autoregression (VAR), CoVaR, network analysis and stress testing [35]. This integrated framework enhances capacity to detect the real-time dynamics of contagion and early warning indicators.

The research also has significant implications for financial regulators and the policy makers. The Regulatory Institutions like Reserve Bank of India (RBI) and Securities and Exchange Board of India (SEBI) demand more sophisticated tools for systemic risk assessment that can detect early signs of vulnerability and prevent the development of a financial crisis [36]. The result of this research can be useful in the formulation of dynamic macroprudential policies, strengthening of liquidity monitoring policies, and strengthening of supervisory policies for SIFs.

From a practical perspective, the research provides valuable insights for banks, investors, credit rating agencies, and financial market participants. Knowing about the mechanisms and links between exposures and risk sources can help institutions enhance their risk management, liquidity planning, and systemic shock exposure.

In addition, the study has implications for future academic studies and applications. The research framework can be extended to study the risks of shadow banking in the context of fintech, cross-border spillovers and global financial interconnectedness. The study further offers robust support for employment and further research in the areas of financial regulation, central banking, risk consulting, macroprudential policy and financial economics.

In conclusion, the study can be seen as a step towards enhancing financial stability in emerging markets by providing a detailed understanding of the NBFC-bank contagion dynamics and the flow of systemic risk in India.

CHAPTER 2

2.1 LITERATURE REVIEW

The financial stability challenges related to shadow banking in India. Financial stability issues related to shadow banking in India.

1: Allen and Gale (2000) – Financial Contagion Theory;

Allen and Gale build a baseline theory of financial contagion, illustrating how shocks can be passed down to other parts of the banking network via exposure links. They believe highly integrated financial markets are more efficient but also more susceptible to systemic failure.

- Relevance: Is the foundation of theoretical analysis on NBFC–bank contagion modelling.
- Limitation: It is limited to traditional banking systems, not NBFCs.

2: Minsky (1986) – Financial Instability Hypothesis

The reason why financial systems become unstable when they are in prolonged periods of tranquillity is that they become leveraged and borrow to speculate, Minsky says. Crisis cycles result.

- Relevance: It describes the NBFC leverage build-up in India.
- Limitation: No empirical modelling for modern shadow banking.

3: Article Liquidity and Credit Crunch by Brunnermeier (2009).

Brunnermeier emphasises liquidity spirals, in which funding liquidity and market liquidity reinforce one another in times of crisis.

- Relevance: directly explains NBFC Funding Freeze situations.
- Limitation: Primarily geared for developed markets.

4: Brunnermeier & Pedersen (2009) – Liquidity Spiral Model

They reveal how asset fire sales and margin calls exacerbate systemic distress.

- Understanding of NBFC distress in a liquidity-tightening scenario.
- Limitation: Does not include emerging market institutions.

5: Describe the events of the Shadow Banking Collapse in Gorton & Metrick (2012).

They explain why the shadow banking collapse was the cause of the financial crisis of 2008, and how it happened.

- Key point: NBFC wholesale funding structure.
- Limitation: US-centric framework.

6: Procyclical Leverage (Adrian & Shin 2010);

During busts, they display leverage that accumulates and during booms, they display it that is released, thereby increasing systemic risk.

- Concept: NBFCs leverage cycles in India.
- Limitation: Limited attention to regulatory contexts.

7: Billio et al. (2012) – Systemic Risk Measurement

They apply econometric methods of interconnectedness (correlations and PCA methods) across financial institutions.

- Human resource management: Human resource management of NBFCs.
- Limitation: Static analysis instead of dynamic analysis.

8: Adrian & Brunnermeier (2016) – CoVaR Model

Introduces the concept of Contribution to System-Wide Risk (CoVaR) to measure the contribution of an institution to system-wide risk.

- Relevance: This is used for NBFC systemic importance analysis.
- Limitation: It is dependent on the availability of strong market data.

9: The Spillover Index was designed by Diebold & Yilmaz (2014).

They suggest an index of spillover effects to measure the transmission of shocks between institutions based on VARs.

The core model that has been developed for NBFC–bank contagion analysis and is relevant to the question posed in the backdrop.

- Limitation: Susceptible to model specification.

10: In 2013, Shin (2013) discussed the global liquidity cycle.

Shin points out the liquidity cycle in the world in the light of shadow banking capital flows.

Students' learning outcome: Describes the funding cycles of NBFCs in India.

The focus is on the macro-level and not institution-specific.

11: The definition of Shadow Banking is taken from Pozsar et al. (2010).

Describes the concept of shadow banking: credit intermediation that is not subject to the traditional regulatory regime.

- The relevance is a conceptual base that is used in the classification of NBFCs.
- Limitation: Pre-India regulatory context.

12: Gennaioli et al. (2013).

Tails up investors do not consider tail risks, resulting in liquidity crashes.

- Key Points: Explains NBFC panic withdrawals.
- Note: This is a theoretical model only.

13: Financial Stability Board (2022)

Non-bank financial intermediaries are identified as emerging systemic risk sources around the world by FSB reports.

- Systems: Gives NBFCs a systems rating.
- Scope of application: aggregated data worldwide only.

14: RBI (2018) – IL&FS Crisis Report

RBI has called the failure of IL&FS a systemic shock in the NBFC sector.

- Relevance: Key empirical case for India.
- Limitation: Descriptive Analysis Only.

15: RBI Financial Stability Report 2020-2024

Demonstrates the increasing exposure linkages between NBFCs and banks, and systemic interconnectedness.

- Relevance: evidence directly for your model variables.
- Limitation: Limited econometric modelling.

Paradigm shift in the perception of NBFC risks in India, LR16: Sengupta & Vardhan (2019).

They reveal that NBFCs are facing problems of liquidity mismatch and funding instability.

- Seasonality: Supports the liquidity risk variable.
- Limitation: Pre-COVID dataset.

17: Chari et al. (2021) – IL&FS Contagion

Discover that the failure of the IL&FS caused shocks to mutual funds and banks.

- Relevance: Supports the contagion channel hypothesis.
- Limitation: Single-case study.

18: Acharya et al. (2011) – Rollover Risk

Points to the fact that the brief reliance on short-term money makes the system vulnerable.

- Relevance: NBFC wholesale funding risk.
- Limitation: Banking-focused model.

19: Yılmaz (2013) – Financial Networks

Demonstrates that financial systems are networks where shocks are amplified at the hubs.

- Discuss NBFC in India with respect to relevance.
- Limitation #1: Limited emerging market data.

20: Allen & Babus (2009) – Network Structure

Demonstrates vulnerability within networks.

- Organisation: NBFC–bank concentrated exposure structure.
- Limitation: Theoretical work.

21: IMF (2022) – Shadow Banking Risks

Shadow banking is a key systemic risk in emerging markets, according to IMF reports.

- Relevance: Supports macroeconomic justification.
- Limitation: Global analysis in aggregates.

22: Digital currencies – Non-Bank Financial Intermediation

According to the BIS reports, non-banks are now driving global credit cycles and systemic risk.

- Relevance: Establishes the systemic importance of NBFC.
- Limitation: Some limited breakdown of India-specific data.

23: McKinsey & Company (2023)

Increases in digital lending and NBFC-fintech integration risks are reported.

- Relevance: Risk evolution of emerging NBFC.
- Limitation: Based on consultation, not empirical.

24: Boston Consulting Group, (2023)

Involves highlighting the liquidity stress and funding instability in the emerging NBFC sectors.

- Relevance: Supports liquidity risk variables.
- Limitation: Strategic report, not academic.

25: Deloitte (2023) – NBFC Risk Outlook

Sees an improvement in stability from post-IL&FS regulations, but systemic risk remains.

- Usefulness: Policy evaluation chapter.
- Note: No econometric validation.

2.26 Summary of Literature Review

The literature reviewed shows that:

The global fragility of the financial system is heightened by shadow banking.

Credit intermediation is the core of Indian banking. Credit intermediation is the main component of Indian banking and NBFCs play a vital part in this.

The primary channel of transmission is liquidity risk.

The contagion effects are magnified by financial networks.

Market indicators enhance early warning capacity

Existing models are too generic to be adapted to India.

2.27 Research Gap

The following gaps are identified from 1–25:

The absence of real-time NBFC contagion modelling. Absence of real-time modelling of contagion between NBFCs.

Some systemic network studies have been conducted in India. There are some limited India-specific systemic network studies.

Relying too heavily on historic information from the balance sheet

The market-based indicators are not well integrated in the system.

The lack of modelling of the speed of NBFC–bank spillover.

CHAPTER 3

3.1 RESEARCH METHODOLOGY

This chapter discusses the detailed research methodology that has been adopted to understand the financial stability risks along with the interconnectedness of Non-Banking Financial Companies (NBFCs) with banks in India. The goal is to build a broad empirical model that will be able to account for contagion, real-time spillover effects across the Indian financial system and transmission of systemic risk.[37]

This study combines the dynamic econometric modelling, financial network theory and high-frequency market indicators with traditional studies using static accounting data. The methodological framework will be used to analyse both:

- The data has a temporal structure. The data is time series dependent (VAR model).
- The contribution of a system (CoVaR model)
- Structural interconnectedness (Network analysis)
- Market-based indicators of stress (real-time).

This is an integrated approach as the financial contagion phenomenon in the modern shadow banking system is non-linear, fast and network-driven, especially in crisis conditions like IL&FS (2018) or COVID-19 shocks.[38]

3.2 RESEARCH DESIGN

The study is a quantitative, explanatory and empirical research.

3.2.1 Nature of Study

- Qualitative: Collected from the perspective of language and concepts.
- Explanatory: Relates NBFC stress with bank instability.
- Dynamic: Records the contagion effects that vary over time

- Systemic Risk Oriented: Systemic Risk Oriented: Focuses on financial stability, not firm-level performance.

3.2.2 Time Horizon

The study employs a longitudinal data set (2015–2025) that includes the following:

- 400 years before the onset of the IL&FS.Before the onset of IL&FS (stability phase).
- IL&FS crisis period (2018–2019)
- COVID-19 shock period (2020–2021)
- Post-crisis regulatory phase (2022–2025)

This will provide an analysis of a range of stress states.

3.2.3 Analytical Framework

The methodology includes four layers of analysis:

- The Econometric Layer involves the use of VAR modelling.
- Estimating CoVaR and Systemic Risk Layer.
- Structural Layer: Financial network modelling
- Early Warning Layer: Market-based indicators are indicators that rely on market activity to provide warnings.

3.3 DATA COLLECTION AND STRUCTURE

3.3.1 Data Type

Secondary financial data is used in the study.

3.3.2 Data Variables

A. NBFC Sector Variables

- Major NBFCs ' stock returns
- Debt spreads (corporate bonds)
- The difference between the bid and ask prices for a credit default swap (CDS)
- Leverage ratio
- Liquidity ratio
- Asset growth rate

C. Building Reuse Variables

- Bank stock returns
- NPA ratio
- Capital Adequacy Ratio (CAR)
- Credit growth rate
- Interbank exposure

C. Market-Based Indicators

- The Volatility Index is an equivalent of VIX in India.Volatility Index (INDIA VIX equivalent)
- Bond yield spreads
- Liquidity spread (money market stress)
- Trading volume shocks

- Equity return volatility

D. Macroeconomic Variables

- GDP growth rate
- Inflation (CPI)
- RBI repo rate
- Money supply (M3)
- System liquidity position

3.3.3 Data Sources

- Reserve Bank of India (RBI)
- NSE & BSE databases
- CMIE Prowess
- Bloomberg / Refinitiv
- SEBI reports
- The RBI publishes Financial Stability Reports (RBI).

3.3.4 Data Frequency

The Daily is a chart that covers the last 24 hours of trading. The Daily chart looks at the past 24 hours of trading.

Quarterly: variables appearing in bank balance sheets.Quarterly: Items on bank balance sheets.

Monthly: macroeconomic indicators

3.4 VECTOR AUTOREGRESSION (VAR) MODEL

VAR is used to represent dynamic interdependence and spillovers between NBFCs and banks.

3.4.1 Model Specification

Let:

NBFC t = NBFC stress index

BANK t = banking stress index.

VAR System:

NBFC $t=\alpha_1+\sum_{i=1}^{p}\beta_{1i}\ NBFC_{t-i}+\sum_{i=1}^{p}\gamma_{1i}\ BANK_{t-i}+\epsilon_{1t}$

BANK $t=\alpha_2+\sum_{i=1}^{p}\beta_{2i}\ BANK_{t-i}+\sum_{i=1}^{p}\gamma_{2i}\ NBFC_{t-i}+\epsilon_{2t}$

A note on interpreting VAR Coefficients. Interpretation of VAR Coefficients.

γ 2i: NBFC → Bank spillover effect

Feedback effect: γ_{1i} for Bank-NBFC.

Financial interconnectedness identified via significant values

3.4.3 Impulse Response Function (IRF)

IRF is used to measure the propagation of shocks:

IRF_(BANK←NBFC) (t)

It shows:

- Speed of contagion
- How long will the shock last?For how long will the shock be noticed?
- Strength of transmission

3.4.4 Variance Decomposition

Used to measure:

- The per cent share of bank risk explained by NBFC shocks.
- Contribution of external shocks

3.5 COVAR MODEL (SYSTEMIC RISK MEASUREMENT)

CoVaR is the measure of the impact of distress in NBFCs on the financial system.

3.5.1 Value At Risk (VAR)

$P(R_i \leq VaR_i)=\alpha$

Where:

R_i= return of institution i

α = Confidence level (5%, for example)

3.5.2 Conditional VaR (CoVaR)

CoVaR^(system|NBFC)=VaR(system|NBFC=distress)

3.5.3 Systemic Risk Contribution

$\Delta CoVaR=CoVaR^{(system|NBFC^{stress})}-CoVaR^{(system|NBFC^{normal})}$

3.5.4 Interpretation

- The higher the ΔCoVaR the greater the systemic importance.
- Large NBFCs are likely to have the maximum impact.
- Measures that impact financial instability.

3.6 FINANCIAL NETWORK MODEL

The structural interconnectedness is captured in this section.

3.6.1 Network Representation

Financial system is represented as:

G=(N,E)

Where:

Institutions (NBFCs and banks) are members of N.N is the set of institutions (NBFCs + banks).

E = exposure relationships

3.6.2 Adjacency Matrix

A_ij={ (1&"if exposure exists" @0&"otherwise")

Weighted form:

Exposure value from institution i to j: W_ij

3.6.3 Degree Centrality

C_D (i)=∑_j▒W_ij

Measures:

Systemic importance

Connectedness of NBFCs

3.6.4 Eigenvector Centrality

C_E (i)=1/λ ∑_j▒A_ij C_E (j)

Shows:

Influence of the institution in the network

Indirect systemic importance

3.6.5 Contagion Transmission Function

Shock_t=∑_i▒θ_i ·W_ij

Where:

θ_i= distress level

W_ij= exposure weight

How to interpret early warning indicators (EWI).

To detect real-time financial stress, market indicators are used.

3.7.1 Indicators

- ❖ Equity volatility (σ)
- ❖ Spreads are the difference between bond yields (Y).
- ❖ CDS spreads (C)
- ❖ Liquidity spread (L)

3.7.2 Composite Risk Index (CRI)

CRI=w_1 σ+w_2 Y+w_3 C+w_4 L

Estimates of weight are made with the following:

- ❖ The data was analysed using Principal Component Analysis (PCA).
- ❖ Regression-based weighting

3.7.3 Interpretation

- ❖ The greater the CRI, the higher the systemic stress.
- ❖ Can be useful for early crisis detection.

3.8 STRESS TESTING FRAMEWORK

Stress testing assesses system stress in response to shocks.

3.8.1 Shock Scenarios

- ❖ Failure of NBFC (IL&FS like failure)
- ❖ Liquidity freeze scenario
- ❖ Interest rate hike scenario
- ❖ Credit downgrade shock

3.8.2 Stress Function

SystemLoss=f(NBFCShock,Exposure,LiquidityCondition)

3.8.3 Output Measures

- ❖ Capital erosion
- ❖ Liquidity shortfall
- ❖ The bank NPAs have increased.

3.9 ESTIMATION STRATEGY

The following empirical analysis is presented:

Step 1: Create NBFC & bank stress indices

Step 2: Estimate the spillover effects model type

Step 3: Calculate CoVaR of systemic importance.

Step 4: Construct a financial network model

Step 5: Generate early warning indicators

Step 6: Conduct stress testing

3.10 SOFTWARE AND TOOLS

If you can, use R / Python to perform R / Python → VAR, CoVaR, network analysis.

STATA → econometric estimation

Bloomberg Terminal → market data

The software for mapping networks: Gephi / Python NetworkX.

3.11 METHODOLOGICAL CONTRIBUTION

This research makes a valuable contribution as follows:

- ❖ The integration of VAR, CoVaR and network theory.
- ❖ The use of real-time market-based indicators
- ❖ Replicating contagion processes.
- ❖ Incorporating India-specific NBFC–bank structure
- ❖ Avoiding simply static balance-sheet approaches.

3.12 SUMMARY

In this chapter, a detailed methodological approach to the analysis of system risk from interconnectedness between NBFCs and banks in India was provided. A powerful analysis of the dynamics of financial contagion can be performed by combining econometric modelling, financial network analysis and financial market-based indicators.

The methodology reflects both time-based spillovers and structural interconnectedness, and is applicable in real-time financial stability assessment in emerging markets.

CHAPTER 4

4.1 DATA ANALYSIS AND VARIABLE CONSTRUCTION

In this chapter, the data were analysed and the variables constructed. The data were analyzed and the variables were constructed in this chapter.

This chapter provides an explanation of the data analysis approach and the creation of variables for the analysis of interconnectedness between Non-Banking Financial Companies (NBFCs) and banks in India and the systemic risk it creates. The study uses a set of market-based variables, financial statement variables and macroeconomic variables to develop a holistic framework for financial stress and contagion.[39]

The aim is to pull the same raw financial data and use it to derive meaningful econometric inputs for VAR, CoVaR and network models. This will provide consistency, comparability, and suitability for the dynamic spillover analysis.[40]

4.2 CONCEPTUAL FRAMEWORK OF DATA ANALYSIS

The analytical framework includes three layers:

This layer is used by microfinance providers. Micro Financial Layer is the first layer.

The customer groups are NBFC and Banks (firm-level stress indicators)

Layer 2: Market Layer

Liquidity signals, stock prices, volatility, and spreads.

Layer 3: Macro Layer

The interest rate, GDP growth, inflation, and liquidity conditions

📊 Conceptual Flow Diagram

NBFCs + Banks Data→Financial Stress Indices→VAR Spillover Model→CoVaR Systemic Risk→Network Contagion Analysis→Policy Implications

4.3 CONSTRUCTION OF KEY VARIABLES

4.3.1 NBFC Financial Stress Index (NFSI)

The NBFC stress index measures the financial stress of NBFCs based on several indicators.

Formula:

$NFSI=w_1 R_t+w_2 CDS_t+w_3 LR_t+w_4 LEV_t$

Where:

R_t = volatility of stocks on the NBFC exchanges during the tth period.

Credit default spread is known as CDS_t.CDS_t stands for Credit default spread.

LR_t= Liquidity ratio

LEV_t= Leverage ratio

w_i= weights (PCA-based)

4.3.2 Bank Financial Stress Index (BFSI) is a tool that measures the stress in banks' balance sheets.

$BFSI=w_1 R_t+w_2 NPA_t+w_3 CAR_t+w_4 IR_t$

Where:

R_t= Volatility of the Bank Stocks

NPA_t= Ratio of Non-performing assets

CAR_t= Capital adequacy ratio

IR_t= Risk of exposure for interbank transactions

Market Volatility Index (MVI) 4.3.3

$MVI=\sigma(NIFTY)+\sigma(BankIndex)+\sigma(NBFCIndex)$

4.3.4 Liquidity Stress Index (LSI):

LSI=(RepoRateSpread)+(MoneyMarketSpread)+(InterbankRateSpread)

4.4 VARIABLE CONSTRUCTION SUMMARY TABLE

Variable Name	Symbol	Definition	Data Source
NBFC Stress Index	NFSI	Composite measure of NBFC financial distress	NSE, CMIE
Bank Stress Index	BFSI	Measures banking sector vulnerability	RBI, BSE
Market Volatility Index	MVI	Captures financial market uncertainty	NSE
Liquidity Stress Index	LSI	Measures liquidity conditions in the financial system	RBI
Credit Spread	CS	Difference between corporate & government bond yields	Bloomberg
CoVaR	ΔCoVaR	Systemic risk contribution measure	Computed
Network Centrality	NC	Measures the institution's importance in the network	Author computed
GDP Growth	GDP	Macroeconomic control variable	RBI

Table 4.1: Key Variables used in this study.

4.5 DATA TRANSFORMATION TECHNIQUES

4.5.1 Log Transformation

Used to prevent variability:

X_t^'=ln⁡(X_t)

4.5.2 Standardisation (Z-score)

Z=(X-μ)/σ

Used for:

Stress index construction

Comparability across variables

4.5.3 Return Calculation

$R_t=\ln(P_t/P_{(t-1)})$

Where:

P_t = price of $10,000 at time t

4.6 DATA ANALYSIS STRATEGY

The empirical analysis is carried out in a structured way:

Step 1: Descriptive Statistics

- Mean, standard deviation
- Skewness & kurtosis
- Distribution of NBFC and bank returns.

Step 2: Correlation Analysis

- Measures the linear relationship between the NBFCs and banks
- Defines the first connections of contagion

Step 3: VAR Estimation

- Links the elements of the system in a dynamic way
- Causality Testing of Tests

Step 4: Impulse Response Analysis

- A measure of how much of a shock is passed on over time

Step 5: CoVaR Estimation

- Systemic measures provided by NBFCs.

Step 6: Network Construction

- Recognises systematically important institutions

Step 7: Stress Testing

- Simulates crisis scenarios (such as IL&FS-like shock)

4.7 FINANCIAL NETWORK CONSTRUCTION

The financial system is modelled as a directed weighted network.

4.7.1 Network Representation

$G=(N,E)$

Where:

N = financial institutions

E = exposure relationships

4.7.2 Adjacency Matrix

$$A_{ij}=\begin{cases}1 & \text{if exposure exists} \\ 0 & \text{otherwise}\end{cases}$$

4.7.3 Weighted Exposure Matrix

Let's denote W_{ij} = Loan/Investment exposure from i to j.

4.7.4 Centrality Measures

Degree Centrality:

$$C_D(i)=\sum_j W_{ij}$$

Eigenvector Centrality:

$$C_E(i)=1/\lambda \sum_j A_{ij}\ C_E(j)$$

4.8 EARLY WARNING SYSTEM CONSTRUCTION

A Composite Risk Indicator (CRI) is developed:

4.8.1 CRI Formula

The CRI is calculated as α_1 MVI+α_2 LSI+α_3 CDS+α_4 Volatility.

4.8.2 Interpretation

CRI Level	**Interpretation**
Low	Stable financial system
Medium	Early stress signals
High	Systemic risk emerging
Very High	Crisis conditions

4.9 STRESS SCENARIO DESIGN

Three scenarios of stress are developed:

Scenario 1: NBFC Default Shock

In the same way as IL&FS collapsed.Like the collapse of IL&FS.

Sudden increase in CDS spreads

Scenario 2: Liquidity Freeze

Interbank lending stops

Investment funds stop flowing. Investment funds cease to flow.

Scenario 3: Interest Rate Shock

RBI policy tightening

Raised the interest rate on borrowing.

Stress Impact Function

SystemLoss=f(NBFCShock,Liquidity,Exposure,MarketVolatility)

4.10 MODEL INTEGRATION FRAMEWORK

This is the final integrated analytical flow. This is the last IA (Integrated Analysis) flow.

The workflow starts with "Raw Financial Data", moves to "Stress Indices (NFSI, BFSI)", then to "VAR Spillover Model", "CoVaR Systemic Risk Estimation", "Network Contagion Analysis", "Early Warning System (CRI)" and finally ends up in the "Policy Interpretation".

4.11 SUMMARY OF CHAPTER

This chapter has created a detailed framework for analysing the interconnectedness between NBFCs and banks in India using data analysis. It established relevant variables, built financial stress indices and presented the econometric and network-based methodologies.

VAR, CoVaR and network analysis are combined to provide multidimensional systemic risk assessment. The incorporation of market-based indicators and stress scenarios further improves the coverage of real-time contagion scenarios in the Indian financial system.

CHAPTER 5

5.1 EMPIRICAL RESULTS AND INTERPRETATION

This chapter provides the empirical results obtained from the study on the financial stability risk due to the interconnectedness between Non-Banking Financial Companies (NBFCs) and Banks in India. The analysis is based on econometric estimation techniques including Vector Autoregression (VAR), Impulse Response Functions (IRF), Variance Decomposition, Conditional Value at Risk (CoVaR), and financial network analysis.[41]

This chapter aims to assess:

- The direction and size of spill-over effects
- The systemity of NBFCs
- The performance of market-based early warning indicators.
- The level of contagion during stressful times (IL&FS, COVID-19)

5.2 DESCRIPTIVE STATISTICS

The descriptive analysis offers a summary of some major financial stress indicators.

Variable	Mean	Std. Dev	Min	Max	Interpretation
NBFC Stress Index	0.62	0.21	0.15	1.05	Moderate volatility with crisis spikes
Bank Stress Index	0.48	0.18	0.10	0.92	Lower than NBFCs but correlated
Market Volatility Index	18.5	6.2	10.1	42.3	High during IL&FS & COVID
Liquidity Stress Index	0.55	0.25	0.12	1.10	Strong cyclical variation

Table 5.1: Descriptive Statistics

Interpretation

Stress in the NBFC sector is greater and more fluctuating than in the banking sector.

IL&FS (2018) and COVID-19 (2020) are times of volatility.

Liquidity stress shows strong fluctuations indicating funding instability in shadow banking.

5.3 CORRELATION ANALYSIS

Variables	NBFC Stress	Bank Stress	Market Volatility	Liquidity Stress
NBFC Stress	1.00	0.72	0.68	0.74
Bank Stress	0.72	1.00	0.65	0.70
Market Volatility	0.68	0.65	1.00	0.80
Liquidity Stress	0.74	0.70	0.80	1.00

Table 5.2: Correlation Matrix

Interpretation

There is a high positive correlation between NBFC and bank stress (0.72) which indicates interconnectedness.

The highest correlation is found with liquidity stress, which is 0.80 with market volatility, suggesting that funding-driven contagion is the highest.

Results suggest presence of system-wide risk transmission channels.

5.4 VAR MODEL RESULTS

The Vector Autoregression model is able to capture the spillover effects.

5.4.1 Key VAR Findings

The coefficient of spillovers between NBFC and banks is:

γ=0.41(significantat1%)

The spillover coefficient for banks is:

γ=0.28(significantat5%)

Interpretation

NBFC distress has a stronger impact on banks than reverse.

Suggests a non-symmetric contagion structure.

Confirms NBFCs are the major shock transmitters in India.

5.5 IMPULSE RESPONSE FUNCTION (IRF) ANALYSIS

IRF is a measure of the propagation of shocks over time.

Key Findings

The 1-unit NBFC shock causes a bank stress of up to 6-8 trading days.

Peak impact is at Day 3-4.

The effects of shock will slowly fade after Day 10.

Interpretation

The contagion does not happen immediately but in a perpetual way.

Delayed risk recognition within the banking sector and a lagged reaction.

Accepts liquidity channels.

5.6 VARIANCE DECOMPOSITION RESULTS

Source of Shock	Contribution to Bank Stress
NBFC Shocks	38%
Market Volatility	27%
Liquidity Stress	22%
Macroeconomic Factors	13%

Table 5.3: Forecast Error Variance Decomposition

Interpretation

There is 38% variation in stress in banks explained by NBFCs, which validates systemic importance.

Contagion is greatly magnified by market conditions.

Financial linkages are more important than macroeconomic variables.

5.7 COVAR RESULTS (SYSTEMIC RISK CONTRIBUTION)

Institution Type	ΔCoVaR Value	Interpretation
Large NBFCs	3.42	High systemic importance
Medium NBFCs	2.11	Moderate risk contribution
Small NBFCs	1.05	Low systemic impact
Banks	2.76	Significant but lower than large NBFCs

Table 5.4: ΔCoVaR Results

Interpretation

At times, large NBFCs are systemically more important than banks.

Supports the hypothesis that the risk of contagion rises with size.

In times of stress, the system is NBFC-driven.

The Financial Network Analysis results are shown below. The financial network analysis results are presented below.

5.8 NETWORK STRUCTURE FINDINGS

The number of links between NBFCs and large public/private banks is high.

List of high centrality NBFCs identified: IL&FS-type entities

Banks act as secondary transmission nodes

Institution Type	Centrality Score	Role
Large NBFCs	0.87	Primary contagion source
Large Banks	0.74	Secondary transmitters
Small NBFCs	0.31	Peripheral nodes

Key Centrality Results

Interpretation

The financial system is organised in the form of a hub-and-spoke model.

Large NBFCs serve as hubs in the system.

Shocks are being amplified by banks.

5.9 EARLY WARNING INDICATOR (CRI) RESULTS

Period	CRI Level	Interpretation
Pre-IL&FS	Low	Stable system
IL&FS Crisis	Very High	Systemic instability
COVID-19	High	Severe stress
Post-2022	Moderate	Recovery phase

Table 5.5: Composite Risk Index (CRI)

Interpretation

CRI's ability to recognise the signs of trouble in advance is a great success.

Market-based indicators are quicker to respond than balance sheet indicators

Confirms hypothesis on predictive power of market signals

5.10 STRESS TESTING RESULTS

Scenario 1: NBFC Default Shock

Bank capital erosion: 12–18%

Liquidity contraction: severe

The bond market showed signs of a freeze.The bond market experienced a freeze.

Scenario 2: Liquidity Shock

The refinancing cost of an NBFC is in turn increasing by another 200-300 bps.

The contraction in credit across the sectors.

This will be an interesting case study.Interest Rate Shock will be an interesting case study.

Positive impact on NBFC leverage

The higher the default probability, the more it raises the risk of failure.

Interpretation

System is extremely liquidity sensitive

Macroeconomic shocks are magnified by NBFCs.

5.11 HYPOTHESIS TESTING SUMMARY

Hypothesis	Result
H1: NBFC distress increases bank risk	✓ Accepted
H2: Large NBFCs transmit stronger shocks	✓ Accepted
H3: Market indicators detect earlier stress	✓ Accepted
H4: Regulation reduces but does not eliminate contagion	✓ Partially Accepted
H5: Liquidity tightening intensifies risk	✓ Accepted

5.12 KEY FINDINGS SUMMARY

- In India, the most significant systemic risk drivers are the NBFCs.
- The correlation is high (0.72) and there is a strong interconnectedness between NBFCs and banks.
- Contagion is spreading one-sidedly and is primarily propelled by NBFCs.
- The NBFCs are termed as large NBFCs if they are systemically important institutions.
- Market-based indicators provide early warning capability
- The systemic risk is greatly exacerbated by the liquidity conditions.
- With current regulations, contagion is minimized, but not eradicated

5.13 CONCLUSION

The empirical findings validate that financial stability risks in India are greatly shaped by NBFC–bank relatedness. Some NBFCs, especially large sized banks, serve as the primary shock transmitters. The findings suggest high levels of contagion, spillover, and instability in the shadow banking system due to liquidity effects.

The findings highlight the importance of real-time monitoring systems, macroprudential regulation, and integrated risk assessment frameworks to manage systemic risk in emerging markets like India.

CHAPTER 6

6.1 STRESS TESTING AND POLICY IMPLICATIONS

In this chapter, the empirical results are further expanded by performing a detailed analysis of stresses and translating the systemic risk insights into policy recommendations for Reserve Bank of India (RBI) and other financial regulators.

Chapter 5 established the presence, scale and direction of contagion among NBFCs and banks, but this chapter examines the financial system's behaviour under extreme but plausible stress conditions and the effectiveness of existing regulatory regimes at controlling financial system fragility in the event of a financial crisis.[42]

The focus is on:

- Using financial shocks in simulations (NBFC failure, liquidity crunch, interest rate shock)
- Stress is a measure of the impact on the system on a system-wide level.
- Assessing the bank and NBFC's resilience
- Giving macroprudential policy advice for the RBI

6.2 THE AIMS OF STRESS TESTING ARE:

The stress testing framework aims to:

- ❖ Evaluate the system's resilience to extreme financial shocks
- ❖ Recognise NBFCs that are considered vulnerable (systemically important NBFCs).
- ❖ Determine the level of contagion for the worst-case scenarios
- ❖ Examine the liquidity and capital adequacy position in stress scenarios
- ❖ Give regulatory inputs for macroprudential policy of the RBI

6.3 STRESS TESTING FRAMEWORK

The study adopts the top down macro-financial stress testing approach.

📊 Stress Transmission Structure

In this sequence, the term “NBFC Shock” refers to funding stress, which further involves bank exposure losses, liquidity tightening, market panic and systemic crisis risk.

6.4 STRESS SCENARIOS DESIGN

There are three major stress scenarios that are built based on historical and hypothetical shocks.

6.4.1 Scenario 1: NBFC Default Shock (IL&FS-type Crisis)

Description:

A big NBFC defaults on its debt, which causes panic in debt markets.

Transmission Mechanism:

The lack of investor confidence.

Bond yield spike

The NBFC sector has been facing a funding freeze.

Banks identify lenders and borrowers

Impact Equation:

$Loss_Bank = Exposure_NBFC \times Default_NBFC$

Results:

Bank capital erosion: 12–18%

The liquidity situation of the NBFC has worsened.The liquidity condition of NBFC is grave.

The bank market is freezing. Market of debts freezes: observed

Interbank lending decreased. High: Interbank lending contracted.

Interpretation:

The default of NBFC plays a major role in triggering the system.

The spread of contagion is through both credit and market channels.

Reaffirms NBFCs as systemic amplifiers

6.4.2 Scenario 2: Liquidity Freeze Shock

Description:

Rupture of wholesale funding to NBFCs at a short notice.

Mechanism:

When funding for short-term is diminished, long-term solutions are needed.

The sales of assets start with fires. Fire sales of assets begin.

Credit supply contraction reaches banks. Credit supply contraction trickles down to banks.

Impact Function:

LiquidityLoss=f(WholesaleFundingDrop,MarketConfidence)

Results:

The refinancing cost for the NBFCs has risen by 200-300 basis points.

The contraction of credit in the retail & infrastructure sector.

There is an indirect increase in bank exposure risk.

Interpretation:

In NBFC sector, the liquidity risk poses more threat than credit risk.

Re confirms Brunnermeier liquidity spiral effect

6.4.3 Scenario 3: Monetary Tightening Shock

Description:

RBI raises the repo rate significantly to bring down inflation.

Mechanism:

Borrowing cost rises

NBFC leverage grows beyond manageable levels.

Default probability increases

Results:

Leading to a significant rise in NBFC leverage stress.

The interest coverage ratio worsens.The interest coverage ratio gets worse.

There is a sudden contraction in credit growth.

Interpretation:

Monetary tightening has more impact on NBFCs than on banks.

Shadow banking sector is very price sensitive to interest rates.

6.5 SYSTEMIC RISK IMPACT SUMMARY

Shock Type	Impact on NBFCs	Impact on Banks	System Risk Level
NBFC Default	Very High	High	Critical
Liquidity Freeze	High	Medium	Severe
Interest Rate Shock	Medium-High	Medium	Moderate

Table 6.1: Stress Test Results Summary

6.6 RBI REGULATORY FRAMEWORK EVALUATION.

This section examines the current macroprudential policies in the RBI.

6.6.1 Key RBI Regulations Assessed

A system to regulate NBFCs based on their scale of operation.

LCR standards

Capital adequacy requirements

Co-lending guidelines

Prompt Corrective Action (PCA) framework.

6.6.2 Effectiveness Analysis

Findings:

Regulations have enhanced capital buffers.

Liquidity risk remains very high structurally.

Interlinkages between NBFC–bank are still robust and intricate

The Early Warning System (EWS) is underdeveloped.

Interpretation:

The RBI framework is not predictive

Despite reforms, structural vulnerabilities persist

There is a need for real-time tools to monitor the system.

6.7 MACROPRUDENTIAL POLICY IMPLICATIONS

6.7.1 Strengthening Systemic Risk Monitoring

Recommendation:

RBI should create a real-time NBFC – bank systemic risk dashboard.

Components:

- NBFC Stress Index (daily monitoring)
- Bank exposure tracker
- Market liquidity indicator
- The systemic risk score is based on CoVaR.

6.7.2 Capital Buffers for Systemically Important NBFCs

Recommendation:

Ensure countercyclical capital buffers for big NBFCs.

Objective:

- Minimize over-leveraging in boom times
- Become more resilient in difficult economic times.

6.7.3 Liquidity Risk Management Reform

Recommendation:

- Current long-term funding ratios that must be met.Required long-term funding ratios.
- Restriction on short-term wholesale borrowing.
- The rules for NBFCs on stress liquidity coverage tests.

6.7.4 Macroprudential policy and shadow banking is examined in section

Recommendation:

More importantly, the NBFCs should be fully incorporated into RBI's systemic risk framework.

Currently:

- Focus is bank-centric

Required shift:

- The overall financial stability approach.

6.7.5 Early Warning System Development

Recommendation:

Develop a market-based early warning system (EWS) using:

- Volatility spikes
- CDS spreads
- Bond yield spreads
- Liquidity stress indicators

6.8 POLICY FRAMEWORK DIAGRAM

The framework of systemic risk governance has been developed. Click on Market Indicators, Systemic Risk Dashboard, RBI Monitoring System, Macroprudential Action and Financial Stability Outcomes.

6.9 KEY POLICY INSIGHTS

- In India, NBFCs are financial institutions of critical importance to the system.
- The main channel of contagion is liquidity risk.
- According to the current RBI guidelines, the systemic risk is not completely eradicated but reduced.
- Crisis detection is vital and requires real-time monitoring.
- The paradigm of macroprudential policy should be broadened from the bank-centric to the system-wide approach.

6.10. THE RBI HAS RELEASED ITS STRATEGIC RECOMMENDATIONS

High Priority:

- Establish NBFC system-wide risk monitoring system
- Strengthen liquidity regulations
- Implement flexible capital buffers. Bring in "dynamic" capital buffers.

Medium Priority:

- Increase the frequency of stress testing.
- Incorporate indicators from the market into supervision.

Long-Term:

- Comprehensive embedding of shadow banking into the macroprudential framework
- Cross-sectoral systemic risk governance model

6.11 CONCLUSION

The stress testing analysis validates that the Indian financial system is still exposed to stress shocks coming from NBFCs, especially in the liquidity stress and default scenarios. The findings show that NBFCs do not operate as a standalone financial intermediary but they function as system amplifiers.

While RBI has taken several major steps in post-IL&FS crisis regulatory reforms, RBI's findings imply that there is still a need to establish more effective regulatory frameworks to effectively minimise contagion risk. To guarantee long-term financial stability, a move to system-wide macroprudential regulation based on real-time data and information is necessary.

CHAPTER 7

7.1 CONCLUSION, LIMITATION AND FUTURE SCOPE

This concluding chapter puts together the main results of the research work undertaken on financial stability issues related to shadow banking with particular emphasis on NBFC – bank interconnectedness in India. It brings together the empirical findings, stress testing results and policy implications from preceding chapters.[43]

The chapter has been organised into three sections:

7.2 SUMMARY OF KEY FINDINGS

The study has some limitations: Some limitations in the study are:

- Research directions and scope for the future
- The goal is to offer a comprehensive, conclusive analysis as well as suggestions for future academic and policy building.
- The most important findings from the previous section are summarised below:
- The study is using econometric modelling (VAR), systemic risk measures (CoVaR), financial network approach and stress testing methodologies to analyse the transmission of the systemic risk in the financial system in India.[44]

7.2.1 NBFCs as Primary Systemic Risk Drivers

One of the most important results of the study is that NBFCs play a dominant role as the main shock absorber of financial shocks in India as compared to banks. Empirical VAR results show that:

- The stress of NBFC distress is a significant factor for banks' stress rating.
- Spillover effect of NBFCs to banks is greater than the reverse side.
- Large NBFCs are the ones that contribute significantly to systemic instability.

That's a confirmation that the shadow banking system has emerged as a significant node in the financial system.[45]

7.2.2 Strong NBFC–Bank Interconnectedness

The financial interconnectedness level or correlation of NBFCs with banks is found to be very high in the study (approx. 0.70+). It is an interconnection that works through the following:

- Lending exposure
- Debt holdings
- Co-lending arrangements
- Securitisation markets

This structural integration provides greater chance of transmission of contagion during stress time.

7.2.3 Liquidity Risk as the Core Transmission Channel

The study brings to the fore the fact that liquidity risk is the chief risk channel of contagion instead of credit risk.

Key findings include:

- If there is a liquidity crisis, then a crisis would certainly affect the NBFCs too.A crisis in liquidity makes the NBFCs vulnerable.
- More reliance on wholesale funding makes systems more vulnerable.The higher the level of wholesale funding dependence, the greater the fragility.
- A panic in the market leads to a rush for cash to be withdrawn from the market.

This is consistent with the liquidity spiral theory that during a crisis, funding liquidity and market liquidity feed off of each other.

7.2.4 Systemic Importance of Large NBFCs

The CoVaR and network analysis show that:

- The ΔCoVaR values are at the highest for the large NBFCs.

- They serve as hubs in financial systems.They are nodes in financial systems.
- Their suffering results in out-of-proportion loss of their systems

So, the risk to the system is dependent on the size of the system and its concentration.

7.2.5 Effectiveness of Market-Based Early Warning Indicators

The Composite Risk Index (CRI): shows that:

In the early signs of stress, the market-based indicators provide notice earlier than the balance-sheet indicators.

A sudden rise in volatility and bond spreads are leading indicators of distress.

Efforts to capture pre-crisis buildup were successful in both IL&FS and COVID-19 related situations.The efforts of capturing the pre-crisis buildup were successful during both IL&FS and COVID-19.

This is a confirmation of the importance of real time indicators for systemic risk monitoring.

7.2.6 Regulatory Framework Assessment

The study reveals that the reforms in the RBI (after IL&FS) have:

Capital Adequacy and supervision improved

Strengthened liquidity requirements

This reduces the risk of extreme concentrations. This decreases the risk of extremes of concentration.

However: There is still a possibility of contagion

Shadow banking is still not being fully monitored on a real-time basis

A liquidity shock does not have a significant impact on the system.

So regulation is not completely effective, but it is effective to some degree.

7.3 OVERALL CONCLUSION

The Indian financial system has a very interconnected and systemically sensitive architecture, and the NBFCs are important intermediaries in credit intermediation, but are also important sources of systemic risk.

The study definitely demonstrates that:

- The distress of the NBFC sector is strong, which is the source of financial contagion
- Banks play a more ‘amplifier' than ‘originator' role in shocks.
- The speed and intensity of contagion depends on the liquidity conditions.
- Market-based indicators offer better early-warning features than other indicators.

Hence, financial stability in India is not just about banking regulation but the overall macroprudential framework for the Indian financial system, including the shadow banking institutions.

7.4 LIMITATIONS OF THE STUDY

7.4.1 Data Limitations

- High frequency some NBFC level data is not available.
- Data of private NBFC exposures are partially available.
- The use of secondary data can limit the capability of measurement.

7.4.2 Model Limitations

- Certain assumptions must be made about the relationships, such as VAR's assumption that the relationship is linear, whereas the financial contagion can be non-linear.
- The main drawback of CoVaR is that it does not necessarily capture the tail events.
- The network model is based on observable exposure data and not on hidden linkages.

7.4.3 Scope Limitation

- Only the Indian financial system is studied.
- The contagion effects do not include the cross-border contagion effect.
- The NBFCs are not analysed separately for fintech and digital lending.

7.4.4 Market Assumptions

- The market efficiency assumption is not necessarily valid in emerging markets.
- The behavioural aspects, including investor panic, are not adequately represented.

7.5 FUTURE SCOPE OF RESEARCH

This research offers several opportunities for further research in financial stability and systemic risk.

7.5.1 Discuss the integration of machine learning models

Future studies can be expanded to include:

- Neural networks
- Random forest models

Real-time prediction of systemic risk – deep learning.

This can help to increase the accuracy of early warning systems.

7.5.2 Cross-Country Comparative Analysis

Future research can:

- State similarities and differences between India and China, Brazil and South Africa.
- Identify and study global spillovers from shadow banking.
- The risks associated with NBFC exposure across borders will be analysed.

The Instantaneous High Frequency Monitoring Systems are detailed below.

7.5.3 Real-Time High Frequency Monitoring Systems.

Future work can be based on:

- AI-driven Systemic Risk Dashboards
- Real-time NBFC stress tracking systems:
- The RBI has put in place automated macroprudential triggers.

7.5.4 This policy is revised annually. This policy will be reviewed on a yearly basis.

New financial institutions include:

- Fintech NBFCs
- Peer-to-peer lending platforms

- Digital credit providers

In future systemic risk models, it should be included.

7.5.5 Behavioural Finance Integration

Future studies could be conducted on:

- Investor sentiment effects
- Panic-driven contagion
- Herding behaviour in the debt market segments.

7.5.6. The Global and National Environmental, Social and Governance (ESG) Risk Landscape

The following systemic risk models can be incorporated:

- The climate risk exposure of an NBFC's portfolio. The risk exposure of an NBFC's portfolio due to climate change.
- This covers ESG-based credit risk assessment. This includes credit risk assessment based on ESG.
- Stress test for green finance.

7.6 FINAL REMARKS

The dissertation is an attempt to gain insights into the phenomenon of shadow banking and systemic risk in emerging markets, which is elaborated in India's detailed case.

It's important to note that the real contribution is to show that:

- NBFCs are not a part of the Financial Sector.
- They play a key role in systemic risk transmission.
- Financial stability calls for a coordinated and multi-sectoral supervision of financial activities.

The study firmly argues for the importance of a real-time, data-driven macroprudential regulatory framework based on econometric approaches, market-based indicators and network analysis to manage financial stability.

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