A STUDY OF RISK MANAGEMENT AND DISCLOSURE PRACTICES OF SELECTED INDIAN COMMERCIAL BANKS

A Thesis Submitted for the Award of the Degree of

DOCTOR OF PHILOSOPHY
in
MANAGEMENT

By

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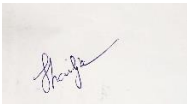
2023

DECLARATION

I hereby declare that current thesis entitled "A Study of Risk Management and Disclosure Practices of selected Indian Commercial Banks" has been prepared by me under the guidance of **Dr. Mahesh Kumar Sarva**, Associate Professor of Mittal School of Business, Lovely Professional University. I also declare that no part of this thesis has earlier been the basis for the award of any degree or fellowship.

Shailja Vashisht 

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CERTIFICATE

I certify that under my guidance, Shailja Vashisht has prepared her thesis entitled "A Study of Risk Management and Disclosure Practices of selected Indian Commercial Banks" for the award of a Ph.D. degree at the Lovely Professional University, India She has carried out the work at the Mittal School of Business, Lovely Professional University,

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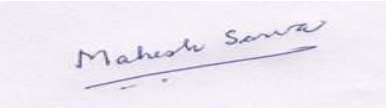

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Abstract

Banking risk is a crucial subject area in financial services and is immensely important for central bankers and market regulators. The financial crisis of 2008-09 showed how a banking crisis could lead to immense global systemic risk. During the current global pandemic scenario, banks face tremendous pressure of credit creation in the economy, increasing their risk profile. On the Indian front, the government is merging public sector banks regularly so that only a few efficient banks remain in the country. Banks' risk management practices must be studied in detail during such times. Basel 3 norms have increased the importance of pillar 3 for growing market discipline and making investors aware of the banks' risk profile and management practices.

The current study aims to study the risk management and disclosure practices of Indian scheduled commercial banks. The study aims to create a risk profile for selected sample banks based on selected financial variables and classify them into various risk clusters. After analyzing the risk management and disclosure practices and the risk profile of the banks in detail, the last objective of the current study deals with establishing the association between the two. The study aims to find out whether the bank's risk profile predicts the risk management disclosure by them. This will help understand whether the shift in risk profile prompts the banks to increase or decrease their market discipline.

For the purpose of carrying out this study, a sample of 30 commercial banks was selected. For sample selection, non-probability purposive sampling was used, and ten banks were selected from each ownership category, namely public sector banks, private sector banks, and foreign banks. These banks were selected based on their asset size to keep the results comparable. Since the study aims to study the progress since the last financial crisis, the period of the study was 13 years, from 2008 to 2020. However, since the Basel 3 norms were introduced in India in 2013-14, risk disclosures were carried out from 2014 to 2020.

The study makes an important contribution to the methodology of risk profiling of banks. The existing literature has focused on risk profiling on the basis of the CAMELS approach or VAR based. However, these approaches are mainly suitable for understanding the risk profile of a single banking firm. The current study uses cluster analysis methodology to profile the banks into high, medium, and low-risk clusters. The study uses two clustering approaches, namely k-means clustering and hierarchical clustering, to classify banks each year during the study period.

For the purpose of risk profiling, a total of 11 financial parameters were selected. These variables were selected on the basis of existing literature, and they represented various banking risks as described by the Basel framework. However, due to the issue of multicollinearity, one variable, Return on Assets, was dripped from the further analysis since its VIF value was higher than the accepted standards.

In order to analyze the risk management and disclosure practices of the sample banks, a scale was developed on the basis of the disclosure requirement of pillar 3 of Basel 3 norms and the regulatory requirements of RBI. The scale was a binary scale, which measured the quantitative and qualitative information disclosed by banks every quarter from 2014 to 2020. The scale measured risk management disclosure practices of commercial banks using six parameters: capital structure, capital adequacy, credit risk, operational risk, market risk, and other risks like liquidity and legal risks. This binary scale had 40 items, and each bank was given a score out of 40 on the basis of their disclosures every quarter.

The hypothesis for the third objective of the study was that there is no significant impact of risk profiling variables on the risk management disclosure score of sample banks. In order to analyze this hypothesis, a fixed effect multiple linear OLS regression model was used. The fixed-effect model was used to control the variable of time since the data collected was from six different financial years. The model was applied to the data of three ownership segments individually and the data from the entire sample collectively.

The study's findings indicate that public sector banks need to work on their risk management disclosure practices as well as their risk profile, especially in the case of a few banks like UCO Bank Indian Overseas Bank (which has already been merged into PNB as on the financial year 2021), etc. Overall, banks were observed to disclose less information in the quarters ending June and December as against the other two quarters. Also, one significant finding of the analysis was that scores of banks in disclosures had remained more or less the same over the study period. Also, the scores remained more or less constant over the period of years, indicating that banks do not increase or decrease the information they provide to shareholders and regulators. The study also found that the major focus of risk disclosure was on credit risk. Some other risks like liquidity and interest rate risks were mostly ignored, or only minimal information was provided. There was a significant difference in the disclosure scores of public sector banks with that of the

private sector and foreign banks, but not a statistically significant difference between private sector banks and foreign banks.

As far as the findings of risk profiling of banks are concerned, one major finding was observed that, on average, most banks fell into medium risk categories. There were few outliers in each category, which made the profiling results interesting. Public sector banks performed worse than the other two categories; however, their performance improved over a period of time. In the case of public sector banks, risk profiling was heavily influenced by profitability indicators. Some banks were incurring huge losses and negative returns for shareholders, and only a few banks were in profit.

On the other hand, loss-making banks were comparatively less in the other two categories. Since two public sector banks, SBI and Bank of Baroda, saw mergers during the study period, a comparative analysis of their risk profile before and after the merger was performed using a paired sample t-test. The results of this analysis indicated that there was a statically significant relationship between these risk profiles. As a result, regulators need to consider the risk profile of banks before merging them.

The second part of the findings that came out of risk profiling dealt with the important variables that were significantly different across different risk clusters in different ownership categories. In order to identify the same, One-way ANOVA was performed. Understanding these variables did not just help define the characteristics of each cluster but also provided direction for future research to study them in detail. As discussed above, profitability indicators were crucial for the classification of public sector banks and LTDR. Non-performing assets became significantly different across clusters later in the study for public and private sector banks but not foreign banks. The main reason for the same was that some foreign banks did not even have any NPAs. As far as the most significant variables are concerned, they came out to be LTDR and DEPTL, respectively. They were significantly different across clusters for most years across different ownership categories.

The findings of the last objective established a strong association between the scores of risk management disclosure practices and the risk profiling variables for banks. The null hypothesis was rejected in all four regression models. The r squared range of around 40% indicated that these variables explained around half of the variation in the disclosure scores. There is a need to

do further research and find out more factors that could explain variation in the risk management disclosure scores. Along with that, on analyzing the direction of intercepts for each variable, it was found that an increase in the risk of banks leads to an increase in the disclosures done by them. Out of the selected ten variables, three variables were not significantly associated as per the model. These three variables were NII, OETA, and CHTA. The significant variables were mostly dealing with the bank's capital adequacy and credit risk, which is in accordance with the existing literature on the area. There is a need to study the behavior of LTDR and DEPTL in the future since the direction of their association with the disclosure scores was not consistent.

In order to help bankers and investors, the study presents a model framework indicating how change in risk predictors should ultimately be reflected in the quarterly disclosures. This will act as a signal to the stakeholders that bank is taking adequate provisions for risk management practices. Indian banks should adopt this model and reflect the changes in liquidity, operating and marketing risk more clearly in their quarterly disclosures over and above the mandatory requirements.

The study will be very useful for future research in terms of its methodological contribution to risk profiling. The scale developed for the purpose of this study will also be of great help in studying the Basel disclosures in India and abroad. The study's findings will also be of great help to investors since they can look at the bank's risk profile before investing in the same. Central banks and regulators can gain insights into commercial banks' risk management practices and take necessary preventive actions to improve their performance. These findings are extremely crucial in the current uncertain times to avoid any future global financial crisis.

Acknowledgment

It is with great pleasure that I express my gratitude and indebtedness to people who have been an immense support in my long and experiential research journey and completion of this thesis. First of all, I would like to thank almighty God for his blessing and guidance throughout the process and every obstacle during the same. My deep gratitude goes to my supervisor Dr. Mahesh Sarva, Associate Professor, Department of Finance at Lovely Professional University, Phagwara, Punjab, for his guidance, constant supervision, and necessary information regarding the research. His support, advice, valuable suggestions, and words of encouragement have benefited me in completing my Ph.D. thesis.

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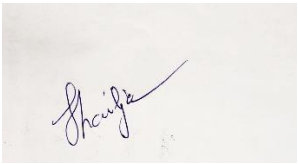
Shailja Vashisht



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Chapter 1: INTRODUCTION AND OBJECTIVES

1.1 Introduction

The current chapter of the thesis sets the foundation and background of the study. The chapter introduces the various concepts and phenomena, including risk management practices in Indian banks, the background of Basel norms and the three pillars suggested by the Basel committee, disclosure practices recommended by the Basel Committee, and the supervisory mechanism of RBI as mandated for Indian banks. The chapter also provides details regarding the justification of the current study and a detailed outline of the various chapters of the thesis and their contents. The last part of the chapter deals with the research objectives of the current study.

1.2 Background

Basel norms are prescribed by BIS for all banks across the globe so that they have adequate financial standards to operate in international financial markets. Right now, we are witnessing the third round of Basel norms which lay focus on capital adequacy, risk management, and proper disclosure. Basel 3 norms were introduced in the aftermath of the major economic crisis of 2008-09 as they laid a lot of stress on the quality of credit extended by the banks to their customers. Like previous Basel norms, this standard also has three pillars focusing on asset quality, capital adequacy, and market discipline.

Basel Standards are to be followed by all member nations, including India. However, the Indian central bank has recently been under fire for its stringent capital adequacy norms and huge capital reserves. RBI has put in capital adequacy norms that are beyond the norms set by Basel Accord. However, banks' credit quality and their assets in India remain questionable. As a result, there is a need to study the relationship between credit quality and the BASEL norms imposed on Indian banks.

1.2.1 Risk Management in Banks

All businesses need to manage their risks. This need becomes even more severe when it comes to banking organizations. Banks operate in a very regulated but dynamic environment and face multiple risks. As a result, it is very important for them to have proper practices for risk management in place. Banks face multiple risks, and governments across the globe have been suggesting various practices to manage these risks. Major risks being faced by the banks in today's times are as follows:

Default risk or credit risk

This is the most important risk faced by the bank as they are primarily engaged in the business of lending. Default risk is the risk of non-repayment of assets and the loans getting bad. The risk is crucial because the banking business has to lend aggressively to earn more profit, but while doing so, the risk of default also increases. NPAs have become a major problem in the banking sector across the globe, especially in India.

Operational Risk

Like all other businesses, banks suffer from operational risks. Operational risks are those risks that might arise from the problems or failure in the operation processes of the organizations. These risks might arise due to the problems of management, faulty internal audits, lack of internal controls and checks, and frauds conducted by the employees working in the organizations. Due to the amount of money involved in banking, operational risk increases. There have been numerous cases of fraud and scams in various banks across the globe due to the failure of operational processes, which has further increased the necessity of managing operational risks

Market Risks

Market risks are those that companies face due to the unfavorable movement of market forces. These unfavorable market conditions ultimately lead to a fall in share prices, which further affects shareholders' wealth. A recent example of such risk is the US sub-

prime crisis which saw the market value of many banks falling down drastically. This risk is not under the control of banks and is largely governed by macroeconomic forces and market forces. However, better internal controls and superior credit quality led to the better market performance of the banks in question.

Safety- Profitability trade-off

A major concern for all the banks is the trade-off between profitability and safety. In order to ensure better profitability bank, have to make certain risky decisions which in turn affect the safety of banks' operations and the quality of banks' operations. For example, banks might lend to customers who do not fulfill the basic lending criteria at higher rates in order to increase their interest income. However, such lending will lead to an increase in the risks of NPAs. Many banks across the globe have seen scandals where the employees tried to open fake accounts, lend risky loans, etc., to fulfill their sales targets and improve the profit position of the banks. Ultimately, such cases lead to mass public outrage and the loss in the market value of the banks' stocks. These instances show that banks have to maintain a trade-off between the safety of the assets and their own profitability.

1.2.2 Risk Management practices in Indian banks

As risk is an important consideration for the performance of every bank, RBI has made a lot of efforts to improve the risk management practices in Indian banks. As far as s the regulatory framework is concerned, banks are governed by the regulations under Banking Regulations Act, SEBI regulations for listed companies, and other RBI regulations. The importance of risk management increased post-LPG reforms as the exposure to risk increased for the banks. The first mechanism devised by RBI for risk management and supervisory discipline was the CAMELS rating approach. This method scored the different banks on the basis of Capital Adequacy, Management, Asset Quality, Liquidity, System Controls, and Earning Sufficiency. The figure below shows the weights given to different parameters in the CAMELS approach.

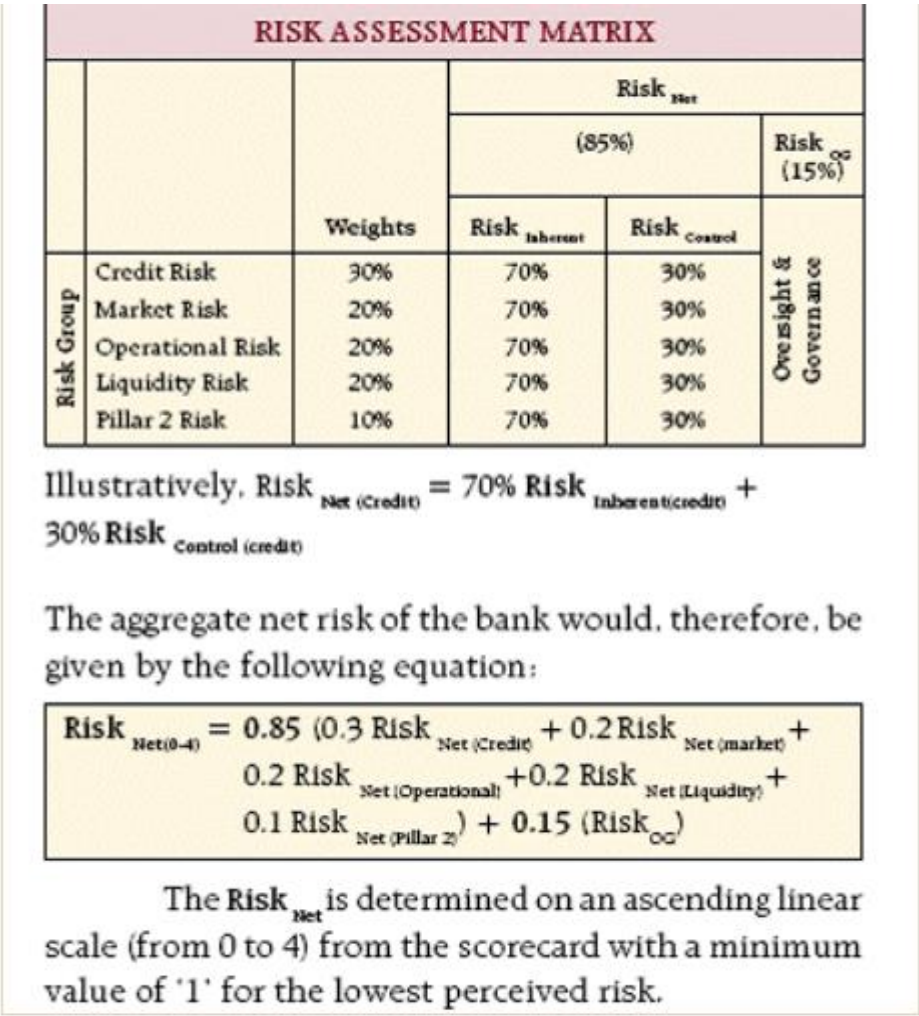
Weights of various parameters under the CAMELS/CALCS Model		
	CAMELS	CALCS
Capital Adequacy	18	18
Asset Quality	18	18
Management	18	–
Earnings	10	–
Liquidity	18	18
Compliance	–	26
System & Control	18	20

Source - (RBI, 2012)

Figure 1-1 Weights of various parameters used under the CAMELS model

However, this system is based on the historical performance of the bank and does not give a projection of its future default. Considering this gap, the RBI decided to shift the risk management practices from CAMELS to RBS (Risk-Based Supervision approach. This approach gives the probability of default and has systems like Prompt Corrective action to prevent banks from further deteriorating their financial position. RBI has recently used the mechanism of PCA to improve the banks' asset quality, and it gave a clear signal to the banks to improve their working.

The supervisory mechanism was designed keeping in line with the requirements of Pillar 2 of the BASEL II accord. The methodology focuses on finding the probability of default on the basis of the bank's exposure to various kinds of risks. The category of risks considered in this approach is also in line with the risk classification of BASEL 2, The rating methodology of RBS is explained in the figure below



RISK ASSESSMENT MATRIX

		Weights	$Risk_{Net}$ (85%)		$Risk_{OG}$ (15%)
			$Risk_{Inherent}$	$Risk_{Control}$	
Risk Group	Credit Risk	30%	70%	30%	Oversight & Governance
	Market Risk	20%	70%	30%	
	Operational Risk	20%	70%	30%	
	Liquidity Risk	20%	70%	30%	
	Pillar 2 Risk	10%	70%	30%	

Illustratively, $Risk_{Net\ (Credit)} = 70\%\ Risk_{Inherent(credit)} + 30\%\ Risk_{Control\ (credit)}$

The aggregate net risk of the bank would, therefore, be given by the following equation:

$$Risk_{Net(0-4)} = 0.85\ (0.3\ Risk_{Net\ (Credit)} + 0.2\ Risk_{Net\ (market)} + 0.2\ Risk_{Net\ (Operational)} + 0.2\ Risk_{Net\ (Liquidity)} + 0.1\ Risk_{Net\ (Pillar\ 2)}) + 0.15\ (Risk_{OG})$$

The $Risk_{Net}$ is determined on an ascending linear scale (from 0 to 4) from the scorecard with a minimum value of '1' for the lowest perceived risk.

Source - (RBI, 2012)

Figure 1-2 Risk assessment matrix under RBS technique

1.3 Basel Norms – Historical Background

Basel Norms are the norms prescribed by the Bank of International Settlement and are accepted by banks across the globe as the standard norms for good banking practice. The origin of these norms can be traced back to the establishment of Basel committee which was initially known as committee on Banking Regulations and supervisory practices set up in 1974, with just 10 member nations. The committee had its headquarters in Bank of International Settlement, Basel Switzerland and aimed at improving financial stability,

banking supervision and forum of cooperation between central banks of member countries. Since then, the membership has increased to 45 nations from 28 jurisdictions. The most notable contribution of this committee is laying the regulatory norms for commercial banking in the form Basel I, II and III norms (BIS, 2022).

The first set of norms issued back in 1988 laid the foundation of risk management practices in modern banking. Basel 1 norms mainly focused on the capital requirements for banks. Basel committee was of the opinion that banks will not be able to meet their liabilities in the absence of adequate capital. So, these norms, not only provided classification of capital, in the form of Tier I and Tier II capital, but also suggested the requirement of minimum capital for banks. Along with that, the norms also provided for the classification of assets on the basis of their inherent risk to form the basis of risk weighted assets in capital adequacy ratio (Singh, et al., 2019).

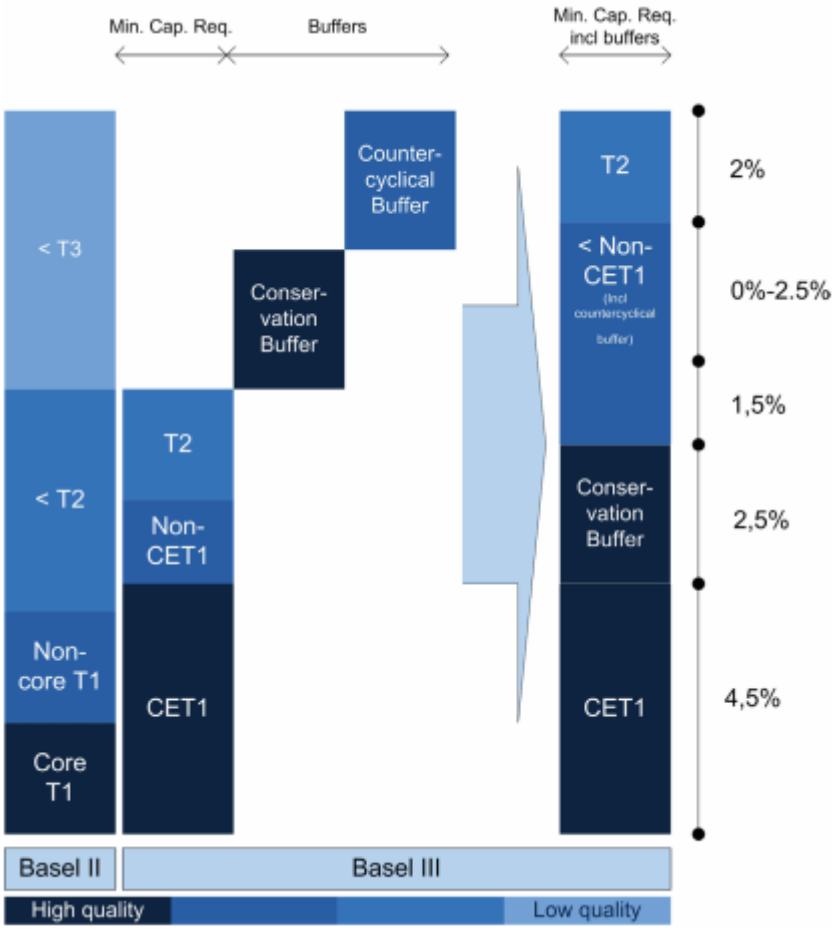
These norms were followed by the second set of norms, known as Basel 2, which made the regulations clearer regarding capital adequacy and credit quality. However, apparently, these norms were not powerful enough to stop the banks across the globe from the financial crisis of 2008-09.

The major reason for the sub-prime crisis is the poor quality of assets and the banks' lack of risk management practices. In order to overcome this shortcoming, Basel Committee came up with the third set of norms, known as Basel III, which are the current set of practices being followed by banks across the globe. These norms laid down clear practices of classifying the risk, capital adequacy norms were made more stringent, and disclosure norms were made stronger.

Basel 3 norms were designed keeping in mind the modern banks' capital adequacy, liquidity, and market discipline requirements. The Basel norms have three pillars like their predecessors. The three pillars of Basel 3 are as follows:

1.3.1 Pillar 1

It is that part of the Basel 3 norms that prescribes the capital adequacy requirements, requirements of buffer capital, and the mechanisms for overcoming various types of risks being faced by the banks. Some of the key changes that have been brought in the third set of Basel norms include an increase in the capital adequacy norms in tier three capital as well; however, Basel 3 norms have eliminated this requirement. In place of that, the norms have suggested the concept of capital conservation and countercyclical buffer for the better functioning of banks during seasons of slow credit growth. The figure below shows the summary of various capital adequacy requirements for banks as prescribed by Basel 3 norms.



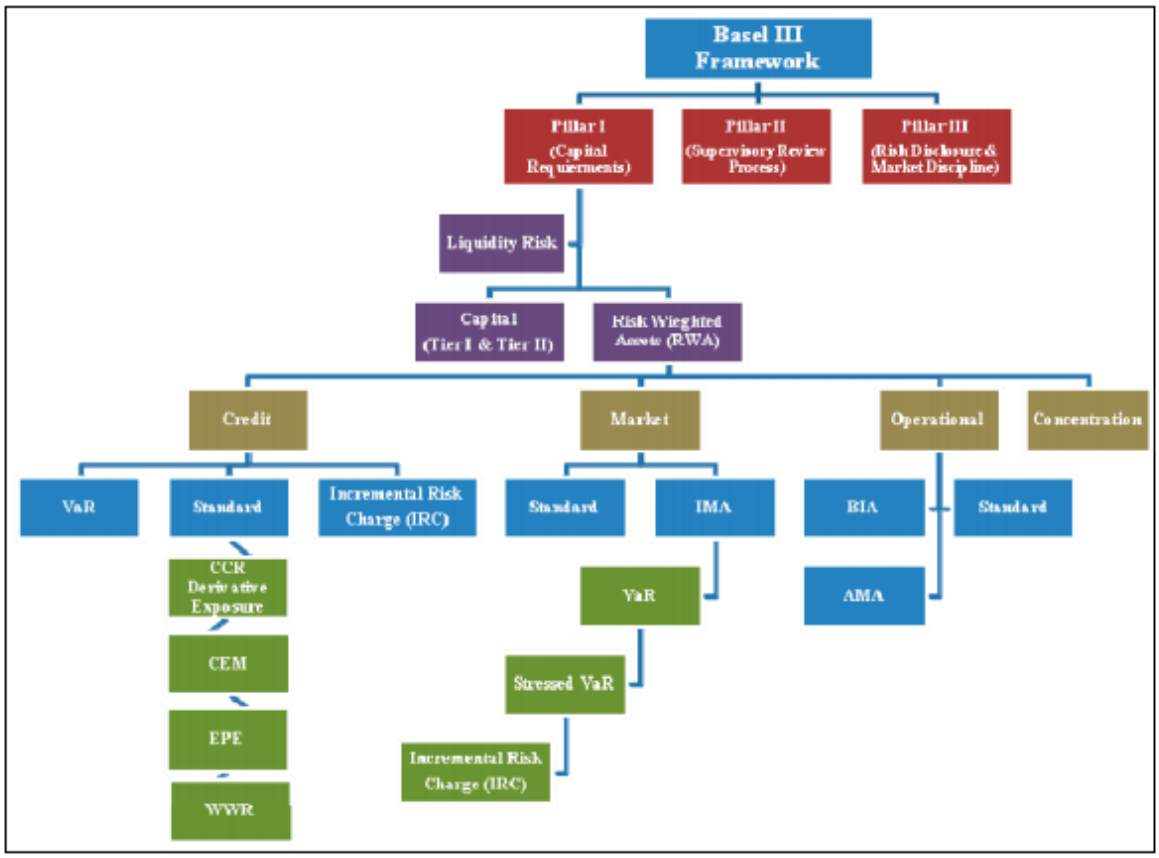
Source - (Achterberg & Heintz, 2012)

Figure 1-3 Capital requirements as per Basel 3 norms

Capital Conservation and countercyclical buffers are a major improvement over the tier 3 capital requirements as the Basel norms just provide norms for the buffer, and keeping of these buffers, especially countercyclical buffer, will depend on the national circumstances and the policies of central banks of the countries.

Tier 1 capital is the most important part of a company's capital, comprising mostly of the common shareholders' equity and certain hybrid instruments having the features of equity. This is the most crucial part of the capital as it is available to the bank to wipe out any sudden losses. Basel 3 norms have also r also done away with the inclusion of goodwill in Tier 1 capital as it cannot be used in times of loss to gain back the solvency position.

The second part of pillar 1 of the norms deals with the liquidity requirements of the banks. Basel 3 norms have provided for two types of regulatory ratios to be maintained by the banks for short-term and long-term liquidity requirements. The first ratio is Liquidity Coverage Ratio. The ratio is responsible for the control of the short-term liquidity requirements of the banks. It considers the availability of High-quality Liquid Assets as a percentage of net cash flows of investments. NSFR, on the other hand, deals with the long-term liquidity position of the banks. It measures the extent of Available Stable Funding as against the required stable funding. The implementation of this ratio has been in the observational phase in the initial years of the launch of Basel 3 norms.



Source - (Al-Darwish, et al., 2011)

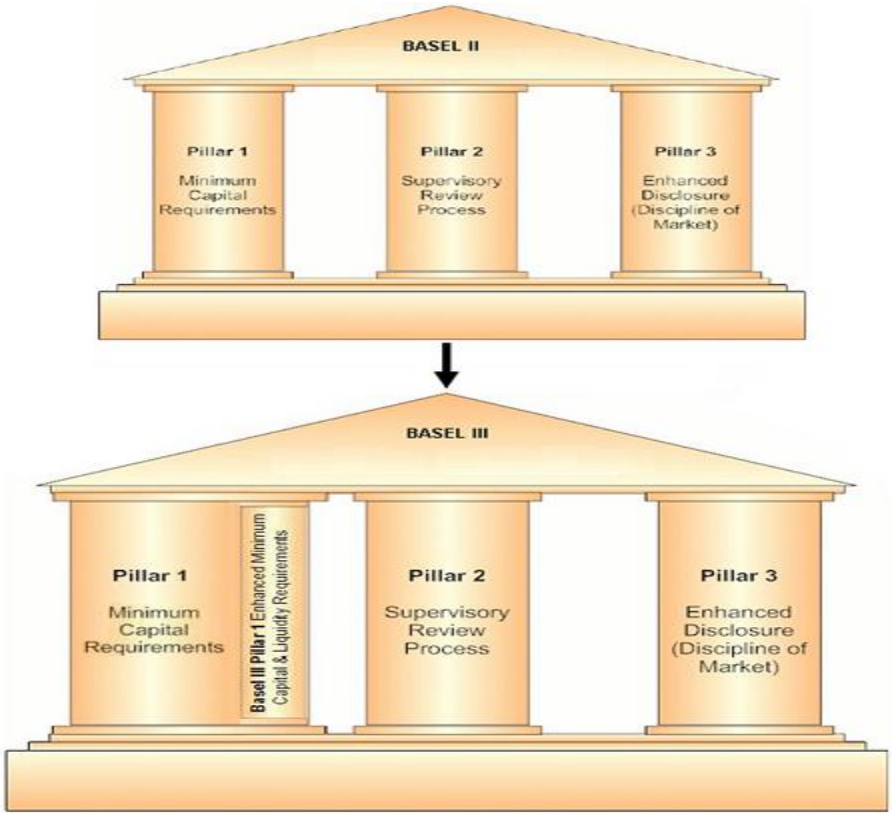
Figure 1-4 Conceptual framework of BASEL requirements under Pillar 1

1.3.2 Pillar 2

The second pillar of Basel 3 norms deals with the supervisory requirements. It is put in the norms to make sure that the requirements laid down in Pillar 1 in terms of capital adequacy and liquidity requirements are fulfilled. In India, pillar two is implemented by RBI by way of 2 procedures ICAAP. It is an internal procedure carried on by the banks themselves and the SREP Supervisory Review and Evaluation Process. This SREP is carried out by RBI under its annual statutory obligation. These regulatory checks ensure that banks maintain proper risk management procedures and approach as prescribed in Pillar 1

1.3.3 Pillar 3

The third pillar of Basel 3 norms deals with the aspect of market discipline. In other words, it prescribes the disclosure requirements for all the banks in terms of publication of certain key performance indicators.



Source - (IBM Knowledge Centre, 2018)

Figure 1-5 Overview of Basel 3 framework

From the above discussion, it can be clear that Basel 3 norms are an important step towards the achievement of better and systematic banking procedures.

1.4 Importance of Pillar 3 of Basel norms

The present report deals with the risk profiling of Indian banks as compared to their disclosures according to the pillar 3 of Basel norms. In order to find out the same, it is important to understand the need and relevance of Pillar 3 of Basel norms. While the first

two pillars deal with capital adequacy and supervisory requirements, the third pillar deals with the market discipline by prescribing certain disclosures to be maintained by banks.

Some of the researchers argue that banks are already required to follow a lot of regulatory requirements as per their country's legal system and the regulations of each country's central bank, respectively. This would put them under the additional pressure of maintaining unnecessary paperwork. However, it is to be understood that these disclosure requirements do not cater to the display of a firm's accounting information and a picture of its profitability for the shareholders. This disclosure acts as a source of additional quantitative information relating to the banks' quality of capital, credit, and market risk and their capabilities to sustain any future capital shock.

In order to be successful in this regard, disclosure norms have to be clearly laid down along with the frequency and the methods to be adopted for such disclosures (Wilms, 2014). Basel 3 norms are an improvement in this regard as it clearly defines the various disclosure documents and their frequency of publication, the Performa to be used, and the rationale behind each disclosure. This will be a great help to the investors and other stakeholders to judge the bank's stability and make their informed investment decisions. Investors often react to the information provided in the disclosure documents. As a result, it will bring about the fluctuation in the price volume pattern of a particular entity, thereby eventually leading to market discipline (European Systematic Risk Board, 2015).

1.4.1 Basel 3 norms in the Indian scenario

Indian banks are in the process of implementing of all the pillars of Basel 3 norms. The most important indicator of capital adequacy as per Basel 3 is CAAR, which is supposed to be 8%. However, as per RBI's directions, Indian banks are required to maintain a CAAR of 9%. This decision is aimed at improving the capital quality of Indian banks, primarily Public Sector Bans which are generally questioned for their high amount of NPAs. It is estimated that most of the banks do not have the capital adequacy of the required 9%, and they are in need of capital infusion by the government or RBI. The

government has been infusing capital in the public sector banks off late; however, it is not clear whether this capital infusion is of any help to these banks or not.

In a recent review of the Basel 3 implementation timeline, RBI has extended the time for implementation of all the provisions of Basel 3 norms till March 2020. The major reason for this extension is the failure of banks to maintain the Capital Conservation Buffer (CCB) of 2.5%. As per the current guidelines, banks are supposed to maintain the CCB of 1.875, and for an additional 0.25 %, RBI has given the extension till 2020 (Hindu Business Line, 2018). Most banks, especially public sector banks, are not having the capital to maintain even the existing limit, and hence the decision to extend the date seems justified.

1.5 Risk Profiling of Banks

One thing which the 2008 financial crisis clarified for the banks across the globe is that they need to understand their own risk appetite and profile themselves according to the same. Banks operate in a very regulated but volatile working environment, and as such, they incur many risks. Some of the major risk being undertaken by the banks includes the risk of default or credit risks, market risk, operational risk, currency risk, liquidity risk, etc. A bank should have a proper framework in place in order to understand the extent of each of these risks and prepare a strategy in order to mitigate them as well.

The first step in the risk management process is to understand the risk profile. It is an individual or organization's capability to take risks to achieve certain financial objectives. In order to profile the banks according to their risk capabilities, banks need to understand their asset quality, quality of credit, and profitability scenarios. Various authors have provided different parameters to measure the risk profile of a banking institution; however, very few research have been done to classify a group of banks into a certain risk profile to understand the possibilities of success or failure in terms of probable mergers and alliances.

Indian banking is going through a phase of consolidation. It is very important to understand the risk profiling of various banks to understand where they stand compared to each other.

1.5.1 Risk profiling framework of RBI

Risk profiling of commercial banks is an integral part of the supervisory function of RBI. The recent risk-based supervision approach discussed in the chapter is an attempt to improve the risk profiling mechanism of banks. The earlier approach to risk profiling was primarily based on the CAMELS approach combined with onsite inspection and offsite supervision as per the provisions of Section 22 of the RBI Act (RBI, 2002). The on-site inspection was mainly concerned with auditing the books of account of the banks in question, while the market supervision helped keep the discipline of banks in check. However, with time RBI has been trying to make the whole process of risk profiling more dynamic with the incorporation of some more elements.

The current framework of risk profiling of banks consists of data from some key sources of information which include the following:

- Offsite surveillance
- On-site inspection
- External audits commissioned by RBI
- Structured information received from the banks in meetings with them
- Specific supervisory directions
- New policy notices and directions as per the risk faced by the bank (RBI, 2002)

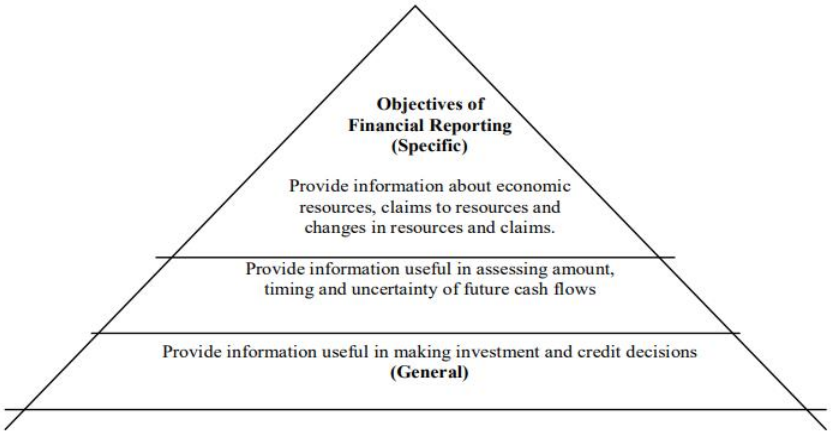
All these are in addition to the financial parameters, which still rely heavily on the CAMELS approach. After the conduct of supervisory inspection, the central bank decides on the supervisory framework for the banks. These supervisory frameworks will be

evaluated frequently on the basis of recent information, and risk profiling of banks will be revised periodically. The period of revision depends upon the bank's risk profile but generally speaking, most profiles must be renewed at least in a period of one year.

1.6 Disclosure practices of commercial banks

Disclosure is an act of communicating the necessary information to the stakeholders in addition to the normal accounting practices. Disclosure means reporting both quantitative and qualitative information from the private domain of the business to the external stakeholders. Disclosure is an important practice in financial institutions, especially banks. There are many grounds on which full disclosure is demanded from banks. Banks are commercial establishments like other businesses, and hence they are accountable to their stakeholders. As a result, it is expected that they disclose complete details of their financial performance in the form of annual reports and other documents as directed by their respective Central banks. The second argument is that financial performance of banks is an important indicator of the economic health of a country, and regulators and investors must regularly check their performance. Along with that, the disclosure allows investors to avoid uncertainty inherent to investing, as financial disclosures help them in making an educated decision.

The nature and purpose of the disclosure have also shifted over period of time. While the nature of disclosure was oriented towards financial stewardship in the past, now it is more directed towards managerial decision-making. The reporting is no longer aimed at the disclosure of financial information from the past. It is more aimed at facilitating future decision-making. As a result, the annual report is not sufficient alone for the purpose of reporting. Not only is the disclosure necessary, but it should also be adequate. Although there is no clear definition of what makes a disclosure adequate, a disclosure can be considered adequate if it satisfies the statutory requirements and fulfills the objectives mentioned in the figure below.



Source - (Meigs, et al., 1999)

Figure 1-6 Objectives of financial reporting

As per the regulatory framework of Indian banking, commercial banks have to follow the disclosure guidelines set by the Reserve Bank of India and SEBI, along with adhering to the guidelines of Basel 3 norms as applicable. Banks have to follow the prescribed format of Balance Sheet and Profit and Loss Account as per the prescribed format, along with publishing additional information as per the Notes to Account prescribed by RBI. Basel norms have also set up disclosure requirements as per pillar three, which is to be published by banks every quarter. The details of these disclosure requirements under Basel norms are discussed in the chapter earlier.

During the current phase of consolidation and economic distress, it is extremely important to study the disclosure practices to ensure that the financial health of banks is in place and that they shall be able to protect the interests of all the stakeholders.

1.7 Present situation of Indian banks and need for risk profiling

As the economy is in recovery phase from COVID-19 pandemic, there is a need for improved risk management practices to accelerate the rate of economic recovery. Although the financial performance of Indian banks has improved after the pandemic,

there is still a need to promote the supply of credit in the economy and bankers need to be sound in their risk weighted assets to lend more (Times of India, 2021).

One of the major developments in Indian banking sector has been that NPAs have reached 6 year low of 5.9% with a net NPAs down to just 1.7%. Both public and private sector banks saw a decline in their non-performing assets. In order to use this as an opportunity, Indian banks have approached central bank to reduce the prudential norms for standard and substandard assets so as to accelerate growth (Pattanayak, 2022). As a result, it is important for central bank to have a holistic idea of the risk profile of banks to decide on the issue since the decline of NPAs can be due to multiple reasons including writing them off for tax purposes and balance sheet cleanup.

Another very crucial element for the Indian banking sector is the government's policy to increase strategic divestment and sale of public sector banks and hence lead towards their privatization (PTI, 2022). Indian government has already privatized one bank, IDBI in early 200s and is in the process of merging many public sector banks. Such acts of consolidation and privatization require careful analysis of the risk profile of all the banks involved so that the emerging entity does not create a dent in the banking system.

Despite all these positive trends in Indian banks, they are quite vulnerable as compared to other economies in G20. Indian banks have very low capital adequacy as compared to a decent loans-to-deposit ratio. Since capital adequacy is a major concern area of Basel norms, there is a need to look at the risk profile of Indian banks. A recent series of stress tests performed by IMF on India banks found out that although top 63% assets of top 15 Indian banks are resilient, but the bottom 36% are extremely vulnerable (Kundu, 2018). This study indicates that there is a need for classification in terms of vulnerability of Indian banks.

All the above-mentioned reasons indicate the timeliness of the issue under study.

1.8 Justification of Research

After understanding the current state of baking risk management practices in India, it can be seen that there are multiple reasons why such research needs to be carried out. The present section of the chapter deals with the discussion on some of the key reasons for the same.

Financial intermediaries are more exposed to business and financial risk as compared to other businesses. That is why researchers have been actively working on the various issues related to banks' risk management practices. The recent trend of deregulation of financial markets and increased competition in the financial sector have increased the extent of risks being faced by banks (Permatasari, 2020). As a result, it is important to constantly study the phenomenon of risk management and to find out what banks are doing in this regard. Not only that, if the risks in banks are not understood and managed properly, it can cause spillovers into other sectors of the economy, leading to the collapse in the financial sector.

1.9 Design of thesis

The present section of the study deals with the details of various chapters of the dissertation and their detailed contents.

Chapter 1 deals with the introduction to the study and its various elements, including risk management function in banking, Basel norms, Pillars of Basel norms, need for pillar three disclosures, disclosure practices of Indian banks, risk profiling, and risk profiling framework practiced in India. The chapter also deals with the justification of the current study and its objectives and lays out the flow of the thesis with details of all chapters.

Chapter 2 deals with the extensive review of existing literature on the various issues discussed in chapter 1 to find out the gaps in existing research which are being solved with the help of research objectives. The topics covered in the chapter include banking risk and its types, risk management function, the importance for the banking sector,

disclosure practices, banking regulation, Basel norms and disclosure practices, and the relationship between risk and disclosure.

Chapter 3 deals with the detailed methodology of the current study. This chapter contains the details of the design of the study and sampling plan, descriptions of the variables and instruments, clustering methodology, k means and hierarchical clustering methods, One Way ANOVA, disclosure scores, independent sample t-test, OLS regression, correlation and fixed effect model of regression as well as details of hypothesis development.

Chapter 4 deals with the first objective of the study, which relates to the risk management disclosure practices. The chapter discusses the findings of disclosure scores of public, private, and foreign banks. Also, it presents the findings of independent sample t-tests to demonstrate the comparison between disclosure scores of these sectors.

Chapter 5 deals with the second objective of the study, which deals with the risk profiling of India's public, private, and foreign banks. This chapter displays the results of cluster analysis, both hierarchical and k-means clustering, to find out the key characteristics of risk clusters. The chapter also presents findings of one-way ANOVA to find out the significant variables which differ across clusters and are crucial for risk profiling. The last part of the chapter deals with the analysis of the shift in the risk profile of banks that were merged during the study period.

Chapter 6 deals with the discussion of the relationship between risk profiling variables and disclosure scores of Indian banks. The chapter presents the findings of fixed effect OLS regression analysis on all sub-groups individually and collectively on the entire sample.

Chapter 7 presents the summary of the findings related to all three objectives of the study and the discussion on the basis of existing literature on these issues. The chapter also provides concluding remarks and the limitations of the current study, along with providing some key recommendations for bankers and policymakers.

1.10 Research Objectives

1. To compare the risk management and disclosure practices of selected public, private and foreign banks in India.

2. To perform the risk profiling of selected banks and cluster them on the basis of the same

3. To find out the relationship between the risk profile and risk management disclosure practices of selected banks.

Chapter 2: REVIEW OF LITERATURE

2.1 Chapter Introduction

The chapter deals with the existing literature on the various themes related to the current study. The chapter is organized into various sections as per the objectives of the study, namely Banking risk, Risk management in banking, Banking regulations, Banking disclosures, and the relationship between risk and disclosure. The chapter also identifies gaps in the existing literature which will be then addressed in the forthcoming chapters of the current study.

2.2 Banking risk

The risk-taking capability of banks depends on multiple things like the ownership structure of the banks as well as the level of exposure of promoters in total capital. The lower the contribution more is the capability of bankers to take a risk (Ojo, 2011). There are various kinds of banking risks. Some of the prominent ones are described in detail below.

2.2.1 Credit Risk

Credit risk is the greatest risk in the banking business. The majority of the focus of banking regulation is on the control of credit risk. Credit risk can be defined as the potential loss of banks in case of default in the payment of interest and principal by the borrowers. One of the main factors that lead to an increase in banks' credit risk is competition. In order to outperform competitors, banks loosen their lending criteria to increase their demand. This ultimately adversely affects the quality of their loan portfolio (Bolt & Tieman, 2004). The riskiness of a portfolio is the most crucial form of banking risk (Goodspeed, 2017). Geanakoplos (2010) argues that this riskiness leads to the creation of an economic cycle by building leverage, ultimately leading to asset pricing bubbles. The same was witnessed in US housing prices by (Haughwout, et al., 2011).

One of the methods for measuring the risk, especially the credit risk, is the Z index model, which many Indian banks have used to predict insolvency risks on the basis of the quality of assets being held by them. However, the method has not proved very useful in the Indian scenario as the NPAs have been rising, and banks have not been able to control them properly. As a result, it is important to analyze the risk management practices at a macro level to understand the problem (Aneja, et al., 2015).

2.2.2 Operating risk

Due to multiple reasons, operating risks have recently become more prominent in banking firms. Some of them include shifting towards volume processing and outsourcing and maintaining lengthy documentation relating to changing regulatory requirements on credit and market risks. An overall increase in the complexity of the banking business has also led to an increase in operating risks faced by banks (Quick, 2000). Operating risk can be defined as risk arising from the lack or failure of internal processes, people, and systems from external events (Kostjunina, 2018). In the annual reports of banking firms, operating risks are often used as an umbrella term. They include many types of risks, including legal risk, fraud risk, cyber security risks, information risk, money laundering risks, technology risk, business disruption risks, etc. (Sharma & Maddulety, 2019).

Research conducted on linkages of credit risk and banking operations. Koju, et al., (2018) found out that poor management in banking firms will lead to cost inefficiencies, less profitability, and increased subprime or bad lending, ultimately leading to higher non-performing loans and credit risks.

2.2.3 Liquidity Risk

Liquidity risk for a bank can be asset or funding based. Asset liquidity risk is when the transactions cannot take place at the prevailing market price due to the size of the position relative to lot size (Sharma & Maddulety, 2019). Banks' funding liquidity risk arises from financing deposits that are more liquid than their assets, resulting in a shortfall of cash. Liquidity risk increases in times of crisis when the people providing supply for cash and

investment shy away due to uncertainty in the environment (Bushman & Williams, 2015). In other words, it is the inability to meet the funding requirements (Jorion, 2007).

2.2.4 Market risk

Market risk can be defined as the risk of loss due to the volatility of the market. Market risk is a broad term that includes three main types of risks: interest rate risk, equity risk, and foreign exchange risk. Interest rate risks arise from changes in the movement of interest rates, and equity risk arises due to stock market volatility. Foreign exchange risk arises due to fluctuation in the value of assets and liabilities due to changes in foreign exchange rates (Sharma & Maddulety, 2019). It is traditionally measured with the help of techniques like VaR. However, the recent developments in the regulatory framework have shifted the focus to measures like Expected shortfall (Basel Committee on Banking Supervision., 2006).

There are various issues in market risk management as prescribed by the Basel framework. One of the most prominent ones is that banks are allowed to arbitrage between their banking and trading portfolios while allowing them flexibility in issues like managing their risks and disclosing them (Haddad & Hakim, 2015).

2.3 Risk management and disclosure practices in banks

Risk management is a strategic activity whose scope extends beyond models and calculations (Jorion, 2010). Risk management can also be defined as the range of activities that maximize a firm's value by minimizing the costs relating to the volatility of cash flows. Scholars from various fields have suggested various ways in which firms can manage, avoid, transfer or avoid risk.

As a discipline, risk management in banking evolved in the 1990s due to the emergence of various financial derivative products. The complications in dealing with them led to the rise of risk management as a separate discipline in banking firms in addition to normal business lines. This led to the development of various risk management

methodologies and the extension of these methodologies from market risk to other dimensions like operating, liquidity risk, etc. (Jorion, 2010).

Table 1 The evolution of analytical risk management tools

Year	Tool
1938	Macaulay's bond duration
1952	Markowitz's mean-variance framework
1963	Sharpe's one-factor beta model
1966	Multiple-factor models
1973	BS option pricing model and Greeks
1982	ARCH models
1992	Heath-Jarrow-Morton term structure models
1993	Value at risk
1994	RiskMetrics™
1997	CreditMetrics™

ARCH, autoregressive conditional heteroskedastic; BS, Black & Scholes.

Source - (Jorion, 2010)

Figure 2-1 Evolution of Risk management in Banking

Basel committee defines risk management as a process responsible for identifying, assessing, monitoring, controlling, and mitigating all on and off-balance sheet risks faced by banks, including the ones at group portfolio level and business unit level and taking into account the extent to which these risks overlap (Basel Committee on Bank Supervision, 2010). This definition highlights that risk management cannot be performed in isolation. Risk needs to be measured at the enterprise level (Ellul, 2015).

In the banking sector first risk management function was established by Merrill Lynch in 1987 (Dionne, 2013). However, the function gained much prominence in the industry after the recent financial crisis (Sharma & Maddulety, 2019). The crisis led to a finding

that risk management should be designed bank-wise. Each bank should design its own Key Risk Indicators, which would help in identifying and managing risk in a better way (Sezer & KURT, 2020). Other two reasons for an increase in the importance of risk management function in banks include increased exposure to derivative instruments and pressure to comply with increasingly complex prudential and regulatory norms (Byrne, 2000).

With the advent of technology and digitization of banking services, the amount of data available with banks has increased tremendously. This data comes from multiple internal and external sources. Banks are trying to use it to automate multiple functions, including risk management. This has led to the use of machine learning in the field of risk management of banks (Van Liebergen, 2017). Agencies like SEC also use machine learning to crunch the data on banking transactions and prevent and predict incidents of misconduct (Sharma & Maddulety, 2019).

Another aspect of the risk management function is to determine the entity responsible for deciding the threshold levels for risk. While existing literature gives this duty to the board of the bank, there is a limitation to the extent of competence of the board in estimating and mitigating risk, especially considering the limited financial knowledge of independent directors (Minton, et al., 2014). In order to overcome this issue, Basel Committee on Bank Supervision (2010) suggests that the risk management function should be kept separate from the board itself to avoid any conflict of interest.

In order to make the risk management function successful, it should be noted that its scope should not just be limited to compliance and managing both asset and liability risks effectively (Ellul & Yerramilli, 2013).

2.3.1 Importance of risk management for banks

In order to understand the need for risk management, the first step comes in the form of the MM approach, which suggests that the extent of leverage is not crucial for the value

of the firm. However, as we move away from the theorem and discard its assumptions, the need for risk management functions in banks becomes clearer (Ellul, 2015).

The first reason why risk management processes are required in the banking sector is to reduce the cost of financial distress. Financial distress increases systemic and contagion risk. Also, it creates problems for banks in arranging funds for meeting their short-term liquidity needs (Ellul, 2015). As a result, value-generating banks need to keep a check on the costs of financial distress by setting up proper risk management functions. Another reason why risk management is crucial for banks is their involvement in the stock market. Since the banks are heavily involved in the stock market, banks' risk-taking behaviour could erode their capital, creating more problems for them (Hossain, 2012).

Ellul (2015) suggests that risk management as a function should not be tasked with the responsibility of making banks avoid taking risks. This task is based on the assumption that banks' boards are aware of the optimal level of risk, and the same can be anticipated by an empiricist. Practically, it is very difficult to estimate the optimal risk level of a project for a bank to determine whether a bank should undertake it or not if it generates value for the business.

2.3.2 Risk management in Indian Banks

Depending on the size and risk exposure of the banks, Indian banks follow various risk management practices to manage their risks. These practices include GAP analysis, asset-liability management, Value at Risk, sensitivity analysis, and maintaining the capital adequacy ratios and liquidity ratios as per international standards. The risk management practices are not limited to the control of risk but also identifying the risk and finding out its appropriate solutions (Narayana & Mahadeva, 2016). The risk-based supervision method introduced by RBI is closely linked with Pillar 2 of Basel norms, which in turn deals with the supervisory provisions. If this practice is properly implemented, it will help the central bank to allocate the resources on the basis of their risk exposure, and it will, in turn, help improve the asset quality of banks. There is a need to align these two

frameworks so as to improve the risk management of Indian banks (Arunkumar & Kotreshwar, 2006).

India is one of the fastest-growing financial markets in the world, and this brings a lot of challenges for its banking sector. These challenges were complicated even further when Indian banks were liberalized after decades of nationalization (Das, 2002). These unique features make it important to study the risk profile of Indian banks in modern times. The majority of the public sector banks in India understand the importance of Basel norms and are also aware of the cost of implementation and the risks of failure to comply with the provisions. They also have an adequate capital cushion and fulfil the capital adequacy norms set up by RBI. However, there is a great need to look at these banks' lack of risk management practices. As a result, the need for supervisory control and better market discipline becomes even more severe (Boora & Jangra, 2019).

It will not be easy for the Indian banks to adopt Basel norms completely. Being a growing economy, India will witness a huge demand for credit in the coming years. Basel norms suggest so many restrictions on the lending and capital requirements, which would ultimately slow down the process of economic growth. Also, banks would need regular rounds of capital infusion from the government to comply with the capital requirements of Basel 3 norms (Jayadev, 2013).

Indian public sector banks will face more difficulty in implementing the capital reforms introduced by Basel 3 norms. The main reason is that the investors do not have confidence in the working of these banks as government control is believed to bring inefficiency in its working. The government needs to infuse capital or reduce its stake in these banks to make compliance easier (Jain, 2013). Nguyen & Nghiem (2015) also found out that Indian public and private sector banks are expected to have different efficiency levels, despite having the same disclosure requirements. The main reason for the same is the lack of proper management efficiency in the case of public sector banks.

The existing research on risk management is generally based on market-related factors faced by banks that are completely different from those considered by banks while making credit decisions. Also, since most of the models are based on the assumption of rationality, the studies are based on the counties where the markets are transparent and risk exposure data is easily available. There is a need to understand the process of risk management separately for countries like India (Win, 2018).

RBI has also been very proactive in realizing the importance of banking disclosures in improving transparency and market discipline. The disclosure of risk factors has reduced the level of information asymmetries to a great extent. This has resulted in an increase in the confidence of investors and shareholders while dealing in the stocks of banks (Chipalkatt, 2005).

2.3.3 Disclosure practices in the Banking sector

Banks' risk-taking behaviour does not just lead to problems for individual banks but also creates the possibility of systemic risk for the entire economy. There are many ways with which regulators have been trying to monitor banks' risk-taking behaviour. One of them is increasing transparency. Bank transparency is the availability of information about banks to external stakeholders, including depositors, borrowers, regulators, policy makers, and competitors. An important measure of transparency is the published disclosure or financial reports, which provide financial information about the banks (Bushman & Williams, 2015).

Before the 2008-09 financial crisis, the third pillar of Basel norms, or the concept of disclosures, was widely overlooked by both bankers and regulators across the globe (Vauhkonen, 2012). The financial institutions across the developed world relied on overly complicated models developed by rating agencies and the sophisticated calculations of asset-backed securities. They overlooked the importance of transparency in the supply of financial information and its relevance for shareholders. As a result, the

sudden collapse of credit quality was not even observed by the stakeholders across the globe (Benli, 2015).

Disclosure is also important from the point of view of corporate governance. Lack of monitoring can result in conflicts between managers, promoters, and shareholders (Epure & Lafuente, 2015). Since management has the discretion of setting up the limits for important indicators like prudential norms or provision for non-performing assets, this might create opacity in the disclosure and transparency for shareholders (Cohen, et al., 2014). In such scenarios, there is a need for a standardized disclosure norm like the one prescribed by Basel norms. The other two pillars of Basel norms will not be effective if the disclosure is not properly implemented. Since disclosure increases transparency, investor confidence increases, and the fluctuation in the prices also reduces. All of these ultimately lead to a lower cost of capital for financial institutions (de Jesus, et al., 2014).

One of the other benefits of banking disclosure is that it helps in the reduction of corruption in the banking sector. However, the success of disclosure in controlling corruption also depends heavily on the success of the country's judicial system (Alam, 2013). Not only that, but the effect of capital adequacy norms can also be made more effective if the banks indulge in proper disclosure compliances. Also, the disclosure as per Basel norms ensures that the banks achieve the objective of their trade-off between liquidity and safety (Vauhkonen, 2012).

Traditional disclosure in the banking sector was limited to financial reporting and was historical in nature, which did not serve as an important aspect of helping in decision making. In recent times, however, the importance of forward-looking information is increasing. The most common place for finding such disclosures is the chairman's speech section of the annual report, where the prospects of the industry and the banks are discussed. It has been found that these sections of information are more useful for the purpose of decision-making than the financial reports themselves (Mahboub, 2019).

While the disclosure is important for investors and policymakers, not all banks disclose similar information. The disclosure practices of the banks are affected by the size of the banks, and their capital type or the extent of leverage, while the nationality of the bank, as well as the concentration of the votes on the board, do not have any significant relationship with the disclosure made by the banks (Santos, et al., 2014).

2.3.4 Risk measurement variables

There are various financial variables that can indicate the extent of the presence of multiple risks mentioned above. The present section of the review discusses some of the key variables used in the current study and their relationship with the various types of risks mentioned above.

One of the most prominent proxies for credit risk in banking is non-performing loans or non-performing assets. NPL is not just a major source of banking firms' instability; it also causes systemic risk and, ultimately, the fallout of the entire financial system (Koju, et al., 2018).

Another variable that is used to determine the extent of credit risk is loans to total assets. This ratio indicates banks' growth in credit flow. A higher ratio indicates aggressive credit, which increases the chances of poor lending norms (Meela & Prasad, 2016). Other important risk parameters for credit risk include the probability of default, the loss generated at default, and exposure at default (Sharma & Maddulety, 2019).

The next variable is the link between credit and operational risk in the form of the operating efficiency ratio. It is measured with the help of operating expenses to total assets (Berger & DeYoung, 1997) and a higher percentage indicates a lack of efficiency in bank operations. Higher operating expenses would instigate banks to dilute their credit standards to give more loans and cover their operating costs, thereby increasing their credit risk (Altunbas, et al., 2007).

Return on Assets is an important indicator of the profitability of banks. It has been found that more profitable banks are more efficient in managing their assets and costs. Hence,

their processes in the disbursement of loans are more prudent, leading to less credit risk (Kwan & Eisenbeis, 1997). Therefore, profitability plays an important role in improving the banks' loan performance.

The extent of non-interest income in the banks' total income is an important indicator of the diversification of banks. A higher ratio indicates more avenues of business for banks and indicates reduced reliance on the loan portfolio. Banks with a high rate of non-interest income will have more diversification and lesser chances of credit risk due to a bigger portfolio (Koju, et al., 2018).

2.4 Risk Profiling of Banks

The health of banks can be measured by checking the three important variables, namely the risk profile of the banks, earning capability, and capital quality. While the first two parameters are measured with the help of financial ratios, the last one is measured with the capital adequacy framework mentioned in Basel Norms (Sintha, et al., 2016). There are various ways to improve the risk profile for banks. One of them is that they should diversify into non-traditional banking activities like securitization etc. This will aid the banks in diversifying their portfolios and help improve the long-term profit situation. However, overindulgence in such activities will lead to increased systematic risk and complications due to increased agency problems among stakeholders (Apergis, 2014).

One of the important parameters prescribed by Basel norms in measuring the risk profile of banks is the Capital adequacy ratio. The risk-weighted asset component of CAR is an indicator of the risk profile of banks' asset portfolios and contingent operations. This parameter not just reflects the credit risk of banks and their operating and market risk and hence is crucial for banks and regulators alike (Kishore, 2018). Another way of measuring the risk profile of a financial institution is the CAMELS approach (Gambetta, et al., 2017) or probability of default using the z-score (REBI, 2016). (Haryati & Kristijadi, 2014) uses the indicators of all major types of banking risks to classify banks into low, moderate or high-risk profiles.

Although Basel norms prescribe the methods to classify the banks on the basis of risk profile by the use of certain financial indicators, however, there is a need to classify all the banks operating in an economy into sub-groups depending upon their risk-taking ability and for that cluster analysis approach can be quite useful. Taking certain key financial indicators as a base, this technique can be very effective in risk profiling of any institution (Dardac & Boitan., 2009).

2.4.1 Banking Regulations and risk profile

Banking regulations are the frameworks responsible for creating, working, and liquidating banks. These regulations are normally introduced by central banks of respective countries of some specified entities designated by the local government. Banking regulation is very crucial for safeguarding investor interests and the interests of businesses in the economy (Alam, 2013). Banking regulations gained momentum after the financial crisis of the 1990s and the implementation of the Basel accord. It was observed that countries with more stringent rules for market discipline and transparent and powerful supervisory controls proved to be more efficient in terms of the strength of their banking systems (Manlagnit, 2015).

There are many criticisms of modern banking regulation. One of the major criticisms is that most of the banks and central banks are following just Basel norms and not looking into their respective needs. Also, it is not known what the actual contribution of Basel norms is in improving the performance efficiency and stability of banking firms (Barth, et al., 2008). Not only that, but there is also little economic evidence to support the fact that banking supervision and discipline improve banking efficiency and banking relationships with other commercial sectors (Barth, et al., 2008).

2.4.2 Basel Regulations and risk profile

Since the previous sections have described that banking risk is very crucial for the governments and regulators for multiple reasons, this is the reason why various regulations are framed to keep banking risk in check. One of the prominent measures used by regulators is the prescription of capital requirements for provisions of various

kinds of risks. Some big banks go a step further and calculate economic capital requirements and not just accounting capital as prescribed by regulators.

Basel norms are the most widely accepted risk management norms for banking sectors. The Basel framework was developed by the Basel Committee of Bank of International Settlements (BIS) in 1988. The initial framework accounted for only credit risk. The committee made some amendments in 1996, but the framework was still not sound enough. Finally, Basel 2 framework was launched in 2004. In addition to the focus on capital adequacy ratio in pillar 1, the framework also introduced two other pillars, focusing on supervision mechanisms and market discipline, which specified information disclosure requirements for banks (Hossain, 2012).

The current version of Basel norms, Basel III was launched after the financial crisis of 2008-09 in order to help the banks avoid any such future crisis. There are many improvements in Basel 3 compared to Basel 2 norms, including focusing on leverage and liquidity of banks, reducing the reliance on external rating agencies, and increasing capital requirements from the Basel 2 framework (Gatzert & Wesker, 2012). The capital adequacy ratio has been criticized for ignoring the liquidity risks, especially in the short term, so liquidity ratios are a welcome move (JeanDermine, 2015). Many banks failed in 2008-09 because they accumulated a large amount of illiquid equity-based instruments and hence could not get out of financial problems. Also, the majority of the financial institutions laid a lot of stress on raising equity capital while did not pay much attention to the quality of assets they were accumulating. Hence, by introducing liquidity-related requirements, Basel III norms are working towards the same (Amediku, 2011).

Basel 3 is a balanced approach toward solving the major limitations that caused the failure of banks during the financial crisis. The capital adequacy ratios and provisions for the creation of various buffers are a welcome move as they would lead to improvement in the operational efficiency of the banks (Walker, 2011). Basel norms also take care of a very important type of banking risk that arises of debt bias or very little equity as

compared to debt. This is done by prescribing minimum capital requirements for the banking firms. The strength of the Basel norms doesn't just lie in the risk management framework but also in the control and discipline exercised by the financial institutions and regulators (Manlagnit, 2015).

Although Basel is the most universally accepted regulatory norm in the banking sector, it suffers from many criticisms. One of the criticisms is the lack of evidence of its actual usefulness over and above other regulations in maintaining banking stability. The second criticism is that it forces banks to curtail non-banking activities, thereby affecting their overall efficiency and profitability (Alam, 2013). Also, many of the banks which failed in 208-09 had not shown any indication of a problem in their ratios. Therefore, regulatory provisions need to address the issue as well (Walker, 2011). Also, instead of every set of reforms issuing a new set of ratios, there is a need to do away with the previous ratio and utilize only those which work in order to reduce the burden on banks.

Another criticism of Basel 3 is that it, just like its previous versions, suffers from some fundamental flaws. The accord lays too much stress on the liquidity aspect and does not talk about how to deal with sudden cash flow problems as well as situations of insolvency. Earlier versions of Basel norms have also laid too much stress on debt as a source of finance and appear to be biased in favor of certain debt instruments issued by the governments (Blundell-Wignall & Atkinson, 2010). Banks across the globe are not maintaining the required amount of capital as prescribed by Basel norms because they are allowed to make a lot of regulatory adjustments for goodwill (Haddad & Hakim, 2015).

2.5 Relationship between risk management and disclosure practices of banks

Banks have become riskier after the deregulation of the industry in most of the countries. The pressure to grow has led to banks taking riskier loans which have further increased the probability of a banking crisis (Yang, 2014). The same was seen in the global financial crisis of 2008-09. This crisis showed that banking risk could increase the overall systematic risk of an economy (Rezgallah, et al., 2019). Since the banking crisis has had

adverse effects on the economy, regulators across the globe have been looking at ways to prevent the same. One of the most prominent steps in this regard is the launch of Basel norms (Yang, 2014).

In order to keep a check on the risk-taking behaviour of commercial banks, regulators have to perform regular stress tests. However, there is a debate on the extent of disclosure that needs to be made about the results of these stress tests. In most countries, there is a level of opacity in the results disclosed by the central bank. Most of the time, disclosure is made when the performance of banks falls below expectations. This creates information asymmetry since investors start assuming that no news is good news (Bouvard, et al., 2015).

Lack of transparency also creates uncertainty in the minds of investors, thereby increasing the risk profile of banks (Bushman & Williams, 2015). In such scenarios, proper regulatory mechanisms, coupled with monitoring tools, reduce the risk of banks and improve their efficiency (Epure & Lafuente, 2015). Risk-related disclosures are taken seriously by investors, especially when it comes to credit and liquidity risk. Also, due to the standardization brought by IFRS and Pillar 3, these disclosures are no longer vague and complicated for common investors. They consider reading them before making investment decisions. However, most investors still prefer quantitative disclosures, qualitative ones, which need to improve (Giner, et al., 2020).

Market discipline is very important for checking the risk-taking behavior of commercial banks. The higher banks score on the disclosure index, the lesser their risk-taking behavior exhibited by them. As a result, it can be said that market discipline plays an important role in preventing financial crises by preventing banks from taking undue portfolio risk. Also, disclosures put pressure on the banks to keep their stakeholder's content. In the endeavor, they constantly monitor their risk management practices (Naz & Ayub, 2017). However, disclosure alone is not sufficient for improving market discipline. It also depends on the safety net provided by the local governments as well as the extent

of uninsured funding or liabilities of the bank. By disclosing, on the other hand, banks expose themselves to the possible negative reaction by the investors if their capital usage is not adequate or if investors find them having the probability of default (Nier & Baumann, 2006).

There is a strong relationship between operating risk and banking disclosures. Barakat & Hussainey, (2013) found out that operational risk disclosures are directly related to the regulatory and governance structure of the banks, especially the power held by the independent directors, the extent of audit committees, and the government interference and ownership. More powers should be given to independent supervisors to increase the risk disclosures, especially in the case of banks having high outside, non-government voting rights since they have poor disclosure practices.

2.6 Research gaps

After reviewing the literature on the various aspects of the literature, the following gaps can be identified:

- Majority of the research deals with Pillar 1 of Basel norms. The other two pillars of the supervisory role and market discipline and reporting have been ignored in the literature.
- The existing risk management studies in the banks have limited their scope to either of the two: calculation of risk appetite using the traditional Basel approach using models like VaR or with the help of a traditional accounting framework like the CAMEL approach. These studies do not discuss the implications of market discipline on the banks' risk management practices.
- While there are various methodologies being prescribed for measuring the risk profile of the banks, researchers have not been using the classification techniques like Cluster Analysis to compare a complete class of banking companies.

- Most of the research that studies disclosure practices are based on content analysis, which is subjective as it allows giving weights to the different parameters. Very few studies have used an objective methodology like the disclosure index to measure the extent of disclosure.
- The relationship between risk management and disclosure practices has not been drawn with the risk profile of banking companies.

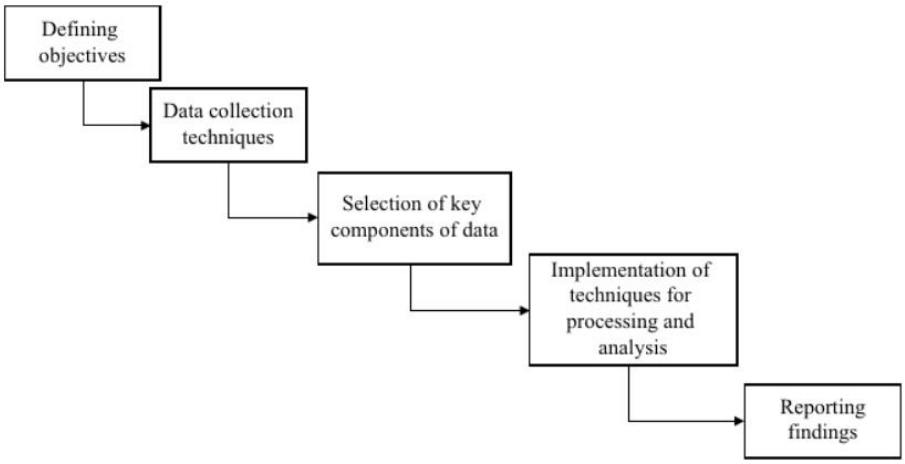
Chapter 3: RESEARCH METHODOLOGY

3.1 Chapter Introduction

This chapter deals with the details of the methodology followed in the study to achieve the various research objectives. The section deals with the overview of the research design and sampling plan, sample banks, and analysis methodologies. The chapter also covers research instruments for disclosure practices, clustering techniques, hierarchical and k-means clustering, OLS regression, one-way ANOVA, and one-sample t-test, which analyze the data collected for research objectives.

3.2 Research /Design

After formulating the research problem, the next step in the research process is to finalize the research design. Research design is a framework or a map that determines methods for conducting the research. It includes a systematic process of collecting and synthesizing the data, analyzing the same with the help of various models and techniques, and presenting the final findings (Habib, et al., 2014). Research design is to be developed while keeping in mind the research questions and the expected and desired outcome. It should be flexible enough to incorporate changes due to fluctuations in the internal and external environment (Mukherjee, 2019). Keeping in mind the suitability of the research problem, a researcher can select a suitable research design from various options available. Selecting an appropriate research design is very important for any research process since it guides the researcher on the ways of data collection, designing the research instrument, and tools to analyze the findings of the collected data (Bairagi & Munot, 2019). There are various stages in the framework of research design. All these stages are shown in the figure below.



Source - (Bairagi & Munot, 2019)

Figure 3-1 Research Design Framework

All research designs can be classified into observational and experimental designs. In the case of social science studies, most researchers tend to use observational research design as experimental research designs can be very complicated while capturing real-life situations (Perri & Bellamy, 2011). Similarly, the current study also uses the observational research design. The purpose of the study is to observe the risk management and disclosure practices of Indian banks and draw suitable inferences from the data. There are further multiple types of research designs in observational design, with each having its own pros and cons.

The research design of the proposed research is empirical in nature. Empirical research gained prominence in the 1980s. Empirical research can be defined as the process of deriving and analyzing data from direct and indirect observation (Roth, 2007). Empirical research design is research that relies on the evidence obtained from the data collected or observations made, and not just on the basis of groundwork laid down by a certain theory. In the case of empirical research, the research question is clearly defined. Its answer is sought on the basis of data collected to support certain hypotheses. Empirical research design is possible in the areas where there is a strong base of existing literature, and the

researcher is able to find the gaps in the same. Empirical research helps in theory building, validation, and designing the objectives and hypothesis, which help fill the research gaps (Jasti & Kodali, 2014). Empirical research design is also useful since it allows the managers to understand the findings more easily by being backed by data even if they are not having a deeper understanding of the theoretical concepts (Soni & Kodali, 2013).

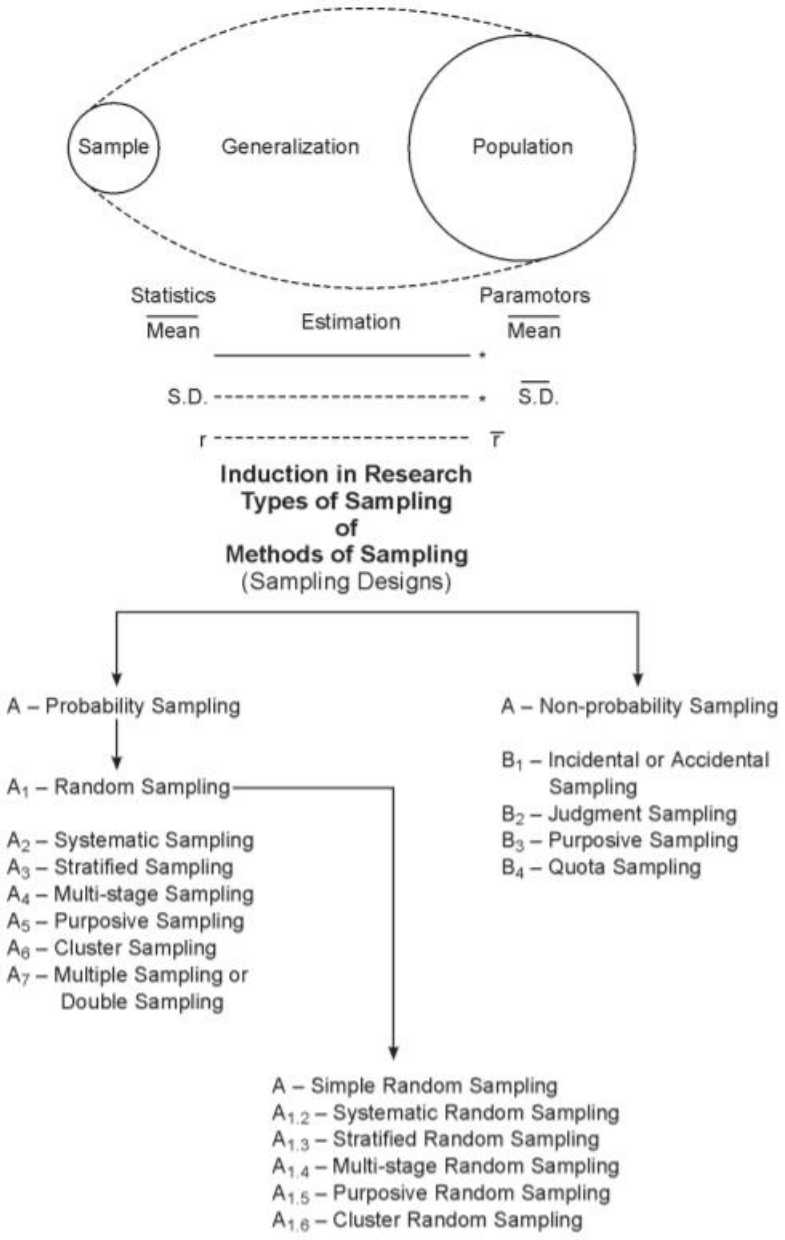
The current study has extensive literature on the risk management practices in banking and the role of disclosure. However, the existing research has not been able to use the clustering and data mining approach to group the banks together on the basis of their risk profile. The present study also fills the gap of developing a disclosure scale based on RBI guidelines and Basel norms of disclosure for banks and establishing the relationship between the ownership structure of the banks and their performance in the risk-disclosure relationship.

3.3 Sampling plan

This section of the research methodology deals with the choice of sample and the sampling technique to be used. A sampling plan is important for all behavioral and social science studies. The sampling process is very useful in cases where the study has to be conducted on large data set. It helps the researcher overcome the limitation of time and resources since the coverage of the entire data set is not feasible. A sampling plan is based on the research design and hypothesis framed. The results of research depend, to a large extent, on the technique of sampling (Singh, 2007).

3.3.1 Sampling Technique

Sampling techniques can be probability or randomized techniques, or non-probability techniques. Ideally, a researcher should use probabilistic sampling techniques so that all members of the population get an adequate chance of being represented. However, it is not always feasible, and hence the researchers resort to non-probabilistic techniques (Chandra & Sharma, 2013). The figure below shows the types of probability and non-probability sampling techniques:



Source - (Singh, 2007)

Figure 3-2 Types of sampling techniques

For the purpose of the proposed research, a non-probability purposive sampling technique is used. This technique involves the selection of items in a sample on the basis of the

need for research and the objectives of the study. Purposive sampling is a combination of judgmental and quota sampling, two prominent non-probability sampling techniques. Judgmental sampling allows researchers to prioritize certain cases in the early stages of their research while finalizing their sample. On the other hand, quota sampling ensures that all strata get adequate participation in the sample (Sibona, et al., 2020). This method is extremely useful when the researcher wants a small yet information-rich sample capable of maximizing the phenomena of interest. This method is more suitable than probability sampling methods when the size of the population is relatively small (Serra, et al., 2018). In the current scenario, the number of banks in India is finite and limited. Hence, probability sampling would not have been much useful.

In the current study, it was important to study all three types of banks in India on the basis of their own, so non-probability sampling was required to ensure all categories of banks get equal representation. Similarly, the decision to choose banks on the asset size was taken on the basis of existing literature on the issue. Since market capitalization is a volatile factor, asset size ensures that all the grouped banks fall into similar asset size categories within their own strata.

3.3.2 Sample size

In the case of the purposive sampling technique, a researcher has the flexibility of selecting the sample size as per the purpose of the study. There is no need to have a statistical base for the selection of sample size in this kind of sampling plan. For the purpose of the current study, a similar approach was used. A sample size of 10 each was chosen from amongst public sector banks, private sector banks, and foreign banks on the basis of their asset size. The sample sizes have been kept as ten because after the recent mergers and consolidations, there are just 12 public sector banks in India, while IDBI has been recategorized as a private sector bank.

During the course of this study, some more mergers were expected, which might have reduced the number further. In order to give all the ownership structures equal representation, a sample size of 10 each was selected for both private and foreign banks

as well. The top 10 banks are selected on the basis of total assets. The reason for selecting the criteria is that banks of similar size would generate better comparative results, and their size would not affect their risk profile. Total asset size was selected from the annual publication of the RBI as of 31st March 2020. This was done because the study period was 2008-2020.

The list of selected banks is as follows

Table 3-1- List of Sample Banks

Public Sector Banks	Private Sector Banks	Foreign Banks
Bank of Baroda	Axis Bank Limited	Citibank
State Bank of India	HDFC Bank Limited	Standard Chartered Bank
Punjab National Bank	ICICI Bank Limited	HSBC Corp. Limited.
Canara Bank	YES Bank Limited	Deutsche Bank Ag
Bank of India	Kotak Mahindra Bank Ltd.	DBS Bank India Ltd.
Union Bank of India	IndusInd Bank Limited	JP Morgan Chase Bank
Central Bank of India	Federal Bank Limited	BNP Paribas
Indian Bank	IDBI First Bank Limited	Bank Of America, National Association
Indian Overseas Bank	Jammu & Kashmir Bank Ltd	Barclays Bank Plc
UCO Bank	South Indian Bank Ltd.	Mufg Bank Ltd

Source – Created by the author on the basis of results from RBI, (2021)

3.4 Data collection

For any observational study to be successful, it is important to collect the right data. There are two kinds of data collection designs, primary and secondary data. While primary data is collected firsthand by the researchers for the specific purpose of the study, secondary data is already collected by other agencies and used by the researcher. Primary

data is very useful and gives full control to the researcher. However, it has limitations of time and resources involved. Also, it is not always possible to collect data from the firm's internal management for financial studies like the current one. Hence, the research is conducted with the help of secondary data. Secondary data is collected for some other purposes but has wider applications to be used by multiple researchers (Prada-Ramallal, et al., 2018). Secondary data is more convenient to use for the researcher. However, a careful analysis has to be conducted regarding the credibility of the data source and the possibility of bias in the original data collection. Not only that, but it is also the responsibility of the researcher to ensure the validity and reliability of the secondary data so that the results generated are authentic in nature. Data ethics has also to be taken care of while using secondary data (Rabianski, 2003).

There are no specific methods for the collection of secondary data since the data collected by one person as primary data becomes secondary data for some other researcher. The data is either collected from the original data collection source like RBI in the current case or the external agencies, which summarize the data and make it convenient for the researchers to utilize as per their needs. It is always better to collect the data from the original data source since it not only reduces the chance of missing information, but such sources also provide details of collection methodology for guiding the researcher (Rabianski, 2003).

For the purpose of carrying out the proposed research, secondary data is used. Secondary data is collected from the official Basel 3 disclosure reports of banks, RBI publications, research publications in peer-reviewed journals, the BIS website as well as other publicly available credible resources.

3.4.1 Biases in secondary data collection

As discussed above, although secondary data is very useful for the researchers, it gives way to various biases that can arise while collecting and processing data. There are four main types of such biases and errors.

The first major category of errors is sampling errors. These include errors during the selection of samples and are more prominent in methods that are non-probabilistic. These errors mainly arise when the sample does not represent the data correctly and a certain bias of the researcher does not let truly represent the population. The second category of errors is non-sampling errors, which mostly occur while processing and analyzing data. These might relate to data being wrong or omission of certain cases while analyzing the data (Rabianski, 2003).

Another type of error includes those which reduce the validity and reliability of such data. The researcher should apply proper statistical techniques to ensure the data reliability of data before using the same. Not only that, but there might also be issues in the ethical consideration of the data collection agencies. If the data collection agency is not ethical, there are chances of data manipulation and improper collection of data. The researcher should also disregard such data. Such manipulation is even more dangerous when the collection agency has any stake or interest in the results of the study. This would lead to undue influence over the researcher to present the results in a certain way (Rabianski, 2003). In such cases, it is the researcher's responsibility to make sure to avoid any organization that might have a conflict of interest.

3.5 Variables and scales

As discussed above, the research was carried out on the basis of secondary data collected from the public domain, i.e., from the website of RBI and the corporate websites of banks. For each purpose of the study, a different statistical technique was used. Before discussing the techniques, it is important to understand various variables which will be analyzed by using these statistical techniques. The present section of the chapter discusses the variables used to analyze each objective.

3.5.1 Risk Profiling Variables

In order to conduct the risk profiling, the cluster analysis approach prescribed by (DARDAC & Boitan, 2009) is used. This study uses nine major indicators. Along with these, one more indicator suggested by (Dao & Khanh, 2014) and one variable related to

non-performing assets to measure credit risk, as suggested by (Arora & Kumar, 2015), was added to make the list more holistic. The approach classifies the credit quality and risk appetite of the banks on the basis of the following 11 parameters:

1. Capital and reserves to total Assets

This variable measures the ratio between a bank's total equity capital and total assets. The capital includes all contributions of shareholders, indicating tier 1 capital of the bank, including the reserves of all kinds. This ratio indicates the proportion of assets being financed by the owners' capital. The formula for the ratio is shown below.

$$\frac{Share\ Capital + Reserves}{Total\ Assets} \quad (1)$$

This ratio is an important indicator of the bank's risk profile as during the time of losses, the equity capital of banks acts as a cushion and helps them make necessary financial decisions (Aiyar, et al., 2015). The equity ratio is also the basis of the capital adequacy ratio (CAR), the most important regulatory instrument of Basel norms. As a result, it is important to understand the equity position of banks in order to determine their risk profile.

2. Cash/ holdings to Total assets

The second variable used for risk profiling of banks is cash holding to total assets. This ratio is an important indicator of banks' liquidity position, hence an indicator of banks' liquidity risk. The ratio can be calculated as follows:

$$\frac{Cash\ Balance\ of\ banks + Bank\ balance\ with\ RBI}{Total\ Assets} \quad (2)$$

An increase in the cash and bank balances of banks can prevent liquidity shocks and improve the overall liquidity positions of the banks. As a result, banks in India are required to maintain a certain minimum level of cash reserves in the form of Cash Reserve Ratio to avoid liquidity shocks (Dahir, et al., 2018). Not only that, but the

liquidity level of banks is also considered to be an important indicator of financial stability in any economy (Dahir, et al., 2018). However, excess cash holdings also deprive the banks of taking advantage of market opportunities and lending more money, thereby decreasing profitability. These issues create problems for banks because they create a mismatch between the liquidity of assets and liabilities of banks, thereby increasing their liquidity risk profile (Alzoubi, 2017). For banks, it is important to maintain the right level of cash holdings so as to strike a balance between liquidity and profitability.

3. Loans to deposit ratio

It is an important indicator of the financial health of banks. This ratio indicates the proportion of loans and advances against the deposits of the banks. In other funds, it is the ratio between the supply of funds and the utilization of funds for any bank. Banks have witnessed an increase in the ratio since the last financial crisis due to the decline in deposit interest rates across the globe and increased investment opportunities in money and capital markets (Wetmore, 2004). The ratio can be calculated with the help of the formula given below.

$$\frac{Loans\ and\ advances\ of\ the\ bank}{Total\ Deposits} \qquad (3)$$

An increase in the loans to deposit ratio is an indicator of the banks' aggressive lending, which can lead to both credit and liquidity risks. Since the deposits do not match the assets being generated by the banks, it will create a liquidity crisis for the banks (Keeton, 1998), opening them to the nervous funding approach to prevent liquidity from drying up (Wetmore, 2004). This will also indicate the risk of credit risk since too much lending would also mean a compromise on the lending norms, thereby increasing the probability of non-performing loans. However, the too low ratio would also mean lack of income for the banks and could create a liquidity crisis from the asset side. As a result, this ratio will determine the extent of possible credit and operating risk for the banks.

Despite these implications of the ratio, there are several drawbacks of the ratio. The ratio does not indicate anything about the quality of the assets being generated and the duration and gap analysis between assets and liabilities of the banks (Bod'a & Zimková, 2019). As a result of these drawbacks, this ratio should be used in combination with other financial indicators to determine the financial health of the banks.

4. Loans to total asset ratio

The next indicator of the risk profile of the banks is the loan to total assets ratio. Loans are the most important assets for any bank and hence an important indicator of their financial health as well as the credit risk possibility. The ratio can be calculated as follows:

$$\frac{Total\ Loans\ and\ advances\ of\ the\ bank}{Total\ Assets} \quad (4)$$

Loans are an important source of interest income for banks. However, a very high ratio will mean that the liquidity position of the bank is problematic. However, it would also mean that the bank is lending aggressively, leading to a probability of default in loan repayment. This ratio is also an important indicator of the loss provisions which need to be created by banks against non-performing assets. In most of the existing studies on the issue, there has been a positive relationship between loans to asset ratio and the loss provisions maintained by the banks (Ozili, 2018). These provisions further create stress on the banks' balance sheets.

5. Operational expenses to total assets

The fifth indicator used for the measurement of the risk profile of banks is operating expenses to total assets. This ratio is an indicator of the operating efficiency of a bank. It is linked to various types of banking risks. The ratio can be calculated as follows:

$$\frac{Operating\ expenses}{Total\ Assets} \quad (5)$$

Banks' operating expenses are those expenses related to the daily affairs of banks. Their relationship with risk is complicated. Banks that spend more money on the prevention of credit standards and checking the quality of borrowers have lesser chances of credit risk (Lotto, 2018). At the same time, very high expenses create a negative impact on the overall operating efficiency of the banks and their profitability. It has also been seen that there is a U-shaped relationship between the bank's operating efficiency and loan growth. In other words, as the loans of banks start to grow, the operating efficiency of the bank's declines, thereby increasing their overall risk profile (Osei-Assibey & Asenso, 2015).

6. Return on Assets

Return on assets is one of the most important profitability indicators for banks. The ratio is a measure of returns generated over total assets by the banks. It can be calculated as follows:

$$\frac{Net\ Income\ after\ interests\ and\ taxes}{Total\ Assets} \quad (6)$$

The decline in ROA is a warning sign for banking supervisors since it is an indicator of multiple risks. When multiple banks exhibit a decline in return on assets, this can also lead to a financial crisis if no intervention is done by the central banks and the governments. ROA is also related to non-performing assets, another indicator of banking risk since bad loans would reduce the income of the bank, thereby generating lesser money for investors and shareholders (Widajatun & Ichsani, 2019).

ROA is also an important indicator of the market risk of the banks. A very low return on assets will bring fluctuations in the prices of shares for a bank, thereby increasing the market risk. Banks can increase their ROA by diversification and increasing the share of non-interest income (Banerjee, et al., 2017). However, the extent of non-interest income should be kept in check since too much reliance on that would mean that bank is moving away from its core business activities.

7. Return on Equity

Similar to return on asset, the return on equity variable is also an important profitability and risk indicator. This ratio measures how much returns have been generated for the shareholders of the firm. The same can be calculated with the help of the following formula.

$$\frac{Net\ Income\ after\ interests\ and\ taxes}{Shareholders'Equity} \quad (7)$$

With the new Basel norms, a lot of importance is being given to capital regulation and risk-weighted assets. As a result, the investment of banks is closely monitored, which results in a lower return on equity. In order to generate more returns, banks tend to invest in riskier assets, thereby increasing the overall risk profile (Bhattacharya, 2013). On the other hand, if the banks do not generate enough returns for the shareholders, it indicates that the quality of assets and investments is not good, and banks need to improve their financial performance. Another relationship between ROE and risk can be explained with the help of the amount of capital. The higher capital level would reduce the level of risk and, in turn, lower the level of expected return on equity by the investors (Tan, et al., 2017).

8. Profit margin

As the name suggests, the net profit margin is an indicator of the profitability of the bank. This indicator is often used along with ROA and ROE in order to determine the profitability of the banks. The ratio can be calculated as follows:

$$\frac{Net\ Profit\ after\ interests\ and\ taxes}{Total\ Income} \quad (8)$$

Existing studies on the relationship between profitability and risk are inconclusive. These studies indicate that levels of risk might not have any impact on the profitability of the banks. On the other hand, the level of profitability is directly related to the extent of market and credit risk (Duho, et al., 2020). Although generally, a high-profit margin is

considered good for the financial health of banks, it might be due to the reason of bad lending practices, risky investments, and market movements. As a result, there should be an in-depth study of the profitability of banks before establishing its relationship with the risk profile of banks.

9. Deposits to total liabilities

This ratio is a measure of the liability side of banks' balance sheets. It indicates the proportion of deposits in total liabilities of banks. The ratio can be calculated as follows:

$$\frac{Total\ Demand\ and\ Time\ Deposits}{Total\ Liabilities} \quad (9)$$

This ratio indicates the level of confidence placed by the general public in the banking system of a country in general and a bank in particular. It also indicates the extent to which a bank has to rely on external debt financing to finance its loans. During recent years, the interest rates of deposits have come down drastically, which has reduced the level of despots in banks as compared to other capital and money market instruments. As a result, banks have to resort to riskier investments in order to generate more loans. Banks need to keep a check on deposits so as to improve their financial health.

10. Non-interest income to interest income

Interest income is the major source of income for any bank. However, in order to diversify, the banks look for other sources of income besides interest. The current indicator is a measure of the same. The ratio can be measured as follows:

$$\frac{Total\ Non-interest\ income\ of\ banks}{Total\ Interest\ income\ of\ the\ bank} \quad (10)$$

With the increasing deregulation across the globe, the share of non-interest income is increasing for banking firms. However, the relationship between non-interest income with risk is complicated. The banks with higher idiosyncratic risk are more interested and

incentivized to enter into activities with non-interest income. However, for the banks already having a higher risk profile, investors and regulators get more worried if they diversify too much and drift away from their core activities (Chen, et al., 2017).

11. Gross NPAs to total assets

Non-performing assets are considered to be one of the most prominent indicators of credit risk for a bank. It indicates those assets where the borrower fails to repay the principal or interest or both within a stipulated period of time. It indicates the assets which would not generate any income for the bank. The ratio can be calculated with the help of the following formula:

$$\frac{Total\ Non-performing\ assets}{Total\ Assets\ of\ the\ bank} \quad (11)$$

Indian banks have been dealing with the problems of non-performing assets, and stringent prudential and provision norms are formed in order to improve the risk management practices in this area. At present, these assets are classified into four categories- standard, sub-standard, doubtful, and loss assets depending upon the time period for which the debt is still unpaid (Sharifi, et al., 2019). The extent of NPAs in a country depends on various factors, some of which are bank-specific and some related to the entire economy (Narwal & Pathneja, 2020). That is why there is a need to understand the importance of NPAs in a group of banks with similar ownership structures to understand the extent of their importance to the risk profile of Indian banks.

3.5.2 Risk profiling for merged banks

As some of the PSU banks have been merged during the period of study, in order to check the effect of mergers on their risk profile, the following variables suggested by (Boloupremo & Ogege, 2019) were studied only on these banks.

- Profitability margin

As explained in the previous section, profitability margin is an important performance and risk indicator for any firm, especially in the case of a firm that is going to be merged. It will determine the confidence which can be placed by the investors in the bank and also determine the risk profile of the newly created entity. The formula for calculating the profitability margin is shown below.

$$\frac{Net\ Profit\ after\ interests\ and\ taxes}{Total\ Income} \quad (12)$$

- Shareholders' funds to total assets

Since shareholders are the most important stakeholders when it comes to mergers, it is important to understand how much equity capital cushion a firm has before and after the merger. If the capital cushion significantly goes down, it would mean an increase in the risk profile of the bank. This ratio also determines the extent of leverage required to finance future expansion and working capital needs. The formula for the ratio is given below

$$\frac{Share\ Capital + Reserves}{Total\ Assets} \quad (13)$$

- Loans to total assets or asset profile

While the equity ratio measures the strength of the liability side of the balance sheet of a bank, the loans to asset ratio are used to measure the strength of its asset side. The ratio indicates the aggressiveness of the loan policy of the bank. While the ratio of a high loan indicates a large loan base, it also means that the bank has lesser liquidity because of the same. A very high loan-to-asset ratio also indicates a high credit risk because it might signal a lapse in the lending provisions to generate more loans. In the case of a merger, acquiring bank can see a sudden increase in its loan ratio because of acquiring loans from other banks. However, it must be noticed that the quality of these assets is not compromised. The formula for this ratio is as follows:

$$\frac{Total\ Loans\ and\ advances\ of\ the\ bank}{Total\ Assets} \quad (14)$$

- Operating expenses to net income

As discussed previously, this ratio is an indicator of the operating efficiency of the banks. This ratio tends to increase during the process of the merger because of various expenses related to the consolidation process. It is important to note that there can be a sudden increase. However, it should be only for a short period because a constant increase in operating costs would mean that the banks have problems managing their day-to-day operations. The ratio can be calculated as follows:

$$\frac{Operating\ expenses}{Net\ income} \quad (15)$$

- Cash and short-term funds to deposits

This is the direct indicator of the liquidity position of banks. If the banks do not have enough cash and short-term reserves, this might create a problem in meeting the obligation of deposits. On the other hand, too much cash as compared to deposits would mean that the banks are not lending efficiently. The banks also need to keep a pre-determined amount of deposits in cash as per regulatory requirements. This ratio would help in understanding how much change was brought into it because of the merger of banks. The ratio can be calculated as follows:

$$\frac{Cash\ and\ bank\ holdings\ with\ RBI}{Total\ Deposits\ of\ bank} \quad (16)$$

3.5.3 Scale development for risk management and disclosure practices

In order to find out the strength of market discipline of the selected commercial banks, Risk Disclosure Index is used. The risk disclosure index is an objective index that ranks the banks on the basis of their BASEL norms Pillar 3 disclosures. The risk disclosure index has been designed from the existing disclosure indices by (Giner, et al., 2020),

(Naz & Ayub, 2017), (Dhar, 2014) (Santos, et al., 2014) and (Barakat & Hussainey, 2013). These indices are mostly similar in nature and cover one or more of the six dimensions of risk management as per the BASEL disclosure survey and quantify the extent of disclosure as per BASEL standards. However, since most of these indices are designed on the basis of the Basel -II Accord, some changes have been made as per the RBI pillar three disclosure guidelines.

3.5.3.1 Elements of disclosure scale

The index follows a nominal scoring technique where one is given for every present parameter and 0 for every missing parameter. The index has 40 parameters which mean that a bank can score between 0 to 40 in the risk management and disclosure practices. The six parameters used in the index are:

- Capital Structure

The main purpose of this segment is to provide detailed information about the various equity and debt instruments being used by the bank and their key information. For a common investor, it might be difficult to understand the key features of these instrument, so Basel 3 requires banks to provide important details like paid-up capital, maturity of debt instruments, nature of instruments, etc.

- Capital adequacy

This section of the bank's disclosures relates to the details regarding the nature of capital, including their risk weights and other regulatory capital requirements. The main purpose of this section is to let the investors know whether the bank is following the regulatory requirements of various kinds of capital and where the bank stands in terms of capital provisions for various types of risks.

- Credit risk-modeling,

A large part of pillar three disclosure and RBI-mandated disclosure is dedicated to credit risk disclosures. It covers quantitative and qualitative disclosures regarding the bank's actions to mitigate credit risk, including the description of the credit risk committee, credit rating, provisions of non-performing assets, detail regarding sector-wise and area-wise lending, etc. This section will help the investors in understanding the preparation of banks to deal with the default and credit risk

- Operational risk,

This section of the disclosure deals with the capital requirement of operating risk and the provisions and methods used by banks to prevent operating risk, details of internal controls and audit systems, cybersecurity and legal risk prevention measures, etc. This section should also deal with the measuring methodologies which will be best suited for banks in order to measure operating risk and standardized and non-standardized approaches to measuring and mitigating this risk

- Market risk internal modeling

Market risk is very crucial for investors because it will directly impact their returns from the value of banks' shares. The disclosures related to market risk include capital provisions for market risk and its measurement methodologies. It measures both on and off-balance sheet approaches of market risk for better clarity of stakeholders. Market risk includes two broad categories: interest rate risk due to the debt instrument and trading book values of equity instruments. The second basic category of market risk is the foreign exchange risk caused by banks' exposure to foreign markets.

- Other risks

This section includes all the remaining risks which are not covered in the previous sections of the disclosures. These risks include liquidity risks and legal risks, which could also hamper the risk profile of the bank. This section will include the quantitative and

qualitative disclosure related to all the remaining segments, which might give some information to investors and regulators regarding the riskiness of banks' operations.

On the basis of this basic framework of the Basel committee and RBI, the scale was designed to analyze the disclosure practices of Indian banks.

The scale is given in the annexure at the end of the report.

3.6 Data Analysis Techniques

The present section of the chapter deals with the details of statistical techniques and analysis which were used to obtain results for various objectives of the study. The study uses different analytical tools for each objective. These techniques include clustering analysis (hierarchical and k-means clustering, one-way ANOVA, disclosure score comparison using scale scores and one sample t-test and OLS regression using a fixed-effect model. The details of each of these techniques are discussed below.

3.6.1 Risk profiling of banks

For the second objective of the study, which is to measure the risk profile of the banks, cluster analysis was used. On the basis of cluster analysis, banks were divided into three main clusters, namely high, medium and low-risk clusters. This clustering was done on the basis of 10 financial variables discussed in detail in the previous section. The relationship of these variables with banking risk, as established by literature, was used for classifying them into three clusters.

3.6.1.1 Cluster analysis

Cluster analysis is a classification technique that is used to group observations into different subsets on the basis of their similarities and dissimilarities. The similarity between two or more objects is measured in the form of mathematical distance among these variables. There are various ways of measuring distance, one of the most common of which is Euclidean distance (Mazzocchi, 2008). The same can be calculated as follows:

$$D_{ij} = \sqrt{\sum_{k=1}^{n} (x_{ki} - x_{kj})^2} \quad (17)$$

Were

X_{ki} is the measurement of k-th variable and i-th observation

There are two main types of clustering, and both of them have been used in the current study. These two approaches are hierarchical and non-hierarchical (k means clustering)

Hierarchical clustering

The present study uses hierarchical agglomerative clustering. This approach creates new clusters by merging already created clusters in a hierarchy. The word agglomerative indicates that the process starts from a stage where all the participants are divided into as many clusters as possible, moving towards a single cluster solution. The cluster formation is analyzed through a graphical tool called a dendrogram.

K means clustering

While hierarchical clustering is used to determine the number of clusters, k means clustering allows researchers to easily classify the data points and objects into a predetermined number of clusters. This is a non-hierarchical cluster where the number of clusters is already decided by the researcher, and observations are classified accordingly. One of the biggest limitations of the k-means clustering is that it is more sensitive to outliers than hierarchical clustering.

3.6.1.2 One Way ANOVA

After classifying the banks into three clusters on the basis of hierarchical and k-means clustering for all the years of the study period, the significant variables are identified with the help of one-way ANOVA. This test, also known as the analysis of variance, is used to identify if there is any significant variation in the means of two or more independent samples. In other words, it is an extension and generalization of the t-test. The formula for calculation of one-way ANOVA is shown below.

$$F = \frac{MST}{MSE} \tag{18}$$

MST = mean square between groups

MSE = mean square within groups

$$MST = \frac{\sum_{i=1}^{k}\left(T_i^2 | n_i\right) - G^2 / n}{k-1} \tag{19}$$

$$MSE = \frac{\sum_{i=1}^{k}\sum_{j=1}^{n_i} y_{ij}^2 - \sum_{i=1}^{k}\left(cT_i^2 | n_i\right)}{n-k} \tag{20}$$

Y_{ij} = any observation,

T_i^2 = a group total

G = sum of all observations,

n_i = number in group i and

n = total number of observations.

In this case, these samples were the three clusters. The test was used to identify which of these variables were significantly different among the clusters. Analyzing these variables

over the years helps us in identifying the most significant variables over the period of study for each banking group.

3.6.1.3 Analysis of post-merger risk change

In order to identify whether there is any statistically significant difference between the above-mentioned variables before and after the merger of these banks, a paired sample t-test was run.

Paired sample t-test

Paired sample t-test is a parametric statistical test that is used to check the statistical difference between the mean values of two samples taken from the same variable. In this case, it means the difference between the mean values of these financial indicators prior to and post the merger of the bank.

$$t = \frac{\sum d}{\sqrt{\frac{n(\sum d^2) - (\sum d^2)}{n-1}}} \quad (21)$$

Were

n = number of samples

d= difference per paired value

3.6.2 Analysis of risk management and disclosure practices

The analysis of disclosure practices was conducted with the help of the disclosure scale developed above. Each bank was awarded a score on all the parameters on the scale on the basis of the presence and absence of the phenomenon, thereby making the highest achievable score to be 40. The Basel 3 pillar three disclosures are published every quarter and were introduced in India in 2013-14, so data has been taken from that financial year.

In order to find out the difference between the disclosure scores for public and private sector banks, an independent sample t-test was used. It is a statistical tool that checks whether the mean values from two independent samples are statistically significantly different or not. The formula for the same is as follows:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{s^2\left(\frac{1}{x_1} + \frac{1}{x_2}\right)}} \quad (22)$$

$$S^2 = \frac{\sum(x - \bar{x}_1)^2 + \sum(x - \overline{x_2})^2}{n_1 + n_2 + 2} \quad (23)$$

Were,

$\overline{x_1}$= mean of sample 1

$\overline{x_2}$= mean of sample 2

S^2= sample variance

$n_1$and n_2 represent the sample size

3.6.3 Relationship between risk and disclosure

The third objective of the study deals with the establishment of the relationship between the risk profile of the banks and their disclosure scores. The hypothesis for the current objective is as follows:

H_0 = Risk management and disclosure score of the banks is not significantly dependent on their risk profiling parameters

H_1= Risk management and disclosure score of the banks is significantly dependent on their risk profiling parameters

H_{1a}= Risk management and disclosure score of public sector banks is significantly dependent on their risk profiling parameters

H_{1b} = Risk management and disclosure score of private sector banks is significantly dependent on their risk profiling parameters

H_{1c} = Risk management and disclosure score of foreign banks is significantly dependent on their risk profiling parameters

In order to test the above-mentioned hypothesis, the OLS regression was used on each of the bank groups and their respective risk scores and parameters of risk profile.

OLS regression stands for an ordinary least square regression model, which helps determine the dependence of one or set of variables on the other variable in a linear equation with the help of the least square method. In simple words, it helps in determining the relationship between the set of variables in a linear equation.

$$\begin{aligned} \boldsymbol{Discl_{it}} = {} & \boldsymbol{\beta_1} + \boldsymbol{\beta_2}\, \boldsymbol{ROE_{it}} + \boldsymbol{\beta_3}\, \boldsymbol{LTDR_{it}} + \boldsymbol{\beta_4}\, \boldsymbol{OETA_{it}} + \boldsymbol{\beta_5}\, \boldsymbol{LHTA_{it}} \\ & + \boldsymbol{\beta_6}\, \boldsymbol{NP_{it}} \\ & + \boldsymbol{\beta_7}\, \boldsymbol{CHTA_{it}} + \boldsymbol{\beta_8}\, \boldsymbol{DEPTL_{it}} + \boldsymbol{\beta_9}\, \boldsymbol{CRTA_{it}} \\ & + \boldsymbol{\beta_{10}}\, \boldsymbol{NII_{it}} + \boldsymbol{\beta_{11}}\, \boldsymbol{NPATA_{it}} + \boldsymbol{\varepsilon_{it}} \end{aligned} \qquad (24)$$

Were,

$\boldsymbol{Discl_{it}}$ = Risk management and Disclosure score of a bank *t* for period *i*

$\boldsymbol{\varepsilon_{it}}$ = Error Term for the model

$\boldsymbol{ROE_{it}}$ = Return on Equity of a bank *i* for period *t*

$\boldsymbol{LTDR_{it}}$= Loans to deposit ratio of a bank *i* for period *t*

$\boldsymbol{OETA_{it}}$= Operational expenses to total assets of a bank *i* for period *t*

$LHTA_{it}$= Loans to households to total asset ratio of a bank *i* for period *t*

NP_{it}= Net Profits margin of a bank *i* for period *t*

$CHTA_{it}$ = Cash and Bank Balance to Total Assets of a bank *i* for period *t*

$DEPTL_{it}$ = Deposits to total liabilities of a bank *i* for period *t*

$CRTA_{it}$= Capital and Reserves to Total Assets of a bank *i* for period *t*

NII_{it} = Non-interest income to interest income of a bank *i* for period *t*

$NPATA_{it}$= Gross NPAs to total assets of a bank *i* for period *t*

The above-mentioned model was applied four times during the study in order to get the results for the entire sample as well as three ownership categories.

3.7 Chapter Summary

The current chapter discussed the details of various statistical tools and techniques used in validating all three research objectives. The chapter also discussed the details of sample and sampling plan as well as the whole process of hypothesis development. The chapter discussed the key variables and concepts used in the research along with their formulae as well as supporting literature which justifies their application. The chapter helps in analyzing the research design of the current study in detail for laying the groundwork of future analysis explained in the coming chapters.

Chapter 4: STUDY OF RISK MANAGEMENT AND DISCLOSURE PRACTICES OF COMMERCIAL BANKS

4.1 Chapter introduction

The second objective of the study deals with the study of risk management and disclosure practices of scheduled commercial banks. The chapter deals with the analysis and findings of the same objective. The chapter discusses the results of scores on the disclosure scale for each bank and banking sub-group, a comparative analysis of the scores among different ownership groups using a T-test and the resulting findings of the same

In order to find out the performance of banks on risk management and disclosure practices, a binary scale has been used. All banks disclose specific information about their financial health as per the BASEL III framework every quarter. An Indianized version of this risk disclosure has been prescribed by RBI, which covers information about all major kinds of banking risks as specified under international standards. Each of the sample banks was studied on the basis of a risk disclosure index developed, having 40 statements discussing various types of risks. The details regarding scale development are discussed in the research methodology chapter. Since the banks in India adopted Basel III disclosures in the middle of 2013-14, the data has been collected for six financial years from 2014-15 to 2019-20. Each bank has been given a score out of 40 in each quarter, and inferences are drawn on the basis of these scores. The tables below discuss the scores of risk disclosure in public and private sector banks, respectively, for the given study period.

4.2 Risk management disclosure scores of public sector banks

The table shows the disclosure scores of sample public sector banks for the study period of 2014-2020 on the basis of the quarterly disclosures published by them.

Table 4-1- Risk disclosure scores of Public Sector Banks from 2014-15 to 2019-20

IOB	Indian Bank	CBI	UBI	BoI	Canara Bank	PNB	SBI	BoB
31.5	31	30	33.5	34	34	32	32	34
10	18	15	16	12	15	21	11	15
31.5	31	30	33.5	34	34	32	32	34
10	18	15	16	12	15	21	11	15
31.5	31	30	33.5	34	34	32	32	34
10	18	15	16	12	15	21	11	15
31.5	31	30	33.5	34	34	32	32	30
10	18	15	16	12	15	21	11	15
31.5	31	30	33.5	34	34	32	32	30
10	18	15	16	12	14	21	11	15
31.5	31	30	33.5	34	34	32	32	30
7	18	15	16	12	15	21	11	16
31.5	31	30	33.5	34	34	32	32	30
7	18	15	16	12	14	21	11	14
21.5	31	30	33.5	34	34	32	32	30
7	18	11	16	12	15	21	11	14
31.5	31	30	33.5	34	34	32	32	30
7	18	15	16	12	14	21	11	14
21.5	31	30	33.5	34	34	32	32	30
7	18	15	16	12	15	21	11	14
31.5	31	30	33.5	34	34	32	32	30
7	12.5	15	16	12	14	21	11	14
21.5	25	30	33.5	34	34	32	32	30
7	12.5	15	16	12	15	21	11	14

UCO Bank	10	10	10	10	29	10	10	10	29	10	10	10	29	10	10	10	29	10	29	10	29	10	29	10
Banks	Mar-20	Dec-19	Sep-19	Jun-19	Mar-19	Dec-18	Sep-18	Jun-18	Mar-18	Dec-17	Sep-17	Jun-17	Mar-17	Dec-16	Sep-16	Jun-16	Mar-16	Dec-15	Sep-15	Jun-15	Mar-15	Dec-14	Sep-14	Jun-14

From the below tables, it can be said that although banks declare information quarterly, the quarter ending September and March disclose more information than the other two quarterly disclosures. The main reason for the same is that RBI has declared some information to be mandatory disclosures quarterly and some semi-annually. The most elaborate disclosures relate to banks' credit risk disclosures, and the same is disclosed in detail every quarter, unlike other risks like operational risk, which is one of the least discussed risks in the books of banks.

It can be seen that the highest score received by any public sector bank on the scale comes out to be 34 out of 40. This is mainly because banks do not provide some qualitative information about operating and liquidity risks. The highest scores are generally obtained in the quarter ending March, where the banks tend to disclose maximum information. As far as the lowest disclosure scores are concerned, they are received by Indian Overseas Bank and UCO Bank with 7 and 10 out of 40, respectively. Both these scores are for the lean quarters of June and December. While UCO Bank has scored 10 in each lean quarter, the Indian Overseas Bank has witnessed a decline in the scores from 10 to 7 in later years of the study.

When it comes to good performing banks, PNB scored 21 out of 40 in lean quarters, which was the highest among all public sector banks. For March and September, it scored around 32, which was also one of the highest. SBI also scored 32 in these quarters, but the scores in the other two quarters were around 11, which is among the lowest in the category. Another good performing bank that performed well in all four quarters was Union Bank of India, which scored around 33.5 in the quarters ending March and

September and 15 in the other two quarters. These findings are in line with the findings of the risk profile of banks, where UCO Bank and Indian Overseas Bank were among the high-risk banks, and they also scored among the lowest in their risk disclosure scores. Similarly, PNB and Union Bank of India were among the best performing banks in terms of their risk profiles, and they performed better in their disclosure scores as well. The findings of the regression model in the next chapter will throw more light on this relationship.

4.3 Risk management disclosure scores of private sector banks

The table below discusses the disclosure scores of sample private sector banks during the study period

Table 4-2- Risk disclosure scores of Private Sector Banks from 2014-15 to 2019-20

Axis Bank	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12	36	12
HDFC	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	14	14	14	35	14	35	14	35	14	35	14
ICICI	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18	37	18
YES Bank	35	28	35	28	35	28	35	28	35	28	35	28	35	28	35	28	35	28	35	24	35	24	35	24	35	24
Kotak Mahindra	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	14	35	11	35	11
IndusInd	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14	34	14
Federal Bank	31	17	31	17	31	17	31	17	31	17	33	17	33	17	33	17	33	17	33	17	33	17	31	17	33	17
IDBI Bank	33	14	33	14	33	14	33	14	33	14	33	14	33	14	33	14	33	14	33	14	33	13	33	14	34	14

J&K Bank	31	11	31	11	31	11	31	11	31	11	31	11	31	21	31	11	31	11	31	11	31	20	31	11	
South Indian Bank	30	13	30	13	30	13	30	13	30	13	30	13	30	13	30	13	30	12	30	12	30	12	30	12	
Banks	20	19	19	Jun-19	19	18	18	Jun-18	18	17	17	Jun-17	17	16	16	Jun-16	16	15	15	Jun-15	15	14	14	Jun-14	

The table shows that both the highest and lowest scores in the category of private sector banks, i.e., 37 and 11 respectively, are more than that of public sector banks. Also, as observed in the case of public sector banks, the scores of disclosures are almost double in the case of quarters ending March and September as against the other two quarters. Not only that, but in this category as well, the scores across the financial years are similar for respective quarters, which indicate that the banks have not improved their disclosure practices over the years and primarily have been using the same template over the study period.

When it comes to best performing banks in the category of private sector banks, they come out to be ICICI Bank and YES Bank. While YES bank had the highest scores in case of lean quarters of June and December with a score of 28 out of 40, which is exceptionally high for these quarters across the categories, its scores in the other two quarters are also 35 out of 40 which is second only to ICICI bank in this category and higher than any public sector banks studied for the current research. The high scores of YES bank in lean quarters were because the bank disclosed detailed information about the capital instruments and market risk in these quarters as well and not just credit risk modeling like most other banks. YES, Bank also scored good points in the case of risk profiling conducted in the previous section.

ICICI bank scored the maximum 37 out of 40 in the quarters ending /March and December. These scores mean that the bank fulfills almost all the disclosure requirements as per the Basel suggestions. The only few areas where it can give more information include areas of liquidity, and legal risks, where qualitative information is more sought

after as compared to quantitative information. However, the scores are comparatively low in the other two quarters, i.e., just 18 out of 40. Although it is less as compared to YES Bank, it is still one of the highest among all sample banks and the highest in the case of public sector banks.

When it comes to the least performing banks in the category, the least scores are received by J&K Bank and South Indian Bank. While the former scored 31 out of 40 in quarters ending March and September on an average, for the other two quarters, the scores are 11 out of 40. Although the scores are high as compared to public sector banks, but low in the category. South Indian bank, on the other hand, scores 13 out of 40 in the quarter ending June and September, but it scores just 30 out of 40 in the other two quarters. These figures indicate that these banks need to disclose more information than just credit risk modeling in the lean quarters to help their investors. Federal Bank also scored around 31 in quarters ending March and September, but it performed better in the other two quarters and scored 17 out of 40, which is among the highest in the category for lean quarters.

One of the riskiest banks in the category came out to be IDBI bank in the findings of the next chapter. When it comes to scores of disclosure practices, the bank performs better than a few banks in the category. It scored around 14 in the quarter ending June and September and 33 on average in the other two quarters. This is higher than the other three banks discussed above. This shows that although the bank was making losses, its disclosure score was still better in the category. However, the bank still needs to disclose more information about the risk profile and qualitative information about its risk. Had it provided the same, it would have been easier for investors to understand the risky loans given by this bank to borrowers like Vijay Mallya during the same period.

4.4 Risk management disclosure scores of foreign banks

The table below discusses the disclosure scores of sample foreign banks during the study period of 2014-15 to 2019-20

Table 4-3- Risk disclosure scores of Foreign Banks from 2014-15 to 2019-20

Foreign Banks	BNP Paribas	HSBC	Mufg	Barclays	Bank of America	JP Morgan	Deutsche Bank	DBS Bank	Standard Chartered	Citi Bank
Mar-20	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-19	2	21	17	20	19	18	28.5	16	26	16
Sep-19	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-19	2	21	17	20	19	18	28.5	16	26	16
Mar-19	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-18	2	21	17	20	19	18	28.5	16	26	16
Sep-18	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-18	2	21	17	20	19	18	28.5	16	26	16
Mar-18	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-17	2	21	17	20	19	18	28.5	16	26	21
Sep-17	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-17	2	21	17	20	19	18	28.5	16	26	21
Mar-17	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-16	2	21	17	20	19	18	28.5	16	26	21
Sep-16	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-16	2	21	17	20	19	18	28.5	16	26	21
Mar-16	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-15	2	21	17	20	19	18	28.5	16	26	21
Sep-15	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-15	2	21	17	20	19	18	28.5	16	26	16
Mar-15	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Dec-14	2	21	17	20	19	18	28.5	16	26	16
Sep-14	35.5	33	32	33.5	32	35.5	35.5	35.5	32.5	33
Jun-14	2	21	17	20	19	18	23.5	16	26	16

From the above table, it can be seen that foreign banks are better than the public sector banks and mostly on par with the private sector banks. More details are discussed in further sections of the chapter in comparative results. Like in the other two categories, banks disclosed more information in quarters ending March and September as compared to the other two quarters. Also, the trend of scores remained the same across the study period, indicating that foreign banks also disclosed similar information over the period of years.

When it comes to best performing banks in the category, it can be seen that a large number of sample banks obtained similar scores, which was not seen in the other two subgroups. For example, the highest score in the category was 35.5 in the March and September quarter, which was scored by four out of 10 sample banks. Although this score is lesser than the highest score of private sector banks, but the number of banks scoring the same score is much higher. Out of these two banks, the two best performing banks are Deutsch Bank and Standard Chartered Bank as they scored the highest scores in the other two quarters as well with an average score of 28.5 and 26 out of 40 respectively for the quarters ending June and September. These scores are also at par with the highest scores in the same quarter in the case of private sector banks and higher than public sector banks. When we compare the results with the risk profiling results discussed in the next chapter, it can be seen that although a lot of banks were in low-risk clusters, the best performing bank, i.e., Bank of America, did not secure its place in the top banks in terms of disclosure. However, the scores of the bank, which were 32 and 19 out of 40 in lean and other quarters, were satisfactory enough.

When it comes to the worst-performing banks in the foreign banks category, BNP Paribas scored very less in the quarters ending June and September. The bank, on its Indian subsidiary's group, published only a small table of capital disclosures in these quarters. While in the quarter ending March, the firm scored a high score of 35.5 out of 40, which is the highest in the category, it did not publish any information on any type of risk in any other quarter. This brought down its average score to be among the lowest in the entire

sample of the study. On comparing the results of risk profiling for the bank, it can be seen that the bank was also in high-risk clusters for a lot of years during the study period, indicating a relationship between poor performance in both areas.

On the whole, foreign banks as a category performed much better in all the quarters during the entire study period, with scores above 30 scored by all the banks for quarters ending March and September and of more than 15 for the other two quarters, ignoring the outlier in the form of BNP Paribas. If we ignore this bank and its scores, most of the other foreign banks fall into a similar range of scores for all four quarters. These results are again similar to the results of risk profiling, where there were not many banks falling into high-risk clusters during the study period.

4.5 Comparative analysis of risk management disclosure scores

The present section of the chapter deals with the comparative analysis of the disclosure scores of all the categories of banks. The comparison has been made with the help of average scores during the study period and comparative mean analysis using the independent sample t-test. The tables presented below show the results of these comparisons.

Table 4-4 -Comparative analysis of average disclosure scores of sample banks

Private Sector Banks	Average Score	Public Sector Banks	Average Scores	Foreign Banks	Average Scores
Axis Bank Limited	24.00	Bank of Baroda	22.79	Citi Bank	25.74
HDFC Bank Limited	23.63	State Bank of India	21.50	Standard Chartered	29.37
ICICI Bank Limited	27.50	Punjab National Bank	26.50	DBS Bank	26.11
YES Bank Limited	30.83	Canara Bank	24.33	Deutsche Bank	31.76

Kotak Mahindra Bank Ltd.	24.25	Bank of India	23.00	JP Morgan	27.07
IndusInd Bank Limited	24.00	Union Bank of India	24.75	Bank of America	25.74
Federal Bank Limited	24.50	Central Bank of India	22.33	Barclays	27.00
IDBI Bank Limited	23.50	Indian Bank	23.79	Mufg	24.78
Jammu & Kashmir Bank Ltd	21.79	Indian Overseas Bank	18.63	HSBC	27.22
South Indian Bank Ltd.	21.33	UCO Bank	15.54	BNP Paribas	18.75
Category Average	**24.53**		**22.32**		**26.35**

The above table shows the average scores of each bank for study period of 2014 to 2020 for all the quarters. The top three banks on the basis of average scores come out to be Deutsche Bank, YES Bank, and Standard Chartered Bank, with scores of 31.76. 30.83 and 29.37 respectively. Out of these three banks, two are foreign banks, and one is a private sector bank. The highest score in the case of public sector banks was achieved by Punjab National Bank, which was 26.50 out of 40. The category average is also highest in the case of foreign banks, followed by private sector banks with a score of 26.35 and 24.53, respectively. The scores are towards the lower end because of the less reporting in the quarters ending June and December. Most banks do not disclose a lot of qualitative information beyond what is required by the RBI framework. A reason for the high scores

of foreign banks can be because of the high disclosure requirements of their home country or their decision to follow international standards over and above RBI requirements.

When it comes to the least average scores, the least scores are obtained by UCO Bank, Indian Overseas Bank, and BNP Paribas, with their average scores being 15.53, 18.63, and 18.75 out of 40, respectively. Two of these banks are public sector banks, and one is a foreign bank. These scores are almost half of the scores of top-performing banks. While BNP Paribas scored low because of a lack of disclosure in the June and December quarters, but the other two banks in the public sector category have performed badly in all the quarters. These banks have higher risk profiles as well, and less disclosure makes it even more difficult for the investors and regulators to trust them.

If we compare the category-wise performance, it can be seen that foreign banks performed better than the other two categories and public sector banks need to work on their disclosure requirements. Although all the banks fulfill the basic requirements laid by RBI, but in case they start to include more information in the quarters ending June and December and provide information in detail about various other risks like liquidity risk, legal risk, currency risk, etc. this will improve their disclosure scores and improve their image in the minds of investors.

4.5.1 Comparative analysis of disclosure scores of public and private sector banks

The second part of the comparative analysis has been the Independent T-Test between scores of different categories of banks. The table below shows the result of independent sample T-test conducted on the scores of public and private sector banks during the study period.

Table 4-5 -T- Test results for disclosure scores of public and private sector banks

Group Statistics

	Banks	N	Mean	Std. Deviation	Std. Error Mean
Disclosure	Public sector banks	240	22.3167	9.46330	.61085

Scores	Private Sector Banks	240	24.5333	9.83286	.63471

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Public Sector Banks	Equal variances assumed	3.408	.065	-2.516	478	.012	-2.21667	.88091	-3.94759	-.48574
	Equal variances not assumed			-2.516	477.300	.012	-2.21667	.88091	-3.94760	-.48573

If we look at the results of independent sample T-test, we can see that there is a significant difference between the disclosure scores of private sector banks (M=24.53, SD =9.83) and that of public sector banks (M= 22.32, SD = 9.45) conditions, t(478) = -2.516, p =0.12, p<0.05. Private sector banks tend to perform better than public sector banks in terms of risk disclosure scores throughout the course of the study.

These findings are in agreement with the existing literature on the issue since public sector banks have been criticized for poor asset quality and high ratio of NPAs. Not only that, but these findings are also concurrent with the risk profiling done in the coming chapter, which also showed that public sector banks have a higher risk profile than private sector banks.

4.5.2 Comparative analysis of disclosure scores of public sector and foreign banks

The table below shows the result of independent sample T-test conducted on the scores of public sector banks and foreign banks ding the study period.

Table 4-6 T- Test results for disclosure scores of public sector and foreign banks

Group Statistics

	Banks	N	Mean	Std. Deviation	Std. Error Mean
Disclosure Scores	Foreign Banks	240	26.0583	9.33459	.60255
	Public Sector Banks	240	22.3167	9.46330	.61085

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Disclosure Scores	Equal variances assumed	6.704	.010	4.361	478	.000	3.74167	.85802	2.05570	5.42763
	Equal variances not assumed			4.361	477.910	.000	3.74167	.85802	2.05570	5.42763

If we look at the results of independent sample T-test, we can see that there is a significant difference between the disclosure scores of foreign banks (M=26.06, SD =9.33) and that of public sector banks (M= 22.32, SD = 9.45) conditions, t(478) =4.361, p =0.00, <0.05. Foreign banks tend to perform better than public sector banks in terms of risk disclosure scores.

These results are in agreement with the findings of comparative analysis by average as well as the results of risk profiling of banks conducted in the previous section. As discussed above, foreign banks have better disclosure scores in all four quarters, unlike public sector banks, where majority of the banks disclosed less information in quarters ending June and December. Not only that, but there were also some public sector banks, which had relatively lesser scores in the other two quarters as well.

4.5.3 Comparative analysis of disclosure scores of private sector and foreign banks

The table below shows the result of independent sample T-test conducted on the scores of private sector banks and foreign banks ding the study period.

Table 4-7 T- Test results for disclosure scores of foreign and private sector banks

Group Statistics

	Banks	N	Mean	Std. Deviation	Std. Error Mean
Disclosure Scores	Foreign Banks	240	26.0583	9.33459	.60255
	Private Sector Banks	240	24.5333	9.83286	.63471

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Disclosure Scores	Equal variances assumed	16.344	.000	1.743	478	.082	1.52500	.87517	-.19465	3.24465

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Disclosure Scores	Equal variances assumed	16.344	.000	1.743	478	.082	1.52500	.87517	-.19465	3.24465
	Equal variances not assumed			1.743	476.713	.082	1.52500	.87517	-.19466	3.24466

If we look at the results of independent sample T-test, we can see that there is no significant difference between the disclosure scores of foreign banks (M=26.06, SD =9.33) and that of private sector banks (M= 24.53, SD = 9.83) conditions, t(478) = 1.743, p =0.82, p> 0.05. Foreign banks tend to perform better than public sector banks in terms of risk disclosure scores when only averages were studied, but these results show a lack of statistical difference in their mean scores.

These findings are in agreement with their risk profiling scores, where both these categories performed better than the public sector banks

4.6 Key findings

From the above discussion on risk disclosure of public and private sector banks, it can be seen that public sector banks have lower average scores of disclosures as compared to private sector banks. In the case of public sector banks. UCO bank has the lowest scores in both the quarterly and bi-annual scores with an average of around 15, followed by Indian Overseas Bank with an average score of around 18.63. on the other hand, the

banks with most disclosure scores in the category were Punjab National Bank and Union Bank of India with an average score of 26.50 and 24.75, respectively.

On the other hand, if we look at private sector banks, on average they have performed better with less deviation across banks. Not only that, highest scorers in the category, Yes Bank and ICICI bank, have higher averages of 30.83 and 27.50, respectively. On the other hand, lowest scores are by South Indian bank and J&K Bank, with around 21.33 and 21.79, respectively.

Foreign banks tend to perform better than these two categories, with scores ranging between 19-35.5 and highest average scores among all categories. Except for BNP Paribas, which discloses very minimal information in quarters ending June and December, all other foreign banks disclose good amount of information in all four quarters, making the category best in terms of disclosure scores.

Another major area of finding is that most of the banking firms are scoreless in operational risks and highest in credit risk. Along with that, just a very few banks mention details about liquidity risks and legal issues in these disclosures. However, information related to NPAs etc. is disclosed in quite a detail. This is in line with the disclosure requirement set by RBI, where a lot of focus is set on credit risk. Not only that since credit risk disclosures are required to be disclosed every quarter and other major qualitative disclosures require bi-annual disclosure, but most of the banks also release only a brief disclosure statement in quarters ending June and December as compared to other two quarters. This is primarily true in case of public and private sector banks as against foreign banks, who disclose relatively more information in all four quarters.

The findings of these disclosure score analysis is mostly in sync with the findings of risk profiling discussed in coming chapter. Their relationship with the existing literature on the issue and the implications of less qualitative disclosure will be discussed in the coming chapters.

The findings of independent sample t-test indicate that the disclosure scores of public and private sector banks are significantly different from each other, and private sector banks tend to perform better than public sector banks. Similarly, the scores of foreign banks are also significantly different and better than those of public sector banks as per the t-test results. On the other hand, the disclosure scores of private sector banks and foreign banks are not significantly different from each other, even though the average scores of private sector banks are less than those of foreign banks. There is a need to understand the reasons for low-risk disclosure scores of public sector banks and work on those issues.

4.6.1 Managerial Implications

The findings of the current chapter can be equally beneficial for regulators and investors alike. It highlights the lack of qualitative information in the quarterly disclosures by all sample banks. There should be a review of these regulatory guidelines which let banks focus only on numbers, that too mostly related to credit risk and more focus should be given to the qualitative information relating to other types of risk as well.

These findings are also useful for investors and other stakeholders as well. It gives them information that which banks provide more information about their risk management practices, thereby helping them to make a rational investment decision. Along with that, the study also provides a unique scale which is tailored as per Basel norms as well as RBI regulations, which can help investors to measure the performance of banks in future as well without any complicated mathematical operations.

The last implication of the findings of current chapter is that it helps the investors to access the quality of various sections of disclosures according to risk classification as suggested by Basel III norms. Investors can specifically look into the areas which are of their concerns and can gather all the information about that particular section instead of going through the entire set of disclosures.

Chapter 5: RISK PROFILING OF BANKS

5.1 Chapter Introduction

The present chapter deals with the research objective relating to the risk profiling of Indian banks. The chapter will present results relating to risk profiling of public, private and foreign banks using both hierarchical and k-means clustering. The chapter will further present the details of significant variables which cause the difference between the values of these clusters on the basis of the results of a one-way ANOVA analysis for each year. This chapter will also perform a relative analysis of all three ownership groups in terms of risk analysis to find out which sector of banks has improved most since the last global financial crisis.

Going with the objective of finding the risk profile of sample banks, a fundamental analysis was conducted for public sector banks. This analysis included the 11 parameters mentioned in the research methodology for the period of 2008-2020. The period from 2008 was taken since it is crucial to understand how Indian banks recovered from financial crisis and how their risk profile changed with the same. The last decade saw financial recovery, changes in rules regarding NPAs as well as the recent NBFC crisis. This time period will thus help us in understanding the consistency in the performance of banks when we calculate their risk profiles in the next step.

The present section of the report presents the details of 11 parameters required for risk profiling. The details of these parameters are as follows:

Table 5-1 Abbreviations used in results

Model	Parameter
ROA	Return on Assets
ROE	Return on Equity

LTDR	Loans to deposit ratio
OETA	Operational expenses to total assets
LHTA	Loans to households to total asset ratio
NET PROFIT	Net Profits
CHTA	Cash and Bank Balance to Total Assets
DEPTL	Deposits to total liabilities
CRTA	Capital and Reserves to Total Assets
NII	Non-interest income to interest income
NPATA	Gross NPAs to total assets

5.2 Hierarchical Clustering results

The present section of the chapter deals with the results of risk profiling of banks using hierarchical clustering method. This method does not give definitive results in terms of number of clusters, but the graphical representation of clusters in the form of a dendrogram helps in identifying the cluster movement and an idea about the number of clusters that can be formed from the given data set. As discussed in the chapter on methodology, in this study, hierarchical clustering was used to supplement the information received from k-means clustering as well as to validate the results.

5.2.1 Clustering of public sector banks

The present section of the chapter deals with the results of hierarchical clustering for public sector banks during the period of study.

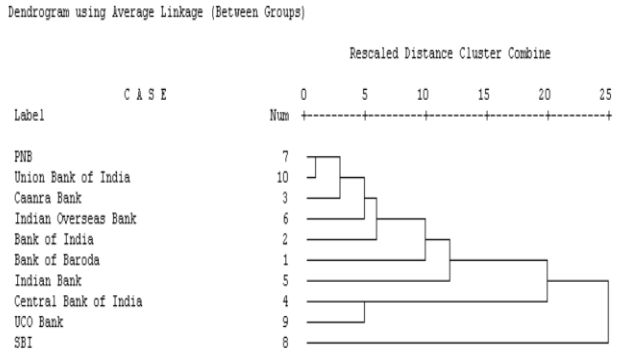


Figure 5-1 Dendrogram of public sector banks 2008

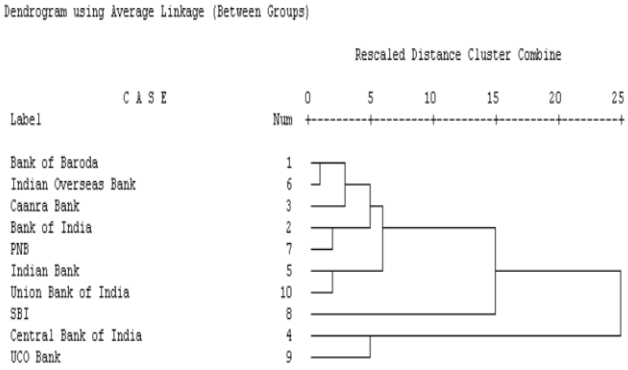


Figure 5-2 Dendrogram of public sector banks 2009

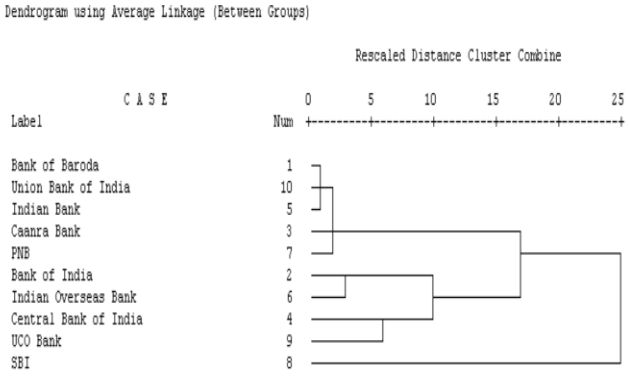


Figure 5-3 Dendrogram of public sector banks 2010

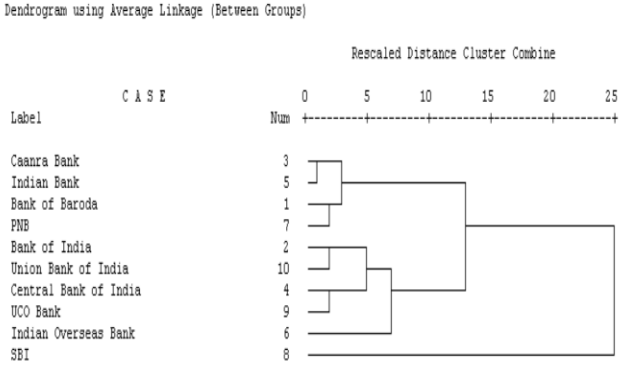


Figure 5-4 Dendrogram of public sector banks 2011

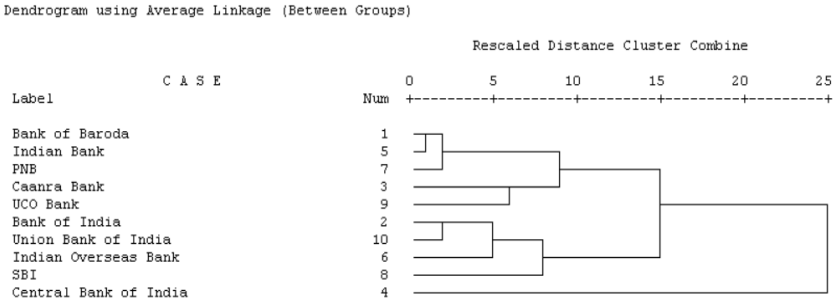


Figure 5-5 Dendrogram of public sector banks 2012

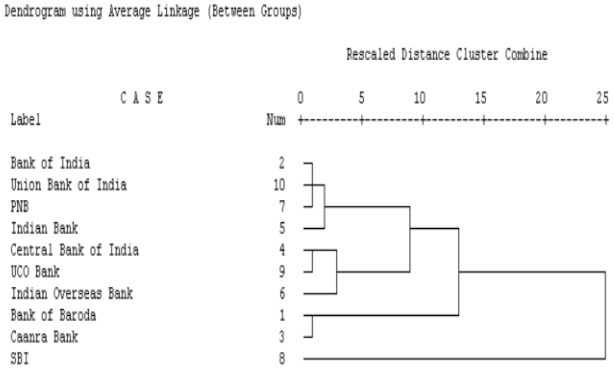


Figure 5-6 Dendrogram of public sector banks 2013

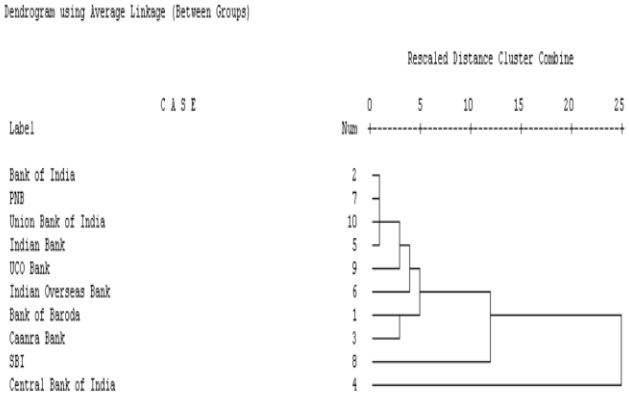


Figure 5-7Dendogram of public sector banks 2014

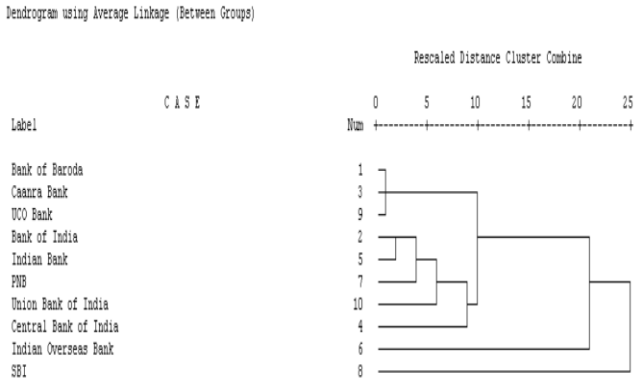


Figure 5-8 Dendrogram of public sector banks 2015

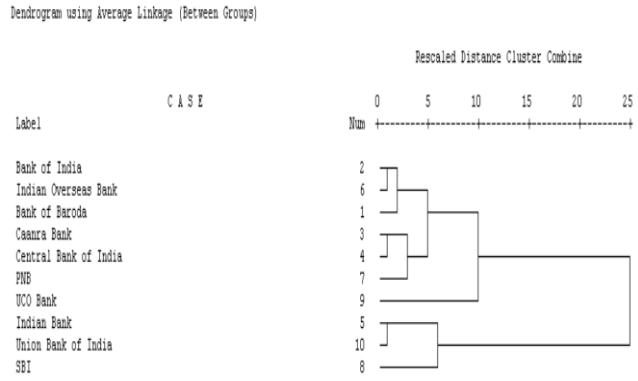


Figure 5-9 Dendrogram of public sector banks 2016

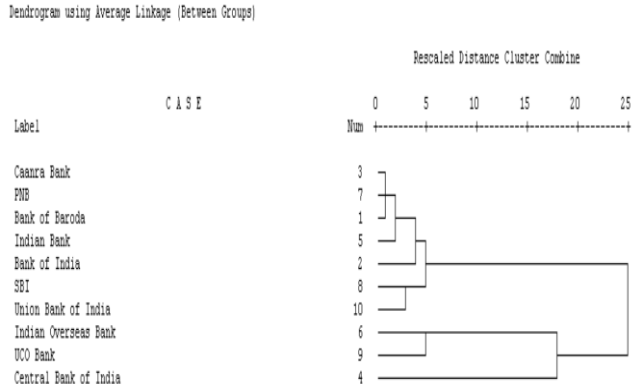


Figure 5-10 Dendrogram of public sector banks 2017

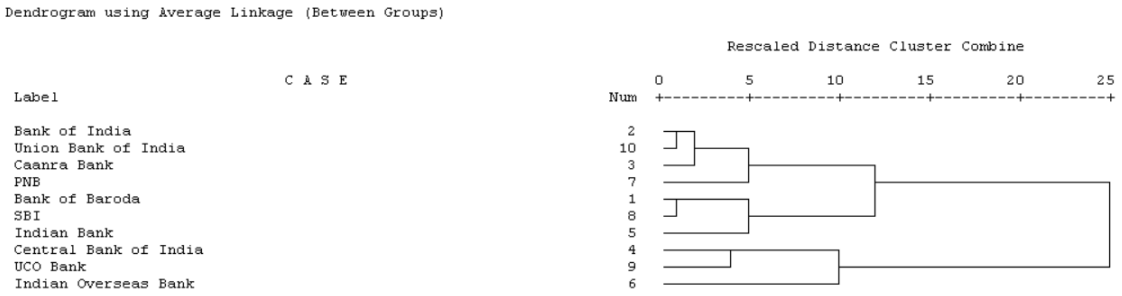


Figure 5-11 Dendrogram of public sector banks 2018

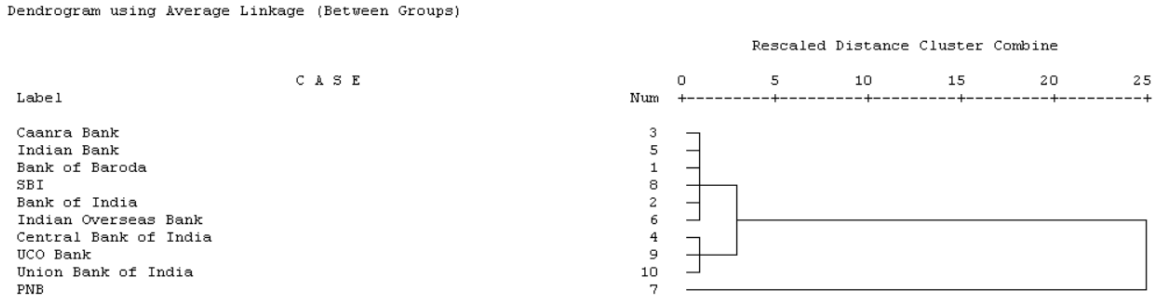


Figure 5-12 Dendrogram of public sector banks 2019

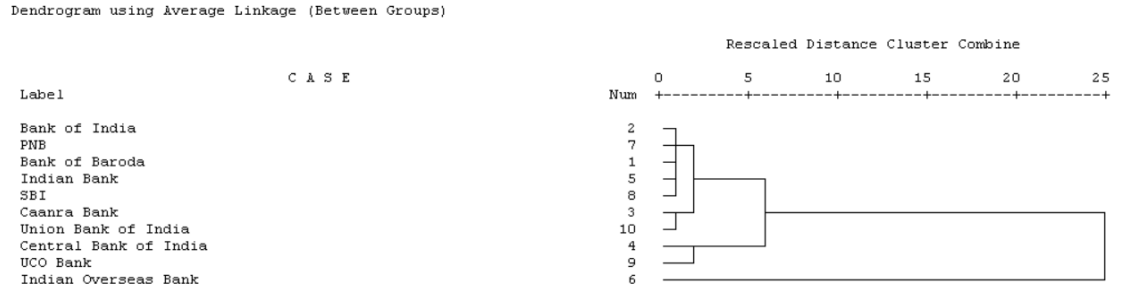


Figure 5-13 Dendrogram of public sector banks 2020

The above dendrograms present the results of hierarchical clustering of public sector banks for the years 2008-2020. They indicate that for most of the years, most of the banks fall into one single cluster, with just 3-4 banks in other two clusters. Loss-making banks like UCO Bank, Central Bank of India and Indian Overseas Bank generally get classified into one cluster. Due to their negative profitability indicators, these are the banks in high-risk clusters. The more profitable banks, on the other hand, like SBI and Union Bank of India, are grouped into other clusters. Most of the other banks tend to form a single cluster. As a result, these findings suggest that k-means clustering should be conducted by taking the number of clusters to three. As discussed in the latter part of the chapter, the findings also are in agreement that for public sector banks, profitability indicators act as important and significant variables for determining the distance between the cluster centers.

5.2.2 Clustering of private sector banks

The present section of the chapter deals with the results of hierarchical clustering for private sector banks during the period of study.

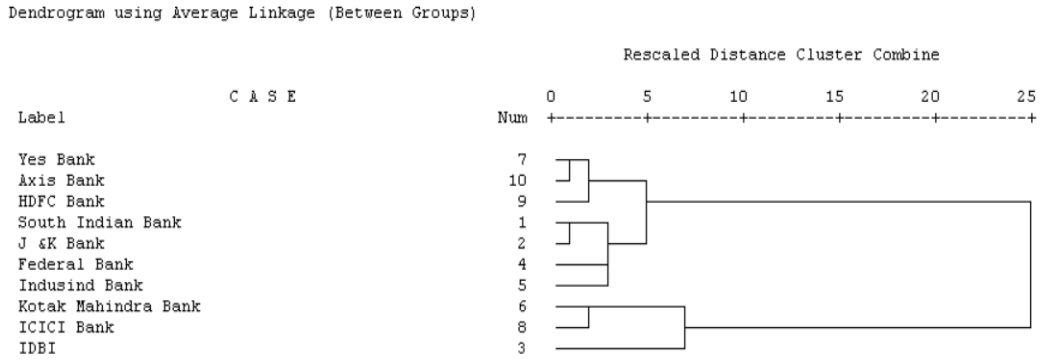


Figure 5-14 Dendrogram of private sector banks 2008

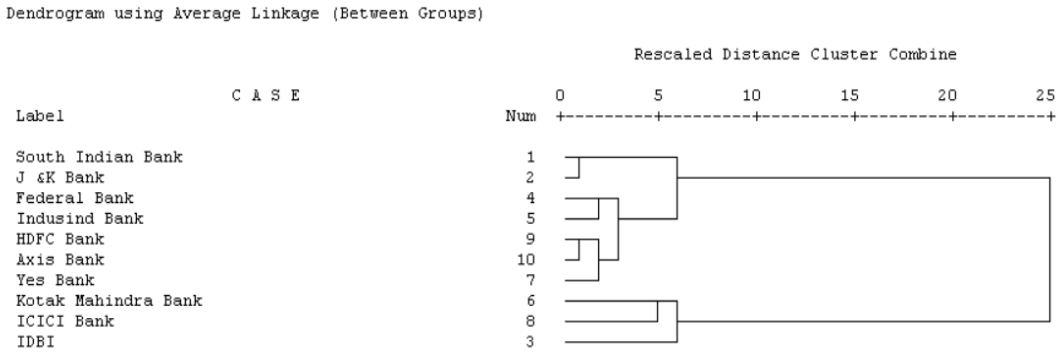


Figure 5-15 Dendrogram of private sector banks 2009

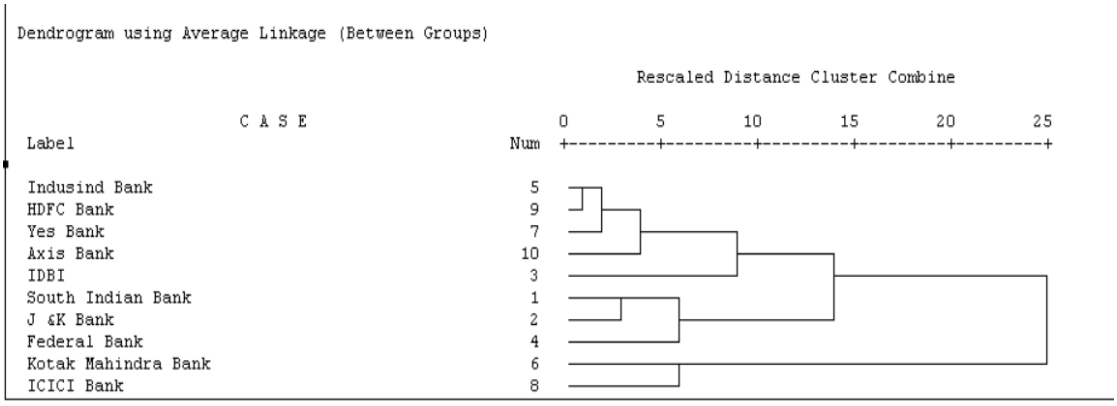


Figure 5-16 Dendrogram of private sector banks 2010

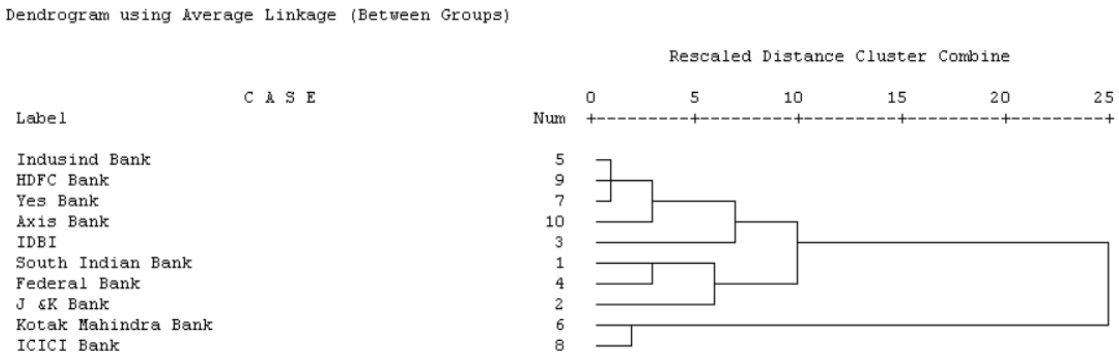


Figure 5-17 Dendrogram of private sector banks 2011

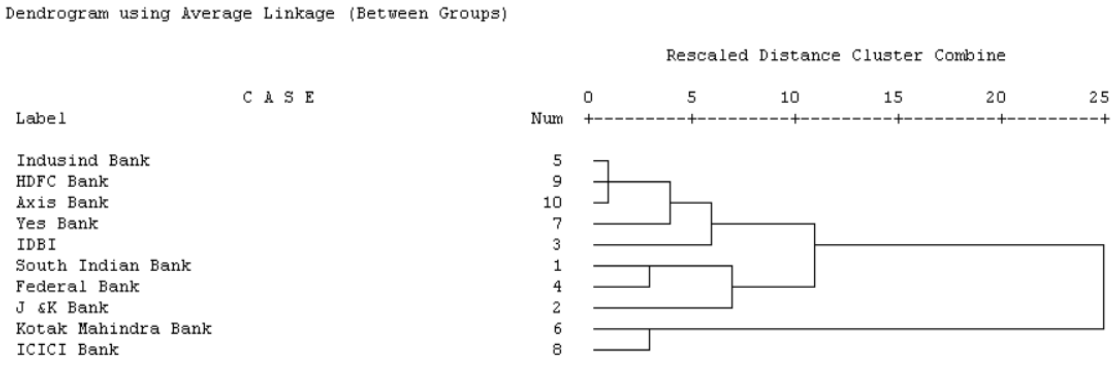


Figure 5-18 Dendrogram of private sector banks 2012

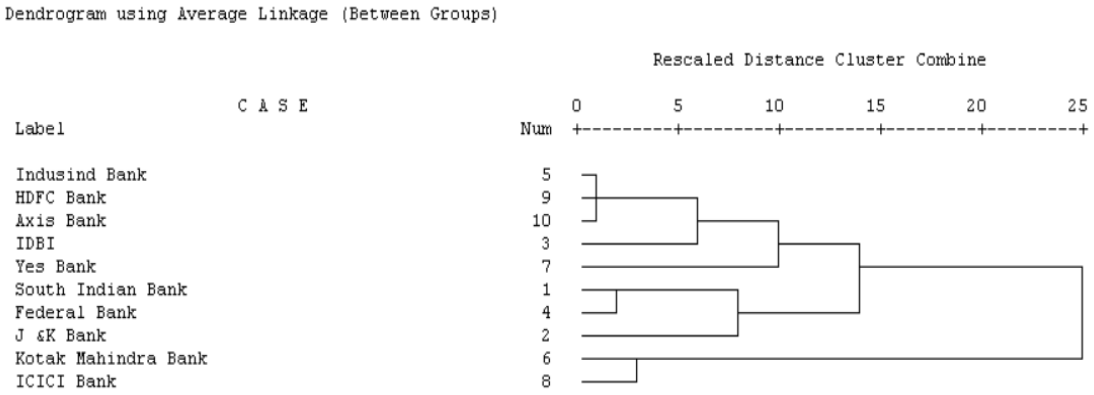


Figure 5-19 Dendrogram of private sector banks 2013

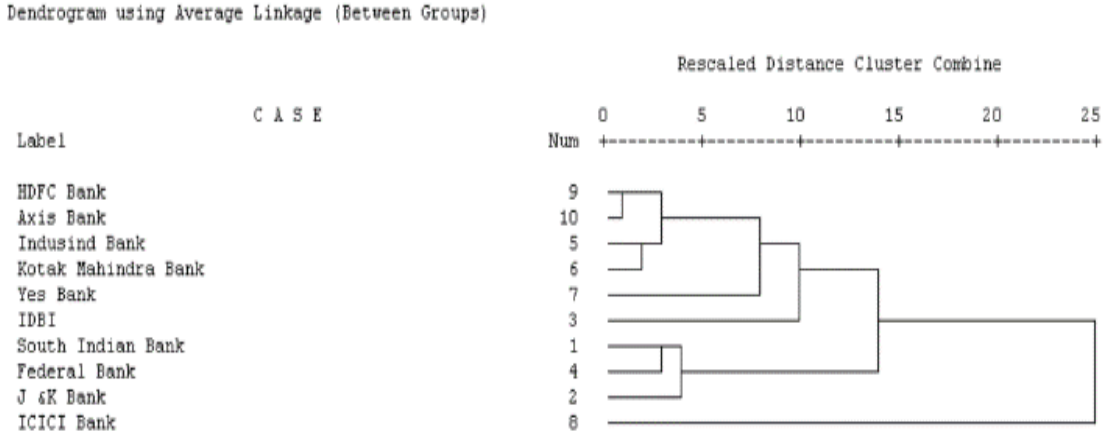


Figure 5-20 Dendrogram of private sector banks 2014

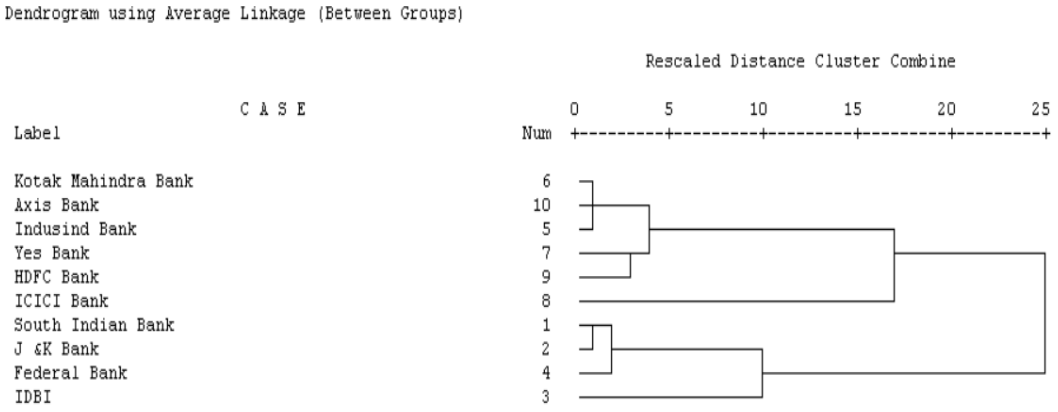


Figure 5-21 Dendrogram of private sector banks 2015

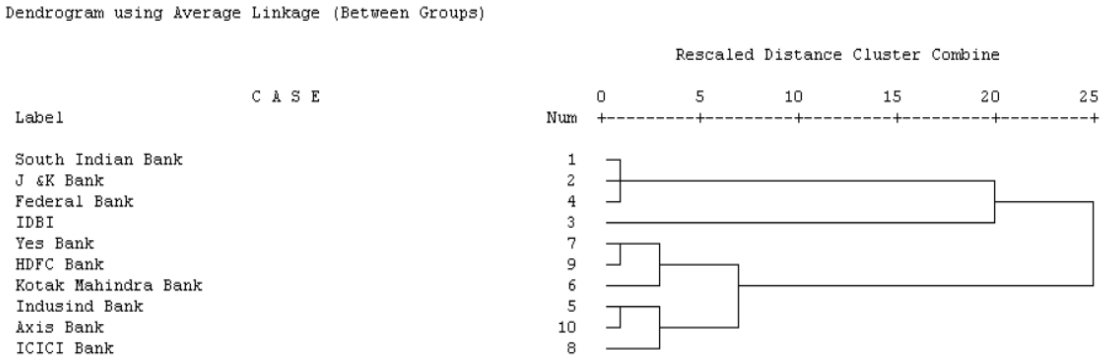


Figure 5-22 Dendrogram of private sector banks 2016

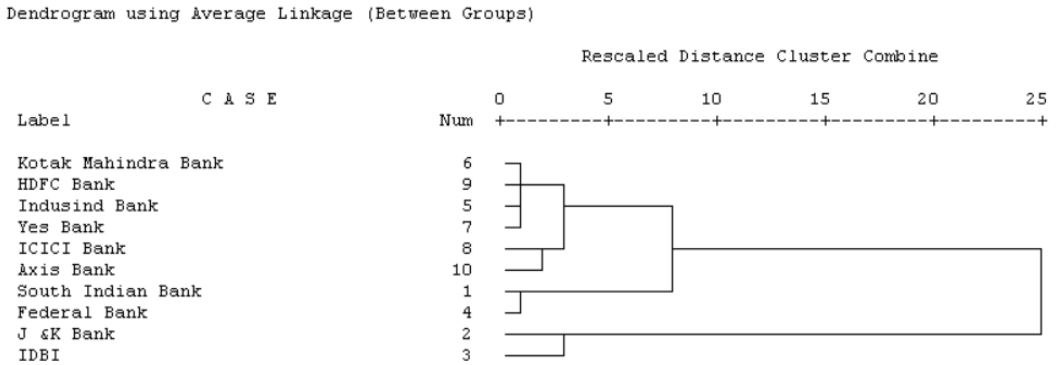


Figure 5-23 Dendrogram of private sector banks 2017

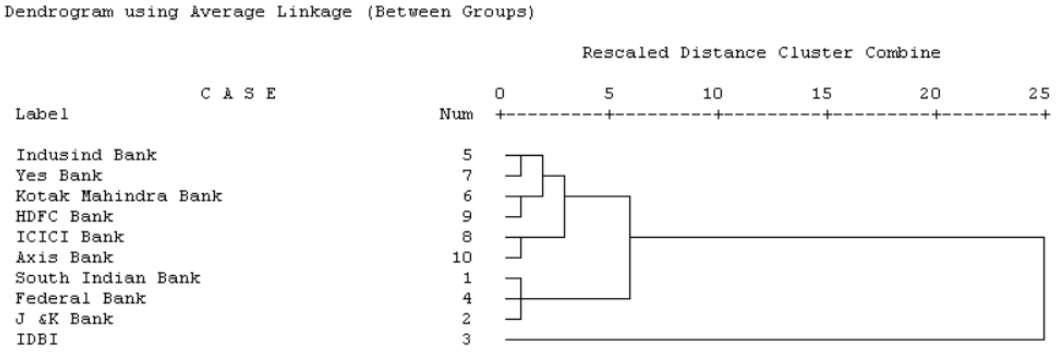


Figure 5-24Dendogram of private sector banks 2018

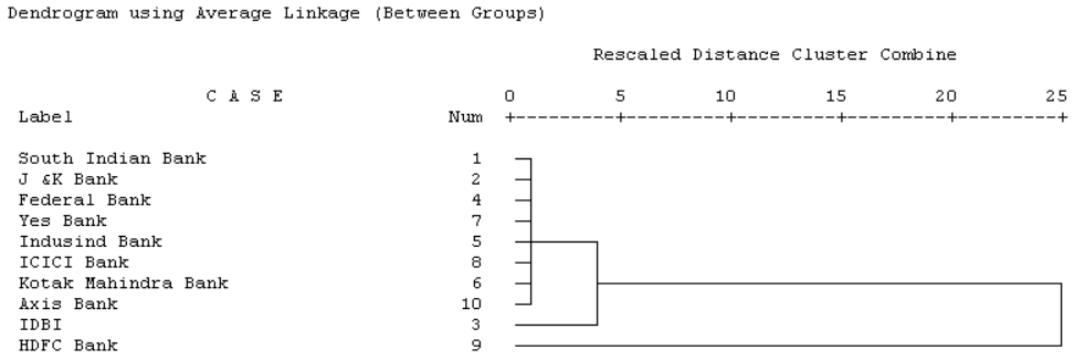


Figure 5-25 Dendrogram of private sector banks 2019

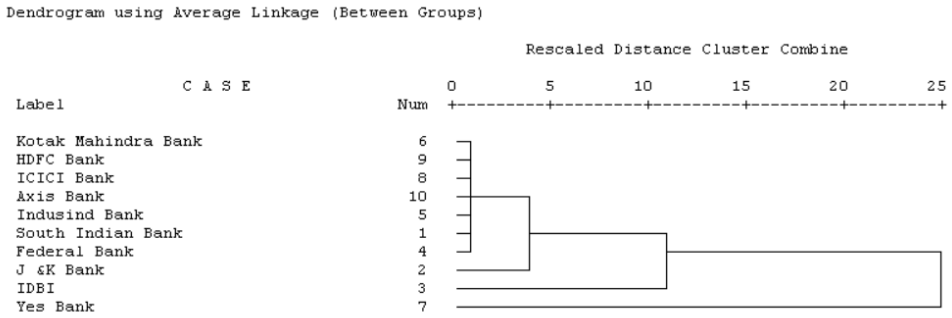


Figure 5-26 Dendrogram of private sector banks 2020

The above figures show the results of hierarchical clustering performed on the financial indicators of private sector banks from 2008-20. The results indicate that for most of the years, the private banks can be classified into three distinct clusters, with few high-risk banks in one cluster. IDBI has been the only bank placed in this cluster for many years during the course of the study, especially because of its high losses. In some years, it is also accompanied by J&K bank, which also had shaky profitability. However, due to its extremely poor financial performance in 2020, YES Bank was the only bank in high-risk cluster. Even though banks like IDBI and J&K Bank were earning negative returns, yet their risk profile was better than YES Bank; therefore, they got classified into a different cluster.

The clusters were evenly distributed for some years during the study, but during the time period of 2014-15, the only bank in the low-risk cluster was ICICI bank, whereas there were more banks in high-risk clusters. However, during the latter part of the study, the number of banks in high-risk clusters tended to get less. This is a positive sign for the risk profiling of the category. Profitability indicators tend to be important variables for banks placed in high-risk clusters. However, for the classification into medium and low risk clusters, there are other variables that are more important than profitability. the details of these variables are discussed in the latter part of the chapter while discussing the results of the ANOVA analysis.

5.2.3 Clustering of foreign banks

The present section of the chapter deals with the results of hierarchical clustering for foreign banks during the period of study.

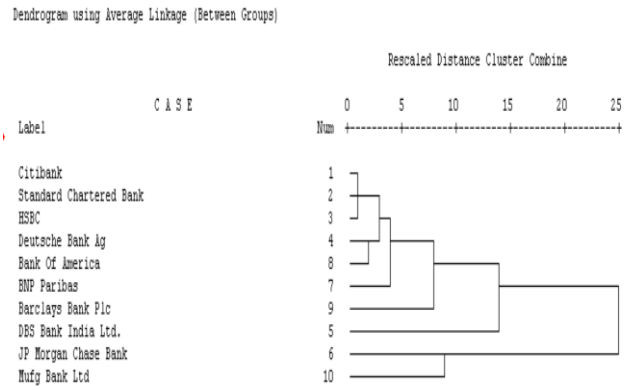


Figure 5-27 Dendrogram for foreign banks 2008

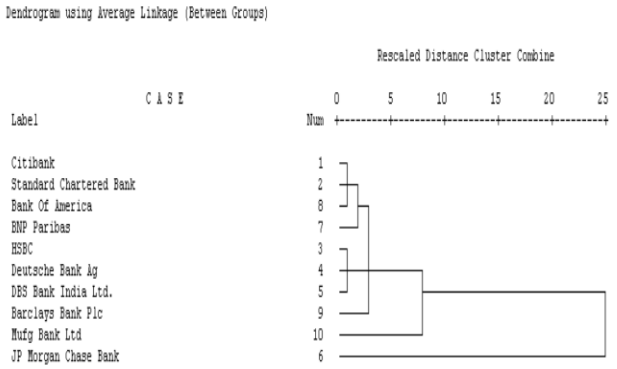


Figure 5-28 Dendrogram for foreign banks 2009

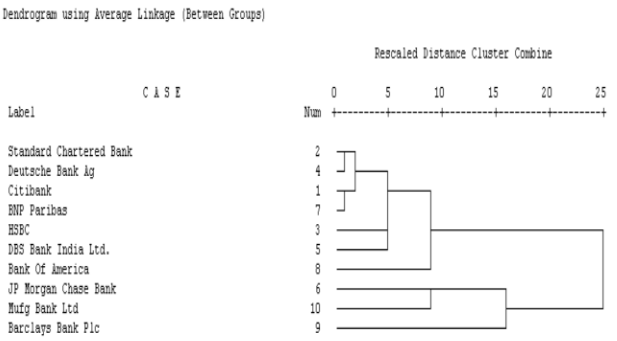


Figure 5-29 Dendrogram for foreign banks 2010

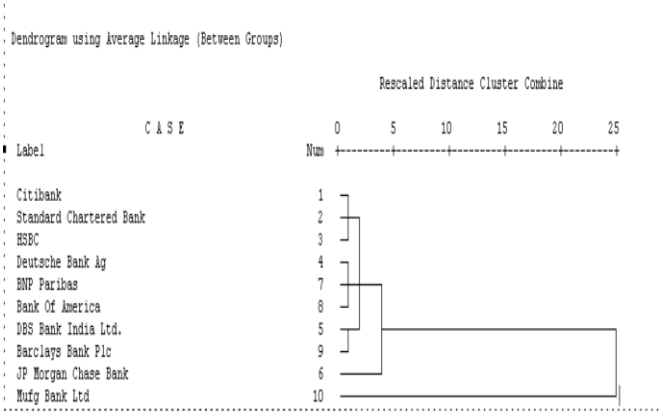


Figure 5-30 Dendrogram for foreign banks 2011

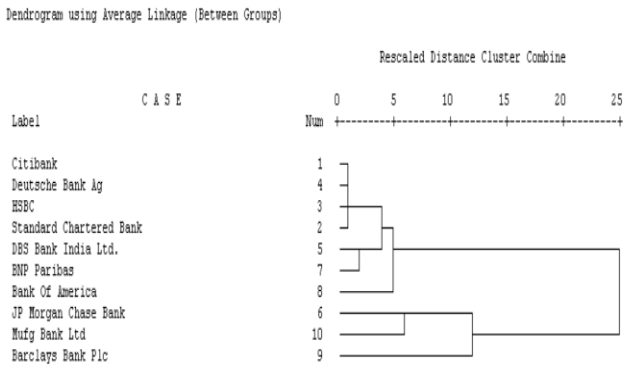


Figure 5-31 Dendrogram for foreign banks 2012

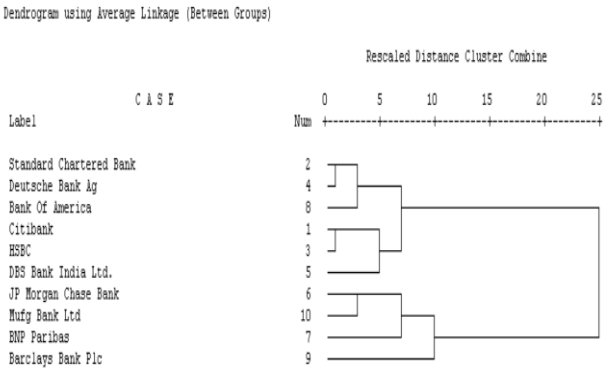


Figure 5-32 Dendrogram for foreign banks 2013

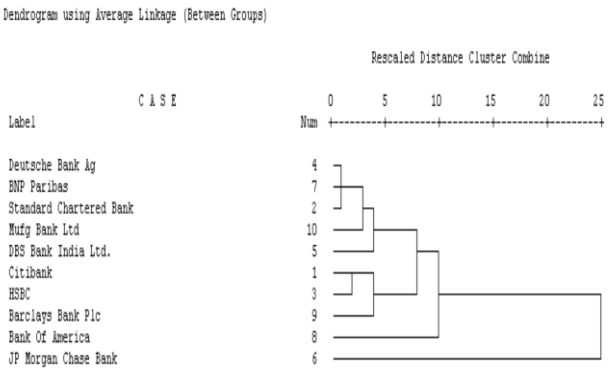


Figure 5-33 Dendrogram for foreign banks 2014

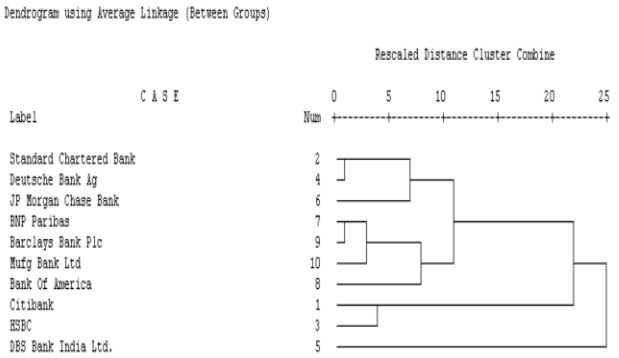


Figure 5-34 Dendrogram for foreign banks 2015

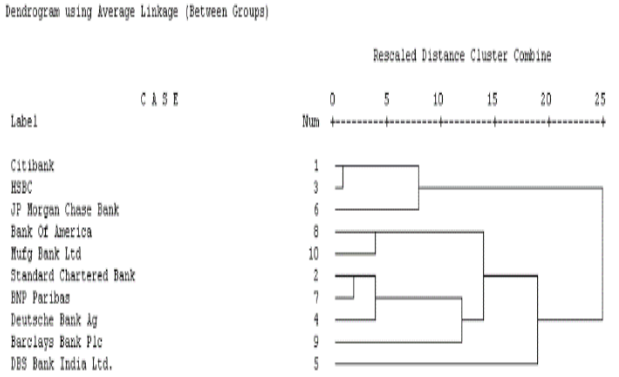


Figure 5-35 Dendrogram for foreign banks 2016

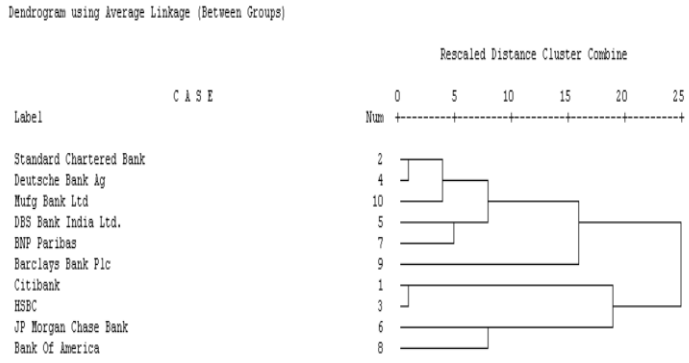


Figure 5-36 Dendrogram for foreign banks 2017

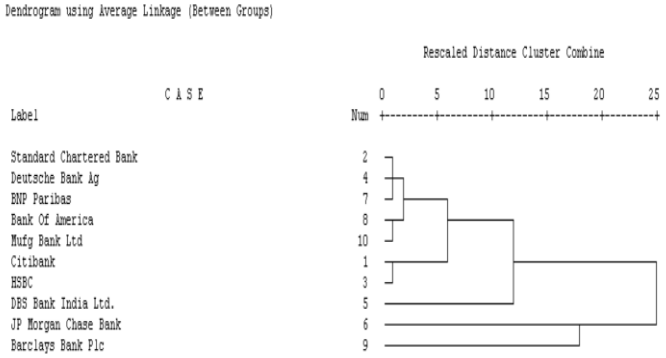


Figure 5-37 Dendrogram for foreign banks 2018

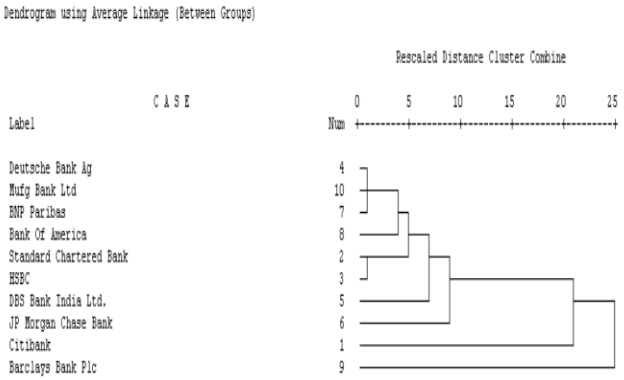


Figure 5-38 Dendrogram for foreign banks 2019

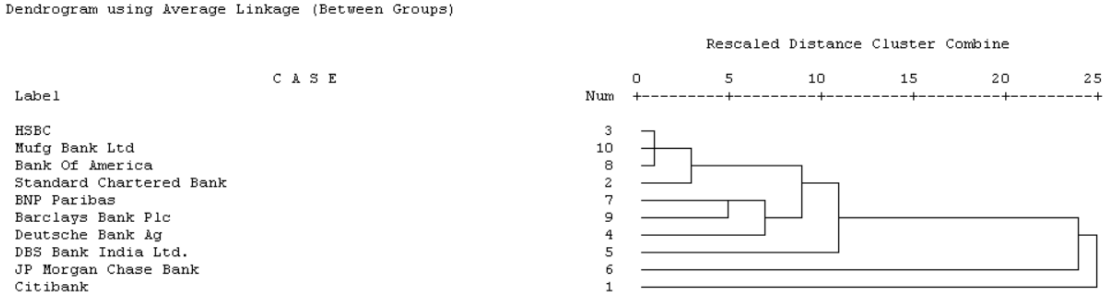


Figure 5-39 Dendrogram for foreign banks 2020

The above dendrograms indicate that for most of the years, banks can be classified into 2-4 clusters depending upon the financial performance of foreign banks. The dendrogram

represents the results of agglomerative hierarchical clustering and the clusters depict linkages between groups. The banks having the least distance are grouped together as a cluster. From the year 2008-to 2013, most of the banks were generally in low or medium-risk clusters, and only a few outlier banks were placed in high-risk clusters.

In 2014, JP Morgan was the only bank in a low-risk cluster; the other two clusters are almost evenly distributed. For the next three years, all the clusters are almost evenly distributed. For the last two years of the study period, most of the banks can be classified into one cluster, and there are only one or two banks in other clusters. For example, Barclays bank is the single bank in its respective clusters in both these years. The findings indicate that there is less distance between the cluster centers in the case of foreign banks in the years where no bank is making any losses indicating an overall strong financial performance.

The main characteristics of these clusters are discussed at the end of this chapter.

5.3 K Means clustering profiling

The present section of the chapter deals with the results of k-means clustering conducted on all three categories of banks. As discussed above, the use of k-means clustering is ideal in this situation as this clustering method allows the easy computation of large data sets, especially when the end goal is not to find optimal number of clusters (Chen, et al., 2004). Not only that, k means clustering helps in identifying not only the firms in each cluster during each iteration, but it also provides with centroids during each iteration (Ramachandran, et al., 2018). In the current scenario, hierarchical clustering has provided us with an initial idea of cluster membership for banks and in order to justify the same, there is a need to understand the position of each banks in terms of their risk profile grouping.

5.3.1 Risk profiling of public sector banks

From the above parameters, cluster analysis was performed on 30 sample banks, category-wise, and each bank was classified into high, medium and low risk profiles on the basis of significant variables estimated using cluster analysis.

The tables below show the risk classes of banks on the basis of the analysis performed for the period of 2008-2020

Table 5-2 Risk profiles of public sector banks 2008-2020

Bank`	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bank of Baroda	High	Low	Low	Low	Low	Medium	Low	Medium	High	Low	Low	Low	Low
Bank of India	Low	Low	High	Medium	Medium	Medium	Low	Medium	High	Low	Medium	Low	Low
Canara Bank	Low	Low	Low	Low	Low	Medium	Low	Medium	Medium	Low	Medium	Low	Low
Central Bank of India	High	High	High	Medium	High	High	High	High	Medium	Medium	High	Medium	Medium
Indian Bank	Low	Low	Low	Low	Low	Medium	Low	Medium	Medium	Low	Low	Low	Low
Indian Overseas Bank	Low	Low	High	High	High	High	Medium	High	High	High	High	Medium	High
PNB	Low	Low	Low	Low	Low	Low	Low	Medium	Medium	Low	Medium	High	Low
SBI	Medium	Medium	Medium	High	Medium	Low	Medium	Low	Low	Low	Low	Low	Low
UCO Bank	High	High	High	Medium	High	High	Low	Medium	High	High	High	Medium	Medium
Union Bank of India	Low	Low	Low	Low	Medium	High	Low	Low	Medium	Low	Medium	Medium	Low

From the above table, it can be seen that majority of the banks keep fluctuating between different risk profiles throughout the period of the study. Despite the financial crisis of 2008-09, the majority of the banks managed to maintain their risk profiles due to the conservative policies of RBI, which kept Indian banks safe during such a crisis. It is also expected that the PSBs performed better because of the lack of exposure to foreign assets, but the details will be clearer after going through the disclosure profiles of the banks in question.

The banks which were in the high-risk category for most of the study period were UCO bank, Central Bank of India and Indian Overseas Bank. While UCO bank went into a low-risk profile in just 2014 and remained in high or medium-risk profiles for all the other years, Indian Overseas Bank has not gone into the low-risk bracket since 2009. Central bank of India, on the other hand, has remained in the high or medium risk bracket during the entire study period. When it comes to low-risk banks, most of the other banks have been performing well and have been in the medium or low-risk class for most of the years. However, the best performing banks have been Canara Bank and Indian Bank, which have never ventured into high-risk clusters during the period of study.

It can be seen that the negative actions can shift the risk class of the bank. For example, the scandal involving Neerav Modi led to a shift in the risk profile of PNB in 2019 since the bank generated some losses and witnessed increased credit risk. However, the risk profile of banks using clustering is a relative measure which means that in 2020, when the other banks like UCO Bank and Indian Overseas Bank were making more losses, PNB's risk profile shifted to low risk, indicating that the fundamentals of the firm are still strong.

5.3.2 Risk profiling of private sector banks

The present section of the report deals with the risk profiling of private sector banks for the period of study. The table below presents the results after cluster analysis on the selected ten private sector banks from 2008 to 2020

Table 5-3 Risk profiling of private sector Banks 2008-2020

Bank	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
South Indian Bank	Low	Low	Medium	High	Low	Low	High	High	Medium	Low	Medium	Medium	Low
J &K Bank	Low	Low	Medium	High	Low	Low	High	High	Medium	High	Medium	Medium	Medium
IDBI	High	High	Low	Medium	Medium	Medium	Medium	High	High	High	High	High	Medium
Federal Bank	Low	Low	Medium	Medium	Medium	Medium	High	High	Medium	Low	Medium	Medium	Low
IndusInd Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium	Low
Kotak Mahindra Bank	Medium	High	High	Low	High	High	Medium	Medium	Low	Low	Low	Medium	Low
Yes Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium	High
ICICI Bank	Medium	High	High	Low	High	High	Low	Low	Low	Medium	Low	Medium	Low
HDFC Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low
Axis Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium	Low

From the above table, it can be seen that most of the private sector banks have been performing decently when it comes to various parameters of risk profiling. One bank that stands out against the general trend is IDBI which has been falling into the high-risk category for most periods covered during the study. The same can be justified since the bank was earlier part of public sector banks since its inception in 2005 and was later made a private sector bank after the government divested some of its stakes. However, even after privatization, the performance of the bank and the resulting risk profile has not been improved.

Like in the previous section, it can be seen here that the impact of negative financial actions can be easily reflected in the risk profile of the bank. The same can be seen in the case of ICICI bank, which took time to recover after the financial crisis of 2008-09 as it had exposure to foreign undertakings. The implications of recent financial frauds and conflicts of interest are yet to be reflected in the financial standing of the company. The same is the case with YES Bank, whose financial troubles started in 2019, showed its worst performance in 2019-20, and its risk profile was worse than the entire category. Not only was it generating negative returns, but its loans to deposit ratio was more than 100%, indicating a huge funds crisis combined with extremely high non-performing assets, which made it the only bank in the high-risk category in 2020.

The two largest private sector banks, HDFC and Axis bank, have been performing consistently well and did not become a part of the high-risk category even once during the period of study. This is an indication of strong financial discipline as well as business strategies. Overall, the number of banks in the high-risk category is relatively less in the case of private sector banks as compared to public sector banks.

5.3.3 Risk profiling of foreign banks

The third section of the chapter deals with the results of risk profiling of the foreign banks during the period of study. The table below shows the results of cluster analysis and risk profile of foreign banks in India from the period of 2008-2020.

Table 5-4 Risk profiling of foreign banks 2008-2020

Bank	208	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Citibank	Medium	Medium	Low	Medium	Low	Low	High	Medium	Low	Medium	Low	Low	Medium
Standard Chartered Bank	Medium	Medium	Low	Medium	Low	Low	High	Low	High	High	Low	Medium	High
HSBC	Medium	Medium	Low	Medium	Low	Low	High	Medium	Low	Medium	Low	Low	High
Deutsche Bank Ag	Medium	Medium	Low	Low	Low	Low	Medium	Low	Medium	High	Low	Medium	High
DBS Bank India Ltd.	High	Medium	Low	Low	Low	Low	High	High	High	High	Low	Medium	High
JP Morgan Chase Bank	Low	Low	Medium	Low	Medium	Medium	Low	Low	Low	Medium	High	Medium	Low
BNP Paribas	Medium	High	Low	Low	Low	High	High	High	High	High	Low	Medium	High
Bank Of America	Medium	Medium	Low	Low	Low	Low	Medium	Low	Medium	Medium	Low	Medium	Medium
Barclays Bank Plc	Medium	Medium	High	Low	High	High	High	High	Medium	Low	Medium	High	High
Mufg Bank Ltd	Low	High	Medium	High	Medium	Medium	Medium	High	High	Low	Low	Medium	High

From the above table, it can be seen that the level of consistency is less in the performance of foreign banks as compared to that of public and private sector banks discussed above. Only bank of America has been performing consistently well and has not entered a high-risk profile even once during the period of study. Rest all the other banks have been fluctuating between the three risk profiles during different years under study. Other decent performers include Citibank, HSBC and Deutsch Bank, which have been consistently in the medium or low-risk categories for12 11 and 11 years, respectively, out of 13 years studied during the research. However, this is understandable as their asset size is much more than that of Bank of America, and hence a slight risk is justified.

When it comes to bad performers in the category, the two main banks are Barclays and DBS Bank, which have been in high-risk categories for most of the periods under study. Although in 2020, more banks appeared in a high-risk cluster, the difference in their actual performance was very small. The main reason for such classification is that JP Morgan had exceptionally high net profit, and the other two banks in the medium risk category as well did not have any non-performing assets, which put them at a comparatively lower risk profile as compared to the remaining banks.

Another significant part of the cluster analysis in the category is that, unlike the previous two categories, the variables like net profits, ROE, ROA, N PA etc., which are generally considered important parameters of performance, were not significantly different in this category as most of these banks have limited presence in the country in terms of operations and geographical operations.

5.4 Comparative analysis of risk profiles

The present section of the chapter deals with the comparison of trends in risk profiles of all the ownership categories by comparing the trend over a period of time.

Table 5-5 Comparative analysis of cluster-wise distribution of sample banks

	Public Sector Banks			Private Sector Banks			Foreign Banks		
Year	Low	Medium	High	Low	Medium	High	Low	Medium	High
2008	6	1	3	7	2	1	2	7	1
2009	7	1	2	3	4	3	1	7	2
2010	5	1	4	5	3	2	7	2	1
2011	1	4	5	2	6	2	6	3	1
2012	1	1	8	2	6	2	7	2	1
2013	1	4	5	2	6	2	6	2	2
2014	1	4	5	1	6	3	1	3	6
2015	1	7	2	1	5	4	4	2	4
2016	1	3	6	6	3	1	3	3	4
2017	1	5	4	3	4	3	2	4	4
2018	1	8	1	6	3	1	8	1	1
2019	4	5	1	1	8	1	2	7	1
2020	7	2	1	7	2	1	1	2	7
Sum	37	46	47	46	58	26	50	45	35
Average	3	3.5	3.5	3	5	2	4	3.5	2.5

If we look at the cluster-wise distribution of three categories of banks over the period of study, on average, more public sector banks fell into the high-risk cluster category, followed by the private sector and foreign banks, respectively. In both public and private sector categories, the average number of banks in the low-risk cluster was 3 out of 10, whereas, in the case of foreign banks, the same number is four on average. On the other hand, when it comes to banks in the high-risk cluster, the number is the same for both

private sector and foreign banks, i.e., 2 out of 10 in a year, the same is 4 in the case of public sector banks. The same trend is reflected in the total banks in each cluster over the years, which also indicates the high-risk profile of public sector banks as compared to other categories of banking firms.

If we look at the trend of progress made by public sector banks, it can be seen that from 2010 to 2017, public sector banks have been performing poorly in terms of their risk profile. This can be seen from the extremely high number of banks in the high-risk cluster. However, the trend is improving, and the number of public sector banks in the high-risk cluster has come down drastically. In the case of private sector banks, except for a couple of years, only one or two banks have been placed in high-risk clusters, and the majority of banks have been either in medium or low risk clusters. This shows the overall good financial performance and risk profile of the private sector banks over the period of study.

In the case of foreign banks, the period from 2014-17 has been the only time frame where a greater number of banks were in the high-risk cluster, apart from the year 2019-20. For the rest of the study period, only one or two banks were placed in high-risk clusters. A careful analysis of the management and regulatory environment of that time period can help in understanding the reasons behind a sudden change in the risk profile of foreign banks in India. As explained earlier, the scale of operations of these banks is relatively less, and their profiling variables are also different from other categories of banks.

Overall, for all the categories of banking firms, the last two years of the study period, i.e., 2018 & 2019, have been very good in terms of their risk profile since, in all subgroups, only 1-1 bank has been placed in the high-risk cluster for both years. This shows an improvement in the risk management practices of Indian banks over the last few years. However, it has to be observed how these profiles would change from 2020 onwards when the banks were faced with the task of maintaining financial stability amidst a global healthcare crisis in the form of the COVID-19 pandemic.

5.5 ANOVA Results

The present section of the chapter presents the results of one-way ANOVA, which helps in identifying the key variables which have caused the difference in the risk profile of banks over time.

5.5.1 Checking ANOVA Assumptions

Before application of One-Way Anova, it was important to check the assumptions for its application. Key assumption of ANOVA is that data has to be normally distributed. In order to check the normalcy of data, skewness and kurtosis were used along with the average and media. The accepted range of skewness is from -2 to+2 and for kurtosis is -7 to +7 (George, 2011), (Hair, 2011). Data for each variable for each category of banks was tested on these limits for each year under the study period. Since the data is converted into percentages, the results proved satisfactory in terms of normalcy of data for application of ANOVA.

5.5.2 Significant variables for public sector banks

The present section of the chapter deals with the variables which appeared significantly different across different risk clusters for public sector banks over the period of study. The table below presents the p value results of the one-way ANOVA carried out on the risk clusters formed by sample public sector banks.

Table 5-6 ANOVA results for significant variables for public sector banks

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ROE	13.36 (0.00)**	8.39 (0.01)**	8.49 (0.01)**	16.68 (0.02)**	11.5 (0.00)**	6.94 (0.02)**	24.19 0.58	12.16 (0.00)**	9.26 (0.01)**	24.64 (0.00)**	12.95 0.22	105.88 (0.00)**	45.361 (0.00)**
LTDR	3.31 0.10	6.55 (0.02)**	4.43 (0.06)*	7.05 (0.03)**	5.02 0.91	6.17 (0.03)**	2.92 (0.02)**	7.57 0.16	5.67 (0.05)*	10.85 0.12	18.26 0.51	4.28 0.06	33.642 (0.00)**
OETA	0.82 0.48	4.83 (0.05)*	0.66 0.55	0.23 0.10	0.62 0.87	3.31 0.10	1.91 0.15	2.82 0.22	0.6 0.21	2.05 0.30	1.28 0.79	0.11 0.90	0.164 0.85
LHTA	0.57 0.59	8.29 (0.01)**	5.53 (0.04)**	12.91 0.11	3.04 0.83	3.08 0.11	1.96 0.11	2.29 0.74	3.16 0.11	18.99 0.25	9.37 0.48	3.26 0.10	37.78 (0.00)**
NP	6.34 0.03	14.75 (0.00)**	27.6 (0.00)**	15.61 (0.01)**	12.12 (0.00)**	8.36 (0.01)**	15.37 (0.00)**	10.02 (0.00)**	9.77 (0.00)**	17.9 (0.00)**	15.51 (0.00)**	6.93 (0.02)**	37.176 (0.00)**
CHTA	0.52 0.61	0.72 0.52	0.16 0.85	0.12 0.99	1.94 0.82	0.01 0.99	0.47 0.35	1.93 0.04	1.06 0.29	321.86 0.42	1.3 0.87	0.22 0.81	2.308 0.17
DEPTL	17.71 (0.00)**	23.22 (0.00)**	9.3 (0.01)**	8.3 (0.02)**	1.86 0.83	7.96 (0.02)**	3 0.03	4.95 (0.02)**	19.54 (0.01)**	1.14 (0.00)**	6.74 0.84	2.21 0.18	0.355 0.71
CRTA	1.36 0.32	4.42 0.06	2.38 0.16	3.33 0.15	2.33 0.91	2.56 0.15	0.31 0.55	0.18 0.85	0.86 0.25	0.76 0.15	2.36 0.17	0.37 0.71	0.452 0.65
NII	1.18 0.36	5.42 0.04)**	11.82 (0.01)**	2.31 0.13	11.33 0.11	2.77 0.13	1.6 (0.00)**	4.56 (0.05)*	7.07 (0.02)**	2.61 0.20	0.62 0.75	0.2 0.82	1.685 0.25
NPATA	2.56 0.15	2.97 0.12	3.09 0.11	3.3 (0.03)**	2.77 0.22	6.19 (0.03)**	4.36 0.21	1.9 (0.01)**	2.89 0.16	6.99 0.04)**	15.16 0.28	8.03 (0.02)**	0.703 0.53

If we look at the variables which significantly differ across the clusters for public sector banks, it can be seen that most important variables come out to be profitability indicators, namely profit margin and return on equity. While net profit is significantly different across different clusters for the entire period of study, the latter variable differs for 12 out of 13 years period of study. These findings are in agreement with the existing literature, which suggests that profitability is strongly associated with the risk-taking behavior of banks. In case of public sector banks, this appeared to be significant in classifying banks because a lot of banks were making losses for the most part of the study, which hindered their ability to generate any return for their shareholders and also produced a negative impact on the other variables being considered in the study.

After the profitability variables, the other two important variables that emerge out of the analysis are Deposits to Total Liabilities Ratio and Loans to Deposit Ratio. They emerge significantly different across the three clusters in nine and eight years out of a period of 13 years considered in the study. While Loans to Deposit Ratio is an important indicator of the credit risk of banks, deposits to total liabilities ratio indicates public confidence and banks' hold on liquidity position. Higher deposits will mean that banks will have to depend less on external sources of funds, indicating a relatively less risky financial position.

When it comes to non-performing assets, the variable has not been significantly different across clusters for most part of the study. Although the existing literature has indicated that non-performing assets are the most important proxies for the credit risk for the banks, the results indicate that when studied as a group, the variable does not differentiate banks into different risk clusters. This, however, does not mean that non-performing assets are not a problem in Indian public sector banks. It simply means that level of non-performing assets is not statistically significantly different across risk clusters. It could very well mean that all the banks had similar level of non-performing assets, and hence the variable did not act as a differentiator.

The two least crucial variables for the category of public sector banks come out to be Capital reserves to total assets ratio and cash holdings to total assets ratio. They do not come as significant variables during any year in the study period. In case these variables remain not significant in other categories of banks, it can be inferred that because these ratios are determined by statutory requirements like Cash Reserve Ratio and Tier 1 and Tier 2 capital requirements, their percentages are not significantly different across the risk clusters over the period of years.

5.5.3 Significant variables for private sector banks

The present section of the chapter deals with the variables which appeared significantly different across different risk clusters for private sector banks over the period of study. The table below presents the p value results of the one-way ANOVA carried out on the risk clusters formed by private sector banks.

Table 5-7 ANOVA Results for significant variables for private sector banks

Variable	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ROE	1.30 0.33	4.91 (0.05)*	1.48 0.29	2.50 0.15	2.32 0.17	1.00 0.42	0.07 0.93	8.45 (0.01)**	30.90 (0.00)**	75.56 (0.00)**	34.43 (0.00)**	76.90 (0.00)**	68.67 (0.00)**
LTDR	122.10 (0.00)**	43.50 (0.00)**	10.88 (0.01)**	23.64 (0.00)**	25.20 (0.00)**	15.25 (0.00)**	11.77 (0.01)**	21.81 (0.00)**	10.06 (0.01)**	10.98 (0.01)**	10.80 (0.01)**	2.40 0.16	57.77 (0.00)**
OETA	3.77 (0.08)*	0.64 0.55	1.13 0.38	0.96 0.43	0.66 0.54	0.63 0.56	0.54 0.60	2.45 0.16	3.53 (0.09)*	0.61 0.57	0.21 0.82	0.68 0.54	2.17 0.19
LHTA	1.53 0.28	5.20 (0.04)**	3.25 0.10	0.98 0.42	0.58 0.59	0.20 0.82	0.36 0.71	0.02 0.98	5.27 (0.04)**	5.48 (0.04)**	17.74 (0.00)**	19.37 (0.00)**	5.04 (0.04)**
NP	0.52 0.62	1.73 0.24	0.05 0.95	0.59 0.58	0.68 0.54	0.75 0.51	0.58 0.58	14.64 (0.00)**	97.63 (0.00)**	32.13 (0.00)**	19.51 (0.00)**	99.77 (0.00)**	15.32 (0.00)**
CHTA	0.84 0.47	2.16 0.19	0.70 0.53	1.40 0.31	0.58 0.59	1.68 0.25	0.72 0.52	0.40 0.69	0.58 0.59	0.12 0.88	0.33 0.73	0.03 0.97	0.59 0.58
DEPTL	28.53 (0.00)**	29.64 (0.00)**	35.79 (0.00)**	44.31 (0.00)**	30.58 (0.00)**	27.74 (0.00)**	32.97 (0.00)**	12.63 (0.00)**	15.79 (0.00)**	4.83 (0.05)*	16.44 (0.00)**	0.06 0.94	9.29 (0.01)**
CRTA	4.45 (0.06)*	1.47 0.29	5.00 (0.04)**	15.06 (0.00)**	17.85 (0.00)**	6.32 (0.03)**	1.53 0.28	4.85 (0.05)*	4.98 (0.05)*	2.89 0.12	4.60 (0.05)*	2.14 0.19	0.27 0.77
NII	0.41 0.68	3.86 (0.07)*	3.54 (0.09)*	2.52 0.15	2.70 0.14	3.50 (0.09)*	8.57 (0.01)**	14.73 (0.00)**	9.08 (0.01)**	14.78 (0.00)**	12.97 (0.00)**	(0.08)* 0.92	7.20 (0.02)**
NPATA	1.42 0.30	4.03 (0.07)*	12.65 (0.00)**	1.38 0.31	0.51 0.62	0.20 0.82	0.28 0.77	4.07 (0.07)*	6.35 (0.03)**	12.39 (0.01)**	13.81 (0.00)**	26.71 (0.00)**	14.74 (0.00)**

The above table discusses the significant variables which differ across risk clusters over the period of study. From the values shown in the table, it can be seen that, like in case of public sector banks, in case of private sector banks as well, the Deposit to Liability Ratio and Loans to deposit ratio come out to be important indicators. Both these ratios appear to be significantly different across risk clusters for 12 out of 13 years period of study. As explained in the previous section, these ratios are important indicators of the credit risk and public confidence for any banking firm, thereby affecting its risk profile. Other than these two ratios, another important ratio for private sector banks come out to be capital reserves to total assets ratio. While most banks follow capital requirements set by Basel committee and RBI, study of their disclosure reports will give more detailed information about the capital position of the private banks.

While Deposit to liabilities ratio appeared significantly different across clusters in case of public sector banks as well, profitability ratios which were very significantly different across clusters in case of public sector banks, do not appear much different across clusters in private sector banks. While Net profit appears significantly different in six out of 13 years, Return on Equity came out to be significantly different for seven out of 13 years during the study period. This is mainly because, unlike public sector banks, very few private sector banks were in losses during study period and generated mostly positive returns for their shareholders. Also, these ratios mainly started becoming significant since IDBI started incurring huge losses.

As far as non-performing assets are concerned, the trend is similar in case of private sector banks as well, and this ratio is significantly different across clusters in just six out of 13 years of study period. Also, like in case of public sector banks, most of these years are towards the latter part of the study, again indicating that this difference in level of non-performing assets mainly came after the cleanup operation started by the Reserve Bank of India.

As far as the least significant variables are concerned, in case of private sector banks, they come out to be operating expenses ratio and the cash holdings to total assets ratio. Neither of these variables was significantly different across different risk clusters for any year during study period. While the cash holding ratio was insignificant in case of public sector banks as well, the variable of operating ratio is new in this category. It would mean that private sector banks spend almost similar kind of money on operating activities. The public sector banks' operating expenses might be fluctuating across the years because of the losses being made by some of the banks, which in turn increased the need for increased operating expenses.

5.5.4 Significant variables for foreign banks

The present section of the chapter deals with the variables which appeared significantly different across different risk clusters for foreign banks over the period of study. The table below presents the p value results of the one-way ANOVA carried out on the risk clusters formed by foreign banks.

Table 5-8 ANOVA results for significant variables of foreign banks

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ROE	0.53 0.61	0.86 0.46	12.48 (0.00)**	2.02 0.20	9.36 (0.01)**	5.70 (0.03)**	0.43 0.67	3.65 0.08	6.05 (0.03)**	3.64 0.08	0.17 0.85	12.60 (0.00)**	3.16 0.11
LTDR	25.16 (0.00)**	23.14 (0.00)**	26.54 (0.00)**	54.14 (0.00)**	17.09 (0.00)**	22.34 (0.00)**	12.96 (0.00)**	23.60 (0.00)**	21.80 (0.00)**	10.87 (0.01)**	13.15 (0.00)**	9.62 (0.01)**	3.19 0.10
OETA	3.53 0.09	1.42 0.30	4.16 0.06	1.25 0.34	2.64 0.14	3.87 0.07	1.73 0.24	1.88 0.22	(0.02)** 0.98	0.37 0.70	2.18 0.18	1.48 0.29	2.70 0.14
LHTA	14.40 (0.00)**	3.82 (0.08)*	8.10 (0.02)**	4.17 (0.06)*	7.20 (0.02)**	3.89 (0.07)*	5.16 (0.04)**	1.23 0.35	1.12 0.38	5.44 (0.04)**	0.35 0.72	0.09 0.91	4.84 (0.05)*
NP	1.84 0.23	1.58 0.27	14.61 (0.00)**	0.08 0.92	13.53 (0.00)**	5.08 (0.04)**	2.90 0.12	2.80 0.13	9.96 (0.01)**	5.51 (0.04)**	1.09 0.39	0.28 0.76	6.92 (0.02)**
CHTA	1.29 0.33	2.54 0.15	0.65 0.55	1.76 0.24	0.45 0.66	1.83 0.23	1.62 0.26	0.27 0.77	0.38 0.70	0.44 0.66	0.75 0.51	0.81 0.48	0.18 0.84
DEPTL	7.54 (0.02)**	3.53 (0.09)*	1.80 0.23	6.14 (0.03)**	4.17 (0.06)*	5.88 (0.03)**	1.42 0.30	3.09 0.11	1.26 0.34	0.60 0.57	9.26 (0.01)**	6.80 (0.02)**	4.62 (0.05)*
CRTA	1.14 0.37	0.74 0.51	6.69 (0.02)**	7.46 (0.02)**	2.92 0.12	3.69 (0.08)*	7.36 (0.02)**	2.01 0.20	0.32 0.74	6.55 (0.02)**	2.78 0.13	7.98 (0.02)**	0.15 0.86
NII	3.14 0.11	29.68 (0.00)**	2.45 0.16	0.52 0.62	3.55 (0.09)*	0.07 0.93	1.86 0.22	8.21 (0.01)**	2.19 0.18	4.20 (0.06)*	19.76 (0.00)**	0.45 0.65	4.96 (0.05)*
NPATA	0.53 0.61	0.48 0.64	42.07 (0.00)**	0.32 0.74	2.83 0.13	0.75 0.51	1.52 0.28	0.12 0.89	1.50 0.29	1.72 0.25	0.30 0.75	0.13 0.88	0.67 0.54

The table shows that the results of foreign banks are slightly different from other two categories when it comes to variables being significantly different across the clusters. The results of ANOVA indicate that most crucial variable is Loans to Deposit Ratio. This variable is significantly different across clusters during almost all years under study, except the last year. This variable is common among all three categories of banking firms. However, apart from this variable, no other variable comes out to be significantly different across the three risk clusters for more than seven years out of 13-year study period.

The least significant variables are same as in case of private sector banks, i.e., operating expenses to total assets ratio and cash holdings to total assets ratio. As discussed above, there can be multiple reasons for the same, but it indicates that operating expenses are not a major differentiator in case of foreign banks' risk profiles. There needs to be a detailed analysis to understand the operating efficiency of foreign and private sector banks.

Just like private sector banks, profitability indicators do not come across as significantly different across clusters in most years under study. Return on equity and Net profit margin is significantly different across clusters in five and four years, respectively, out of the total study period. Similarly, the ratio of nonperforming assets to total assets is not significantly different across clusters for most years during the study period. This is also consistent with the results of other categories of banking firms. However, the number of years in which NPAs significantly differ across risk clusters is even lesser for foreign banks, i.e., just one out of 13 years. One of the reasons for the same is that for latter part of the study, most of the foreign banks did not have any NPAs. Those who did had a minuscule amount of non-performing assets as compared to the total assets of banks. On the other hand, deposits to total liabilities, which appeared as a very significant variable in other two subgroups of banking firms, are significantly different across risk clusters for just five years out of the 13-year study period.

The main reason for the lesser number of variables being significantly different across risk clusters in case of foreign banks can be small size and scale of operations at which they operate, thereby limiting their overall asset base and probability of loss in India. Although they are not compared with other subgroups on these variables, a detailed analysis of disclosure and risk management practices will provide more insights into their risk-taking behavior.

5.6 Characteristics of risk clusters

The present section of the chapter deals with the key characteristics of the three clusters formed as a result of hierarchical and k-means clustering, as well as the significant variables identified with the help of ANOVA analysis. Although the significant variables differ across the years and categories, there were some common characteristics among banks in one particular cluster, which are discussed below.

5.6.1 High-Risk Clusters

Banks in high-risk clusters generally score poorly on profitability indicators. These banks are either in losses and generating negative returns for their shareholders and assets or barely make any profit as compared to banks in other clusters. These profitability indicators are most common in case of public sector banks, where few of the sample banks were loss-making banks for the most part of the study.

As far as the indicators of credit risk are concerned, these banks have higher non-performing assets and very high or extremely low loans to deposit ratios. These banks have operating expenses much higher than other banks and above 2% of the total assets. Another important variable that puts banks into this cluster is their low deposits to liabilities ratio. A lower ratio indicates lower public confidence and higher dependency on external funding, putting pressure on the risk profile of banks. Although literature suggests that very high loans to assets ratio indicate low liquidity and high default risk, that is not always the case in the findings of cluster analysis as many banks with lower loans to asset ratio are placed in high-risk clusters, mainly because of overpowering effects of profitability indicators and non-performing assets.

5.6.2 Medium Risk Clusters

The banks in these clusters depicted different kinds of behavior than low and high-risk clusters. While the banks in those two clusters had a clear indication of good and bad performance, in this circle, some ratios depict conflicting behavior. For example, while they may be profitable as compared to high-risk banks, their operating expenses and loans to asset ratio can be higher than that of high-risk banks.

In most years of study, this cluster tends to have maximum number of banks across the categories because these banks tend to play safe and generate moderate returns with less operating efficiency. These banks have adequate capital reserves as per the required norms but do not exceed expectations in terms of returns and capital cushion.

5.6.3 Low-Risk Clusters

A low-risk cluster contains the least risky banks of the sample for a particular year. These banks generate high returns for their assets and shareholder, have higher net profit as compared to other banks, and have higher capital to assets ratio, indicating their strong capital cushion. As far as their credit risk indicators are concerned, these banks have lower non-performing assets ratio and lower operating expenses ratio. Also, their deposits are more than banks in high-risk clusters and their loans to deposit ratios are generally moderate.

5.7 Risk profiling of merged banks

In order to check whether the merger of public sector banks would have any impact on their risk profile, a paired sample t-test was conducted on following selected variables for banks that merged with other banks during study period:

- Net profit margin
- Shareholders' funds to total assets
- Loans to total assets or asset profile

- Operating expenses to net income
- Cash and short-term funds to deposits

During the period of study, smaller banks were merged with two out of 10 sample banks. SBI was merged with its subsidiaries in 2017, and Vijaya Bank and Dena Bank were merged with Bank of Baroda in 2018. The tables below show the results of paired sample t-test conducted on above-mentioned variables for both these banks.

5.7.1 State Bank of India

The table below shows the results of paired sample t-test conducted on above-mentioned risk profile variables for SBI 3 years pre- and post-merger.

Table 5-9 Paired sample t-test results for State Bank of India prior to and post its merger

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post-merger	14.2662	15	22.80897	5.88925
	pre-merger	16.1253	15	23.42368	6.04797

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Post-merger & pre-merger	15	.991	.000

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-merger - premerger	-1.85909	3.14606	.81231	-3.60133	-.11686	-2.289	14	.038

The results indicate that risk profile of State Bank of India prior to merger (M= 16.125, SD = 23.424) is significantly different from the post-merger risk profile scores (M= 14.266, SD = 22.809), conditions, t(14)= -2.289, p=0.038< 0.05). In other words, it can be said that risk profile of State Bank of India changed after its merger, which might have put it in a different cluster than it might have been had it not been merged.

If we look at the financial variables of the bank prior to and after merger, it can be seen that for the years 2018-19 and 19-20, i.e., the years immediately after the merger, profitability indicators of SBI took a hit, capital reserves came down and so did the cash holdings. However, the bank recovered in its third-year post merger, but the risk profile for the first two years increased, as shown in the mean score as well. If we consider the other parameters like ROA, ROE, NPA etc., they also show similar trends as the above five indicators, i.e., the returns decreased, and NPAs increased because of taking up losses and provisions of the subsidiary banks.

5.7.2 Bank of Baroda

The table below shows the results of paired sample t-test conducted on above-mentioned risk profile variables for Bank of Baroda three years prior to and after the merger.

Table 5-10 Paired sample t-test results for Bank of Baroda prior to and post its merger

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post-merger	14.4200	15	23.80244	6.14576
	pre-merger	12.6833	15	23.47730	6.06181

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Post-merger & pre-merger	15	.990	.000

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-merger - premerger	1.73667	3.42519	.88438	-.16014	3.63348	1.964	14	.070

The results indicate that risk profile scores of Banks of Baroda prior to merger (M= 12.683, SD = 23.477) are not significantly different from the post-merger risk profile scores (M= 14.42, SD = 23.802), conditions, $t(14)=1.964$, $p=0.070 > 0.05$). In other words, it can be said that risk profile of Bank of Baroda did not change after its merger, which means that clustering of the bank on the basis of its risk profile would have remained same, had it not been merged with two other banks in 2018.

However, if we look at the financial parameters of the bank immediately after the merger, it can be seen that profitability indicators and non-performing assets changed drastically

for two years immediately after merger came into force. As a result, in order to check whether the risk profile of Bank remains same if we consider all the variables, a second round of paired sample t-test was conducted to check the shift in risk profile using all the 11 indicators.

Table 5-11 Revised paired sample t-test results for Bank of Baroda

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post-merger	22.4700	33	31.32259	5.45256
	pre-merger	20.8491	33	31.58248	5.49780

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Post-merger & pre-merger	33	.991	.000

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-merger - premerger	1.62091	4.19060	.72949	.13499	3.10683	2.222	32	.033

The results indicate that risk profile scores of Banks of Baroda prior to merger (M= 20.849, SD = 31.582) are significantly different from the post-merger risk profile scores (M= 22.47, SD = 31.322), conditions, t(32)= 2.222, p=0.033< 0.05). In other words, it can

be said that risk profile of Bank of Baroda changed if we consider all 11 variables instead of just the five variables discussed above.

Unlike the previous case, where performance deteriorated after the merger, in this case, the performance of bank on risk profiling indicators improved. Although the operating expenses increased, which mainly happens due to amalgamation costs and more manpower, the profitability indicators improved. The bank was earlier making losses, and it became profitable after the merger. Not only that, loans to deposit ratio also increased, indicating an increase in the asset size of the bank. Despite this increase in the loans to deposit ratio, the non-performing assets and their provisions did not increase. This shows the quality of assets overtaken by the bank after merger.

5.8 Key Findings and chapter summary

The present section of the chapter deals with the key findings that have been arrived after performing the cluster analysis and applying one way ANOVA on all the three categories of banks over the period of study. These findings are further discussed in the discussion chapter in light of existing literature to draw conclusions and directions for future studies and research.

Most of the public sector banks performed relatively weaker in the recent past, out of which some have managed to recover very fast. However, the overall performance of the category has been positive for the most part of the study other than in the recent few years.

Most public sector banks have seen a rise in their NPAs to total asset ratio in the last 3 years due to the change in the policy of RBI regarding nonperforming asset disclosure guidelines. While some of the banks have struggled because of that, many banks have managed to get their NPAs under control after initial losses and a rise in operating expenses.

Most the banks have high operating expenses, which has negatively affected their overall profitability. Along with that, they have not been able to increase their non-interest

income, which is again crucial for their profitability. These two factors have led to losses and negative returns generated during the period.

From the initial observation, it can be seen that the performance of these banks can be classified into different risk-taking behaviors during the study period. The same is evident on the basis of their speed of recovery, improvement in performance and control over quality of assets. Next step of the research in the form of cluster analysis will help us in determining whether the preliminary observation is right or not.

As far as the comparative analysis is concerned, it can be seen that public sector banks are riskier as compared to private and foreign banks, respectively, since a greater number of public sector banks fall into high-risk clusters on average during the study period. However, the performance of public sector banks is improving towards the latter part of the study, and a smaller number of banks are falling into high-risk clusters. The same can be seen for other categories of banks as well, and overall, the risk profile of banks has improved over the study period.

As far as the findings of ANOVA analysis are concerned, it can be seen that most important variables which significantly differ across risk clusters are Loans to Deposit Ratio and Deposits to Total Liabilities Ratio. On the other hand, the ratios which are different across risk clusters for least number of years during study period are cash holding to total assets ratio, operating expenses to total asset ratio and capital reserves to total assets ratio.

The findings indicate that risk profile of banks is less affected by profitability indicators in case of private and foreign banks as compared to public sector banks. Similarly, non-performing assets do not cause differentiation in the risk profile of banks for most years in all three subgroups of banks. As far as the type of risk is concerned, from the results, it can be seen that most important type of risk is credit risk, of which loans to deposit ratio is an important indicator. The discussion chapter of the thesis will deal with the existing

literature on the issue and its relationship with the findings of the current study to draw suitable conclusions.

Since two banks were merged during the period of study, it was important to understand whether their risk profile changed as a result of the same. It was found risk profiles of both the banks changed due to the merger, especially for the two years immediately after the merger. The direction of this shift depends upon the profitability of the bank being acquired and its asset and income quality.

5.8.1 Managerial Implications

The findings of this chapter have implications for managers and investors. Regulators can look at the specific set of variables which are crucial for each ownership category. For example, while profitability is a huge concern for public sector banks, it is not so in case of private sector and foreign banks. This will give an idea about the measures that need to be taken in order to improve the working of those specific banks.

Another major implication of these findings is the understanding of the characteristics of risk-based clusters of Indian banks. Investors can look at the specific characteristics and get a decent understanding of the risk profile of the banks they are thinking of investing in. for example, high risk cluster banks have high non-performing assets, low or negative profitability, extremely high or low LTDR etc. Looking at these indicators itself will not only give an idea about the risk profile of banks, but also help in identifying the areas where there is a scope for improvement.

Along with that, the findings of the study also indicate the impact of merger of banks on the risk profiles of merged entity. The findings indicate that depending upon the bank being merged into, the risk profile of acquiring bank can improve or deteriorate. As a result, RBI must be cautious of the balance sheet of these banks and ensure support in the areas where there is likely to be maximum impact. For example, if the NPAs o merged banks is very high, Central Bank might provide some kind of cleanup options so that balance sheet of acquiring bank is not stressed.

Chapter 6: RELATIONSHIP BETWEEN RISK PROFILE AND DISCLOSURE

6.1 Chapter Introduction

The current chapter deals with the third objective of the study, which is intended to find out the relationship between the risk profile of the banks and their respective disclosure practices. The chapter deals with the results of OLS fixed effect regression applied to public sector, private sector and foreign banks, as well as the combined disclosure scores of all 30 sample banks before discussing the crucial findings of the study.

The third objective of the study is to establish the relationship between the risk profile of banks and their respective disclosure scores. For finding out the same, an OLS regression was carried out between the variables used for risk profiling and the scores of disclosure index of all 30 banks. since the disclosure scale is primarily based on Basel 3 norms, the time period for this analysis was taken from 2014 onwards, the year in which Basel 3 disclosures were fully introduced by RBI for Indian banks. The details of OLS model are discussed in the research methodology chapter in detail.

6.1.1 Checking assumptions of OLS regression

An assumption of OLS regression is interdependence among the explanatory variables, which is often not met due to the limitations of data required for the study. In such cases, some variables often exhibit a high degree of collinearity, which in turn needs to be treated (Jou, et al., 2014). Multi-collinearity can be a problem in k-means clustering as we form the clusters irrespective of the distance measure used. Due to high similarity in the variables, more weight will be attached to them in final clusters, leading to faulty conclusions.

One of the ways to identify levels of collinearity among variables is Variance Inaction Factor (VIF). VIF of different latent variables was calculated and compared with an acceptable threshold (Kock & Lynn, 2012), which ranges between 2.5-5. The variables showing VIF of more than 10 were ROE and ROA. In order to solve the problem of

collinearity, ROA was dropped from the analysis of clustering as well as OLS regression. As a result, the regression equation contained 10 out of 11 variables.

The table below shows the VIF values of all the variables selected for the purpose of the study

Table 6-1-VIF values of selected risk profiling variables

ROE	2.168
LTDR	1.712
OETA	2.883
LHTA	2.319
NP	2.615
CHTA	1.929
DEPTL	2.084
CRTA	2.413
NII	1.490
NPATA	2.221

It can be seen that the VIF values of all the variables except ROA range between 1-3, which is within the acceptable terms, and hence the variable ROA was dropped for further analysis.

6.2 Risk and disclosure relationship in public sector banks

The present section of the chapter deals with the results of OLS regression applied to the risk profile variables and disclosure scores of public sector banks.

Table 6-2 OLS model estimates for public sector banks

Variable	Model Estimate
ROE	-0.030 (0.007).
LTDR	1.173 (0.009).

OETA	0.980 (0.154)
LHTA	-1.360 (0.021)*
NP	0.019 (0.037)*
CHTA	-0.167 (0.118)
DEPTL	1.012 (0.058).
CRTA	-0.898 (0.009).
NII	0.089 (0.139)
NPATA	0.077 (0.017)*
R-Squared:	0.428
Model estimate	29.884 (0.016)*

The results of multiple regression on public sector banks indicate that there was a collective significant effect of risk profiling variables F (10, 40) = 29.884, $p<0.05$, R2= 0.43. On examining the variables in detail, it was found that all variables apart from NII (t= 0.089, $p>0.05$), CHTA, (t= -0.167, $p>0.05$) and OETA, (t= 0.980, $p>0.05$), all other remaining variables are significant predictors of the model. From these results, it can be seen that the null hypothesis is rejected. In other words, risk management and disclosure scores of public sector banks is significantly dependent on their risk profiles.

The above table shows that out of the 10 variables selected for the analysis, OETA, CHTA and NII are not significantly related to the disclosure score. The value of R - squared for the model is 0.43, which means that model explains around 43% variation in the risk management and disclosure score of public sector bank. Out of the given variables, ROE, LHTA, and CRTA are negatively and significantly related to the risk management disclosure score. This establishes a negative relationship between these variables and the disclosure score. On the other hand, the variables NPATA, DEPTL, NP

and LTDR are positively significant for the model. Three variables, namely, NPATA, NP and LHTA, are significant at 5% level, and the remaining are significant at 10% level.

The high number of significant variables along with a reasonable R-squared is a signal of a strong dependence of risk management and disclosure score on the various risk profiling indicators in case of public sector banks.

Negative relationship between ROE and risk management score indicates that banks tend to disclose more in order to justify their declining returns so as to enhance the confidence of shareholders. Similarly, when the capital cushion of the banks goes down, their information goes up. Since capital adequacy is an important pillar of Basel 3 disclosures, the banks tend to give more space to capital requirements in both quarterly and bi-annual disclosures. In case, the banks had to decrease a proportion of capital requirement, they give more qualitative information to shareholders and investors, thereby increasing their risk management score. Similarly, a decline in loans to total assets would also concern bankers and they improve their risk management practices instilling more confidence and generate more assets.

Non-performing assets have a positive and very minimal impact on the risk management and disclosure score in case of public sector banks. This means that increase in NPAs would slightly increase disclosure scores. The main reason for the same is that format of disclosure of NPAs is standardized and banks have to disclose the same in quantitative terms every quarter irrespective of the share of these assets. However, a significant increase in NPAs would require some more qualitative information on the part of banks. Overall, variables indicating credit risks like LHTA and LTDR and capital structure like CRTA and DEPTL have more impact on the risk management scores of the bank. The findings indicate public sector banks should keep their asset quality and capital structure in check in order to improve their overall disclosure scores.

6.3 Risk and disclosure relationship in private sector banks

The present section of the chapter deals with the results of OLS regression applied on the risk profile variables and disclosure scores of private sector banks.

Table 6-3 OLS model estimates for private sector banks

Variable	Estimate
ROE	-0.051 (0.011)*
LTDR	-0.044 (0.021)*
OETA	-0.533(0.173)
LHTA	0.051(0.014)*
NP	-0.002 (0.042)*
CHTA	0.053 (0.129)
DEPTL	-0.059 (0.028)*
CRTA	0.080 (0.006)**
NII	0.061(0.142)
NPATA	0.227 (0.013)*
R Squared	0.379
Model estimate	23.662 (0.013)*

The results of multiple regression on private sector banks indicate that there was a collective significant effect of risk profiling variables F (10, 40) = 23.662, $p<0.05$, R2= 0.38. on examining the variables in detail, it was found that all variables apart from NII (t= 0.061, $p>0.05$), CHTA, (t= 0.053, $p>0.05$) and OETA, (t= 0.533, $p>0.05$), all other remaining variables are significant predictors of the model. From these results, it can be

seen that null hypothesis is rejected. In other words, risk management and disclosure scores of private sector banks is significantly dependent on their risk profiles.

The above table shows that out of the 10 variables selected for the analysis, OETA, CHTA and NII are not significantly related to the disclosure score, which are same as in case of public sector banks. The value of R -squared for the model is 0.379, which means that model explains around 38% variation in the risk management and disclosure score of public sector bank. This figure is less as compared to the public sector banks, indicating that there are more variables that can influence overall risk management and disclosure score of private sector banks.

Out of the given variables, ROE, NP, LTDR, and DEPTL are negatively and significantly related to the risk management disclosure score. This establishes a negative relationship between these variables and the disclosure score. On the other hand, only three variables, i.e., NPA, LHTA and CRTA are positively significant for the model. All the significant variables have been found to be significant at 5% significance level.

As discussed above, decline in profitability indicators like net profit and ROE increase the demand for more disclosures from the investors leading to increased disclosure. Decline in LTDR and DEPTL also indicate the increase in credit and financing as well as market risk for the firm, which means that increase in these two risks lead to increase in disclosures by the private sector banks. on the other hand, increase in non-performing assets is a clear indication of credit risk and banks increase their disclosure to pacify their investors about their credit situation.

Same is the case with LHTA. Not only does it indicate the increase in asset size of the banking firm, but it also indicates the liberalization of credit policy of bank, which further increases the credit risk. As discussed in previous chapter, if the increase in LHTA is combined with increase in non-performing assets, it would lead to increase in credit risk. This means that increase in credit risk would lead to more disclosure on the part of private sector banks.

The findings in case of CRTA are in contradiction to those of public sector banks. Increase in CRTA would mean more secured capital cushion and protection for banks, which would mean decrease in the risk profile of bank. As per the findings, increase in CRTA would lead to a small but significant increase in the disclosure in case of private sector banks. This is most because most private sector banks disclose more information about their capital structure and the various financing instruments. Their quarterly scores are higher than public sector banks due to the same reason, which would, in turn, mean that increase in capital cushion leads to more disclosure.

6.4 Risk and disclosure relationship in foreign banks

The present section of the chapter deals with the results of OLS regression applied to the risk profile variables and disclosure scores of foreign banks.

Table 6-4 OLS model estimates for foreign banks

Variable	Estimate
ROE	-0.090 (0.015)*
LTDR	0.001 (0.014)*
OETA	0.029 (0.132)
LHTA	0.004 (0.014)*
NP	0.035 (0.023)*
CHTA	0.086 (0.121)
DEPTL	0.014 (0.031)*
CRTA	-0.018 (0.004)*
NII	-0.005 (0.149)
NPATA	0.063 (0.012)*
R Squared	0.346
Model estimate	35.817 (0.019)*

The results, of multiple regression on foreign banks indicate that there was a collective significant effect of risk profiling variables $F(10, 40) = 35.817$, $p<0.05$, $R2= 0.35$. on examining the variables in detail, it was found that all variables apart from NII ($t= -0.005$, $p>0.05$), CHTA, ($t= 0.086$, $p>0.05$) and OETA, ($t= 0.029$, $p>0.05$), all other remaining

variables are significant predictors of the model. From these results, it can be seen that null hypothesis is rejected. In other words, risk management and disclosure scores of foreign banks is significantly dependent on their risk profiles.

The above table shows that out of the 10 variables selected for the analysis, OETA, CHTA and NII are not significantly related to the disclosure score, which are same for all three categories of ownership. The value of R -squared for the model is 0.346, which means that model explains around 35% variation in the risk management and disclosure scores of foreign banks. This figure is less as compared to both private and public sector banks, indicating that there are more variables that can influence overall risk management and disclosure score of foreign banks.

Out of the given variables, only two variables ROE and CRTA are negatively and significantly related to the risk management disclosure score. This establishes a negative relationship between these variables and the disclosure score. On the other hand, remaining variables, i.e., NPATA, NP, LTDR, LHTA and DEPTL are positively significant for the model. All the significant variables have been found to be significant at 5% significance level.

ROE has consistently shown negative relationship with the disclosure score in all three categories. As discussed above, this means that decline in ROE would signal high risk to investors leading to increase in overall disclosure by the bank in question. Just like in public sector banks, CRTA also has a negative relationship with the disclosure score, although the value of intercept is very small. This indicates that decline in capital to total assets in case of foreign banks would lead to increase in risk profile leading to disclosure scores.

When it comes to positively related variables, it can be seen that while ROE has been negatively related in all three ownership categories, Net profit was positively related in case of public sector banks and foreign banks. This may be because although the losses of foreign banks were considerably lower than public and private sector banks, their

investors are more aware, and banks tend to disclose more about their risk management practices assuring them that increase in profit would not mean compromise in risk management practices. Also, since these banks suffered more in financial crisis, their disclosure practices are more stringent.

The three indicators of credit risk, namely LHTA, LTDR and NPATA, are positively related to the disclosure scores of foreign banks. Increase in all these variables indicate an increase in the possibility of credit risk for any banking firms. The detailed reasons for the same have been discussed in previous sections and chapters. Their positive relationship with risk scores indicates that increase in credit risk and its possibility increases the overall risk management disclosure scores.

Last variable, which is positively related to the risk management and disclosure scores of foreign banks is DEPTL. This means that increase in deposits would lead to more disclosure by the banking firms. Increase in DEPTL means decline in the financing risk for the bank and increase in investor confidence. As a result, in this case, a decline in the risk probability of financing issue would lead to increased disclosure. These findings are even more surprising since the deposit details are not discussed in the BASEL pillar 3 disclosures published quarterly. However, this increase in deposits might have come because of aggressive sales policies of expansion of business, which in turn would increase the qualitative information on risk management disclosed by the banks. However, there is a need for more detailed analysis of this variable.

6.5 Risk and disclosure relationship in all sample banks

The present section of the chapter deals with the results of OLS regression applied on the risk profile variables and disclosure scores of all sample banks

Table 6-5 OLS model estimates for all sample banks

Variable	Estimate
ROE	-0.039 (0.003)*
LTDR	-0.015 (0.007).
OETA	-0.081 (0.138)

LHTA	0.038 (0.017)*
NP	0.022 (0.024)*
CHTA	-0.021 (0.104)
DEPTL	-0.010 (0.033)*
CRTA	-0.012 (0.006).
NII	0.001 (0.118)
NPATA	0.092 (0.011)*
R Squared	0.441
Model estimate	47.018 (0.009)**

The results, of multiple regression on all sample banks indicate that there was a collective significant effect of risk profiling variables F (10, 138) = 47.018, $p<0.05$, R2= 0.44. on examining the variables in detail, it was found that all variables apart from NII (t= 0.001, $p>0.05$), CHTA, (t= 0.021, $p>0.05$) and OETA, (t= -0.081, $p>0.05$), all other remaining variables are significant predictors of the model. From these results, it can be seen that null hypothesis is rejected. In other words, risk management and disclosure scores of all sample banks is significantly dependent on their risk profiles.

The above table shows that out of the 10 variables selected for the analysis, OETA, CHTA and NII are not significantly related to the disclosure score, which were witnessed in all three individual subsets as well. The value of R -squared for the model is 0.441, which means that model explains around 44% variation in the risk management and disclosure score of sample banks. This figure is more than the individual values for private sector and foreign banks, but slightly lower than that of public sector banks. It means that risk profiling variables selected for the study explain around half of the variation in the disclosure scores of Indian banks.

Out of the given variables, only three variables, LHTA, NP and NPATA, are positively and significantly related to the risk management disclosure score. This establishes a positive relationship between these variables and the disclosure score. On the other hand, remaining variables, i.e. ROE, LTDR, CRTA and DEPTL are negatively significant for the model. Out of the significant variables, LTDR and CRTA are significant at 10%

significant level and the remaining increase in risk profile or potential variables are significant at 5% level.

If we look at the variables establishing positive relationship, increase in both NPAs as well as Net Profit leads to increase in the risk profile of the bank, which in turn means that increase in risk profile or potential increase in risk of bank leads to increase in disclosure of all the sample banks. Similarly, as explained above, increase in LHTA also leads to increase in risk profile of the bank due to possibility of aggressive credit policy.

LTDR is a very crucial credit risk indicator for any bank. Very high LTDR is considered as an indicator of problem in liquidity and credit policy for bank. However, decline in LTDR can also mean that the bank is not able to utilize the deposits very effectively in order to generate assets, and there is a potential cash flow risk for the firm. In sample banks, range of LTDR fluctuates a lot. While most of the private sector banks have LTDR in the range of 65-95%, the range is quite wide in other two categories. In these two categories, there are some banks where LTDR is even lower than 55%, which indicates that there is a huge gap in asset efficiency. In such scenarios, it can be seen that decrease in LTDR will lead to increase in risk profile of bank and more disclosure.

Decline in CRTA, ROE and DEPTL indicate an increase in the potential of risk profile of a bank from its liability side. These declines often cause concern to the investors and hence in order to pacify them, the banks tend to increase the risk management disclosure.

From the above discussion on the model results of all the sample banks, it can be seen that increase in risk profile leads to increase in disclosure scores for the sample banks. This establishes the relationship between the risk profile and the risk management disclosure practices of the sample banks. The theoretical foundation of model in terms of signaling theory is discussed in the following chapter.

6.6 Comparative analysis of public, private and foreign banks

The present section of the chapter deals with the comparative analysis of OLS model results of public, private and foreign banks

Table 6-6 – Comparative analysis of risk and disclosure scores of public sector, private sector and foreign banks

	Public Sector Banks	**Private Sector Banks**	**Foreign Banks**
Variable	Model Estimate	Model Estimate	Model Estimate
ROE	-0.030 (0.007).	-0.051 (0.011)*	-0.090 (0.015)*
LTDR	1.173 (0.009).	-0.044 (0.021)*	0.001 (0.014)*
OETA	0.980 (0.154)	-0.533(0.173)	0.029 (0.132)
LHTA	-1.360 (0.021)*	0.051(0.014)*	0.004 (0.014)*
NP	0.019 (0.037)*	-0.002 (0.042)*	0.035 (0.023)*
CHTA	-0.167 (0.118)	0.053 (0.129)	0.086 (0.121)
DEPTL	1.012 (0.058).	-0.059 (0.028)*	0.014 (0.031)*
CRTA	-0.898 (0.009).	0.080 (0.006)**	-0.018 (0.004)*
NII	0.089 (0.139)	0.061(0.142)	-0.005 (0.149)
NPATA	0.077 (0.017)*	0.227 (0.013)*	0.063 (0.012)*
R-Squared:	0.428	0.379	0.346
Model estimate	29.884 (0.016)*	23.662 (0.013)*	35.817 (0.019)*

From the above table, it can be seen that model results are similar in case all three categories of banks. All three models are significant, and their R squared values indicate that risk profiling measures explain around 34 -43% of variation in disclosure scores of these banks. Out of the ten variables selected, three variables are non-significant across the categories. These include NII, OETA and CHTA. While profitability indicator ROE is

negatively related to risk management disclosure, non-performing assets are positively related in all three categories. The detailed discussion on the possible explanation is given in the previous sections. For all other variables, no clear pattern is observed in terms of the direction of their relationship with the risk management disclosures. As a result, it can be said that each of the variables need to be studied in detail in each banking ownership subgroup to understand their impact on risk management disclosure scores.

6.7 Framework development

A major contribution of this study is to establish the relationship between risk management and disclosure scores and risk profiling variables. The same has been done with the help of prior studies and insights from current research. As per signaling theory, performance indicators of banks are linked to risk management and risk signaling (Hughes & Mester, 1998). Signaling theory suggests that good banks can distinguish themselves from bad banks by projecting better financial results (Besancenot & Vranceanu, 2011). The findings of current study also indicate the same that overall risk management disclosure scores are affected by risk profiling indicators, which can be seen as the signal by banks to investors and regulators that they are performing well.

The framework establishes the relationship of different risk profiling indicators used in the study and their respective roles in risk profile, which is further associated with the risk management disclosures of the bank. Along with the major dimensions of the banking risk as per our model risk management disclosure scores and Basel framework, an additional dimension of profitability is added keeping in mind its contribution in the risk profile of public sector banks. The model is shown in figure below.

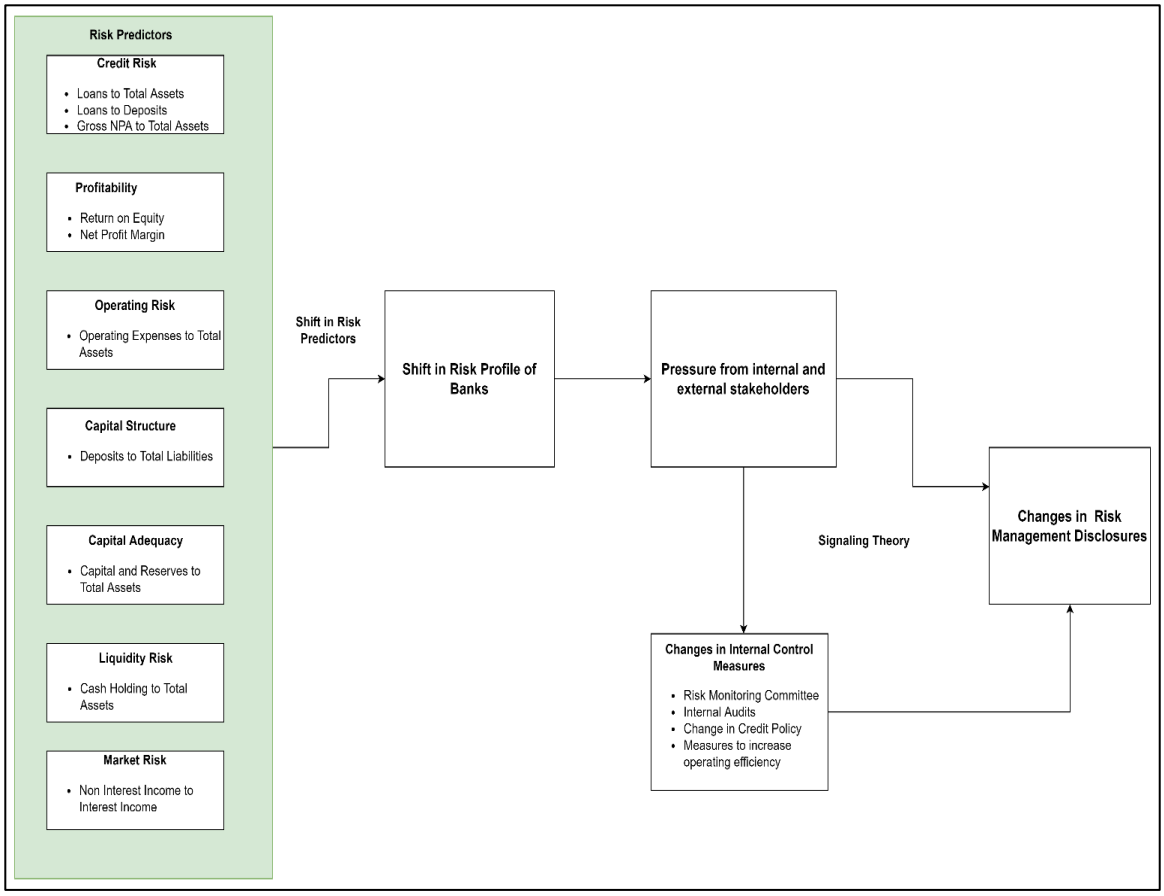


Figure 6-1 - Relationship framework between risk profiling variables and risk management and disclosure scores

Source – Created by author on the basis of model results

The framework establishes that various risk profile indicators of banks would impact their risk management disclosures. The results of regression model indicate that the variables relating to operating, market and liquidity risk are insignificant in the relationship between risk profiling variables and bank disclosures. In case, banks manage to improve their disclosures on these parameters the relationship can strengthen. The direction of these variables and their relationship with respective risks are defined by the results of clustering analysis, and regression results indicate that the relationship between the two is positive and significant. As a result, this framework can be used by both bankers and investors alike.

The framework indicates that any change in risk predictors will lead to change in risk profile of banks, which will in turn lead to pressure from internal and external stakeholders to ramp up the internal controls. When a bank makes some changes in its risk management practices or internal controls, it signals the stakeholders that they need not worry as the adequate practices are in place. This should be done on timely basis and quarterly disclosures under Basel norms provide perfect opportunity for doing so.

This framework can be used to improve their risk profile as well as the quality of their quarterly risk management disclosures. In case a bank sees any adverse variation in any of these risk profiling variables, it should follow signaling theory and adjust its risk management disclosures accordingly. This will also help investors in better utilization of the risk management disclosures since they can refer to specific sections in case of shift in any of these variables to understand the risk profile of their banks.

6.8 Findings and chapter summary

From the above discussion, it can be seen that there is a statistically significant relationship between the risk profile and risk management and disclosure scores in all three ownership categories. The regression models applied to all ownership categories as well as the entire sample have helped us in rejecting the null hypothesis framed for this objective. Also, the r-squared values of these models have proved that variables selected for the risk profiling of these banks have explained significant variation in the disclosure scores of the sample banks. All regression models have come out to be significant.

When it comes to variables and their relationship with risk profiles, it can be seen that three variables out of 10 selected variables have not proved to be significant for any of the regression models. These variables are non-interest income to interest income (NII), Cash Holdings to Total Assets Ratio (CHTA) and Operating Expenses to Total Assets Ratio (OETA). The main reason for the same might be that although these variables are important indicators of the risk profiles of banks, they relate to the balance sheet and income statement of the banks and not the BASEL disclosures specified by RBI. As a

result, these variables do not have any direct or significant relationship with the disclosure scores of the sample banks.

Out of the remaining variables, some display a negative relationship with the disclosure score, and some display a positive one. Depending upon the variables' relationship with the risk profile of a bank, these variables indicate a positive correlation between the risk management disclosure and the risk profile of the banks. For example, ROE has a negative relationship with the disclosure scores indicating that decrease in returns for shareholders increase their perception of risk of a bank and bank increases its risk management practices disclosure to appease them. On the other hand, increase in NPAs leads to increase in risk profile of the bank and its positive relationship with the risk management disclosure scores also means that increase in banking risk leads to increase in the disclosure scores.

The details of these variables and their respective relationship with the risk disclosure scores of banks is discussed in next chapter.

6.8.1 Managerial Implications

The findings of this chapter are useful for policy makers as well as other stakeholders. The findings indicate that most of the risk management disclosures relate to the aspects related to the credit risk of banks. As a result, the investors should look for other sources of information like auditors' report or CEO letter to find out qualitative information about other aspects of risks faced by the banks.

The second implication of the findings of this chapter lies in the framework developed after the analysis. The framework indicates the relationship between risk profile indicators and the risk management disclosure scores. The investors can look at the specific profiling indicators and can apprehend the impact it would have on the overall risk management disclosures.

Another implication for the top management of banks is that since the study establishes a cause-and-effect relationship between risk profiling indicators and risk management

disclosures, they should focus on the improve their risk profile so that a positive signal is sent to all the stakeholders through the disclosures. The investors will look at the specific disclosures and would get the signal about banks' financial health making their financial decision accordingly.

Chapter 7: FINDINGS AND CONCLUSION

7.1 Chapter introduction

This final chapter of the dissertation deals with the summary of major findings of the study and the inferences and conclusions that can be drawn from the same. This chapter is divided into multiple sections dealing with different objectives relating to risk profiling of banks, risk management disclosure of banks and relationship between the risk and disclosure in case of banking firms. The last section of the chapter deals with some suggestions for improvement on the basis of existing literature and the findings of the current study and the concluding remarks.

7.2 Findings

This section of the chapter deals with the key findings of the three objectives of the current study.

7.2.1 Risk management and disclosure practices of Indian Banks

The first objective of the study dealt with the study and analysis of risk management and disclosure practices of the sample banks in India. In order to study the risk management practices a time period of 6 years was taken from implementation of Basel 3 norms. The study was carried out for the period of 2013-14 to 2019-20 and a sample of 30 Indian banks was studied. In order to study their risk management and disclosure practices, a disclosure scale was developed.

The risk disclosure index has been designed from the existing disclosure indices by (Giner, et al., 2020), (Naz & Ayub, 2017), (Dhar, 2014) (Santos, et al., 2014) and (Barakat & Hussainey, 2013). These indices are mostly similar in nature and cover one or more of the 6 dimensions of risk management as per BASEL disclosure survey and quantify the extent of disclosure as per BASEL standards. These indices were then modified as per changes in Basel 3 framework and as per RBI guidelines.

Most of the existing research on risk disclosures are based on corporate disclosures in annual reports (Linsley, et al., 2006). The main reason for development of a scale was

that Basel pillar 3 disclosures not only act as a measure of market discipline but also act as a measure of comparison between different banks' risk management practices. This offers a better measure of measuring the risk management practices of banks since they are uniform across the globe and are more standardized documentary evidence of risk management practice of banks (Samanta & Dugal, 2016).

The findings of the study are in agreement with the previous study conducted by Samanta & Dugal, 2016 and suggest that most the bank disclosures are focused on credit risk and very little importance is given to other types of risks, especially operating risk. All the banks studied as a part of research published Basel III pillar 3 disclosures every quarter as per RBI guidelines, but the amount of information disclosed does not only vary across banks as well as across quarters. Most of the banks disclose only information related to capital structure and credit risk in all four quarters and the information relating to qualitative aspects of operating risk, marketing and interest rate risk etc. only in the quarters ending March and September. This is as per the minimum disclosure requirements prescribed by RBI and most banks do not go beyond the basic guidelines to give more information to investors.

Another important trend was seen that, year after year, most banks published information in the same format and scored similar scores over the years during study period. This is possible because banks use the same format of disclosure and just update the numbers over the years. In other words, **only the quantitative information is updated and the qualitative details provided by the banks remain the same over the years**. This can be seen from the scores obtained by banks across all three categories. The page number of disclosure documents also remain same over the period of years. **Some important risks like liquidity risks and legal risks are almost completely ignored in the disclosure documents**.

The above discussion highlights some common findings which were observed in all three categories. However, an important aspect of the study of these practices was to compare them across the different categories of banks, public, private and foreign banks.

7.2.1.1 Public sector banks

Results of existing studies on disclosure by public sector banks are mixed. While the information disclosure as per accounting standards by public sector banks is at par with that of private sector banks (Poornima, et al., 2016), the other general information displayed on their websites for investors and stakeholders is less than that of private sector banks (Bhatia & Kaur, 2015). The current study focuses on key aspects of Basel 3 pillar III disclosures for easy comparison.

Most of the public sector banks scored between 30-34 out of 40 for most of the quarters ending March and September. The only exception, in this case, is UCO Bank, which has the lowest disclosure score in the category. The bank scored 29 out of 40 in these quarters. However, in the financial year 2019-20, the scores further declined to 10 out of 40 in all the four quarters. Another poor performer in the category was Indian Overseas Bank, which also scored just 10 out of 40 in the disclosures for the months of June and December, making it lowest score tied with UCO Bank. However, unlike UCO Bank, Indian Overseas Bank scored above 30 in the quarters ending March and September.

For most public sector banks, the scores in June and December quarters ranged between 15-16 out of 40. The highest scores were obtained by PNB, which scored 21 out of 40 in these quarters and a score of 32 out of 40 in other two quarters. Another good performing bank was Union Bank of India, which also scored well in all four quarters, with scores of 33.5 and 15 respectively. Largest bank in the country, SBI scored 32 out of 40 in the quarters ending March and September and just 11 out of 40 in other two quarters, indicating that the bank needs to provide more information relating to other risks in quarterly disclosures as well. **Also, even though SBI and Bank of Baroda underwent mergers during the course of study, their disclosure scores were not**

affected by the same. This fact further hints at the importance of more disclosure of qualitative information and not merely satisfying the central bank mandate.

7.2.1.2 Private sector banks

Private sector banks performed better than the public sector banks in terms of their Basel disclosure scores. This is in contrast to the previous research which indicated that public sector banks attach more importance to risk management and qualitative information of disclosure than private sector banks (Kumar & Agrawal, 2017). However, there were some similar trends which were observed in the category, for example less disclosure about operating, liquidity risks etc. and similar scores were observed over the years indicating the similarity in the trend of amount of information disclosed.

All banks scored above 30 from 40 in the biannual disclosures in the month of March and September, which is better than public sector banks. The best performing banks in the category were ICICI Bank and YES Bank. While ICICI bank scored 37 out of 40 for biannual disclosures, YES Bank scored 35 out of 40. Similarly, Axis Bank, HDFC Bank and Kotak Mahindra Bank also scored 35 or more out of 40 in these biannual disclosures. This shows that these banks disclosed all major qualitative and quantitative aspects of their risk management practices in the disclosure documents including the relevant qualitative information. These scores are also higher than the highest scores in case of public sector banks.

In case of quarterly disclosure scores for June and December, the scores are not that great. Although the highest scores in these quarters are 28 out of 40 in case of YES Bank, the other banks score in the range of 13-18, which is in the similar range as in case of private sector banks. However, the lowest score in the category is 11 out of 40, which is slightly higher than that of public sector category. These lowest scores are earned by J&K Bank, which scored 31 out of 40 in case of biannual disclosures. Another small bank, South Indian Bank, was the second-worst performer, who scored 30 out of 40 in case of

biannual disclosures and just 13 out of 40 in case disclosures in the months of June and December.

In case of private sector banks, it can be seen that there are very few banks that scored either high or low in all four quarters. General trend is that the banks which score well in biannual disclosures tend to score less in case of other two quarters and vice a versa. For example, Axis Bank scored 36 out of 40 in case of biannual disclosures, which is among the highest among entire sample, but its disclosure score is just 12 out of 40 in case of quarters ending June and December. Similar pattern was observed in case of HDFC bank as well. These two banks along with SBI are largest banks of the country and their scores are low in lean quarters, which point out the need for more disclosures by large banks.

7.2.1.3 Foreign banks

When it comes to disclosure of risk management practices, foreign banks perform better than both the other categories. The overall scores of these banks are better than public and private sector banks for all four quarters, which indicates a strong market discipline among them.

All the banks in this category score well above 30 out of 40 in case of biannual disclosures of March and September. The highest score in this category is 35.5, which is slightly less than that of private sector banks, but the score is obtained by 4 out of 10 foreign banks, which is indicative of the general performance of the category. Similarly, the scores of the quarter ending June and December are also high in this category and the highest score is 28.5 out of 40. This score was almost same in case of private sector banks as well, but there were three other banks in the category, which scored 20 or more out of 40 in case of quarters ending June and December. Not only that, but the average score also ranged between 15-20 in this category, which is higher compared to the other two sub-groups.

The best performing banks in the category were Deutsch Bank and HSBC, respectively. Deutsche bank scored 35.5 out of 40 in case of biannual disclosures of March and

September and 28.5 in case of June and December. HSBC scored 33 out of 40 and 21 out of 40 in the biannual and quarterly disclosures respectively. Average scores of both these banks are higher than the highest scores of public sector banks and at par with those of private sector banks.

When it comes to poor performing banks, BNP Paribas is the only bank that scores low in the category. The Basel disclosures of this bank is only displayed once a year, i.e., for the year ending March. For other three quarters, the bank displays only the major details relating to capital adequacy with no additional information provided on any other types of risk. This practice decreases the average score of the bank to the lowest in category and one of the lowest in the entire sample. This is in sharp contrast to other banks in the category that disclose a lot of information in detail over and above the mandate of RBI.

These findings are in agreement with previous research which points out that **foreign ownership tends to increase the corporate governance which leads to better market discipline and information in disclosures** (Du, et al., 2016). Indian studies have also found foreign banks to be compliant with Basel as well as Central Bank disclosure norms (Vij & Kaur, 2014). The same findings have been suggested by the current dissertation.

7.2.1.4 Comparative analysis and key insights

In order to perform the comparative analysis of the three categories, an independent sample t-test was performed on all three categories. The results of the tests indicate that disclosure scores of public sector banks, (M= 22.32, SD = 9.45) are significantly different and lower than those of private sector banks (M=24.53, SD =9.83) and foreign banks (M=26.06, SD =9.33) respectively. Lesser standard deviation in case of foreign banks is also an indicator of overall consistency of the disclosure scores in all the sample banks. Had the scores of BNP Paribas not been so low, the standard deviation in foreign banks would have been even lower. On the other hand, the average scores of private banks are slightly lower than those of foreign banks, but they are not significantly different from

each other. In other words, risk management disclosures need to improve in case of public sector banks.

Some other insights drawn from the analysis are as follows:

- Maximum risk management and disclosure focus is on the credit risk information. Banks pay a lot of attention to the control of credit risk, and the same is communicated to the stakeholders through disclosure documents. Also, the frequency of disclosure relating to credit risk is more as compared to few other types of risks. This is well understood since the original purpose of Basel 1 and 2 norms were to provide guidelines for banks for measuring credit risk (Hertig, 2006) and hence the disclosure requirements are also biased toward credit risk.
- Second most reported aspect of banking risk is related to capital adequacy. Some of the important information related to capital adequacy includes Tier-1 and Tier-2 capital, capital requirements for various kinds of banking risks as well as salient features of some crucial debt instruments. This aspect is very important since a crucial reason for subprime crisis was lack of information about the nature of risks associated with complicated financial instruments of the banks. In Indian scenario, this reporting is quantitative, and all banks report the same regularly.
- One of the important findings of the study is that banks disclose very less information, especially qualitative information relating to operating risks. These findings are in agreement with the existing studies which showed that banks follow the central bank regulation in disclosing details of operating risk, but in general the information provided is very less (Nobanee & Ellili, 2017). **Most Indian banks do not disclose the sub-categories of operating risk and mitigation strategies they adopt in countering them. They also do not disclose details of internal audits and controls in detail**.
- Some other crucial types of risks, regarding which very less qualitative information is presented, include liquidity and legal risks. Less disclosure on liquidity risk management can be detrimental in case of financial instability and

turmoil (Asongu, 2013). Information relating to market and interest rate risk is provided in a standardized manner by most banks.

- Depending upon the external and internal environment, banks do not change their disclosure about banking risks, as expected from them. Since this disclosure is published quarterly, it can provide more timely information to stakeholders than annual reports.

7.2.2 Risk profiling and clustering of banks

The second objective of the dissertation dealt with risk profiling of sample banks and clustering them on the basis of their risk profile into high, medium and low risk clusters. As discussed in the chapter dealing with research methodology, the process of clustering was selected because it combines the benefit of data mining along with assessing the financial indicators. Not only that, but since the process works on the principles of data mining and classification, the chances of author bias are relatively less. The current study used two main types of clustering for profiling the banks, namely hierarchical and k-means clustering. After profiling the banks on the basis of their risk behaviour, the second step dealt with the finding out of significant variables which influence the risk profiles of banks and finding out whether these variables are same across the three ownership categories or not. In order to perform this analysis, one-way ANOVA was performed on the various clusters for all the study years to find out variables that were significantly different across the clusters. The key findings from this analysis are discussed below in detail.

7.2.2.1 Risk profiling of public sector banks

As observed in previous section, public sector banks had more issues in their risk profile as compared to other two categories. As a category, public sector banks have improved their performance over the years and number of banks in high-risk cluster has gone down. If we look at the best performing banks, Canara Bank and Indian Bank are the two banks which have never been placed in high-risk cluster throughout the study period of 13 years. In addition to that, other good banks include bigger banks like SBI, PNB, Bank of

Baroda and Union Bank of India. These banks have mostly been in low and medium risk clusters throughout the study, i.e., for 12 out of 13-year period.

On the other hand, worst performing banks include Central Bank of India, UCO Bank and Indian Overseas Bank. These banks have been in either high or medium risk clusters for most years during the study period. These findings are consistent with the findings of previous objective where these banks also scored least in the disclosure index scores in their category and among the sample.

If we look at the trend of risk profile since 2008, it can be seen that for initial 3 years, more banks were placed in low-risk clusters than those in high-risk clusters. However, over time, the number of banks in low-risk clusters has been just 1 while most of the banks have been placed in medium risk clusters. The performance has been improving in the last 3 years of the study period, where more banks are coming in low-risk clusters and number of banks in high-risk clusters are just 1 or 2, indicating an improvement in the risk profile of the public sector banks.

Existing literature has pointed out that public sector banks tend to have more asset-liability mismatch (Arora & Kohli, 2018), which affects their risk profile and these banks might face more difficulty in fulfilling Basel norms of capital adequacy and credit risk, so it is important to keep a check on their risk profile (Jangra, 2020). The same was witnessed in the risk profile fluctuation, where most public sector banks were placed in high-risk clusters in next 3 years after Basel 3 norms were introduced in India in 2014, which might be because of their increase in credit risk and problems of capital adequacy. The detailed analysis of variables is discussed below in next section. However, a lot of public sector banks were incurring losses which outweighed other indicators and defined the risk profile in this category.

Another important point in this category was merger of SBI with its associate banks and Vijaya Bank and Dena bank with Bank of Baroda. **A comparative analysis of the risk profile of these banks indicated that merger of banks affects the risk profile of**

resulting entry. The direction of change depends on the profitability of the merged entity and the parent entity before merger. Rrisk profile of State Bank of India prior to merger (M= 16.125, SD = 23.424) was significantly different and better than the post-merger risk profile scores (M= 14.266, SD = 22.809). On the other hand, risk profile scores of Bank of Baroda prior to the merger (M= 20.849, SD = 31.582) were significantly different and lesser than the post-merger risk profile scores (M= 22.47, SD = 31.322

The above findings indicate that there is a need to keep a check on the risk characteristics of the banks to be merged so as to create a sustainable new banking entity.

7.2.2.2 Risk profiling of private sector banks

Risk profile of private sector banks is better than that of public sector banks and they also tend to have improved their performance over a period of time. If we look at the bank-wise performance in the category, it can be seen that bigger banks tend to perform better than the smaller banks throughout the years. The two biggest banks in the category, Axis Bank and HDFC Bank have been placed in low or medium risk category throughout the period of the study and never in high-risk cluster. Another bank which has always been placed in low or medium risk clusters is IndusInd Bank. YES Bank has also been performing good, but the bank shot up to high risk cluster in the last year of the study, i.e. 2020. This was mainly because of the financial trouble in the bank operations and negative market returns it was generating.

If we look at the worst performing banks in the category throughout the period of study, IDBI comes out to be the bank that has been placed in high-risk clusters for the greatest number of years throughout the study period. This is in line with its performance since it was mostly incurring losses and generating negative returns for its shareholders, along with having higher NPAs than other banks in the category. Other banks which have performed worse than most banks in the category include Jammu & Kashmir Bank, Kotak Mahindra Bank and ICICI Bank, which have been placed in high-risk clusters for 4 years out of 13-year study period. This performance is better than that of least performing

banks of public sector banks. Also, except IDBI, most of these banks have improved their risk profile over the period of time.

If we look at the trend of risk profile for private banks over the period of time, it can be seen that for the first three years more than half of banks fell into low-risk cluster. This number considerably reduced in later years, but in the last few years of the study period, number of banks in low-risk clusters is increasing again. However, for the greatest number of years, most banks fell into medium risk clusters and banks in high-risk clusters have always been considerably less. This can be seen from the average for all 13 years, where average number of banks in high-risk cluster in private sector banks comes out to be 2 out of 10. This is lowest among all the three ownership categories. This trend is an indicator of better performance of risk profile of private sector banks.

Unlike private sector banks, not many banks were incurring losses in the category, except a few like IDBI. In such case the distinction between clusters, especially between low and medium risk clusters becomes dependent on other variables apart from profitability indicators. As a result, it becomes important to study the variables which cause significant variation among clusters in private sector banks.

7.2.2.3 Risk Profiling of foreign banks

The third category of ownership which was studied for risk profiling was foreign banks. **Existing literature on risk profile of foreign banks point out that they are comparatively less risky as compared to local banks as foreign ownership not only reduces financial fragility but also reduces the extent of non -performing assets in a banking firm** (Nguyen, 2020). The findings of the current study are in agreement with this literature and find that foreign banks tend to have better risk profile than public sector banks of India. However, their performance is at par with the private sector banks of the country.

If we look at the bank-wise performance of the category, it can be seen that Bank of America is the best performing bank since it has never been placed in a high-risk cluster

throughout the period of the study. Other two banks which are performing better than their peers are Citi Banka and JP Morgan Chase. These banks have been placed in high-risk cluster only once out of the study period of 13 years.

In case of worst performing banks in the category, it can be seen that the worst performing banks are BNP Paribas and Barclays, which have been placed in high-risk clusters for more than half the number of years during the study. Along with these two banks, DBS bank is also weaker in its risk profile as compared to other banks since it has been placed in high-risk clusters for 6 out of 13 years of study period.

The yearly trend shows that except for the period of 2014-17, more banks have been placed in low-risk cluster as compared to high-risk clusters. The position of foreign banks has been improving in terms of their risk profile over the years since then, except in case of last year, i.e., 2020 when the number of banks in high-risk cluster was almost double than those in low-risk cluster. This in contrast to the findings of other two categories. On an average more banks have been placed in low and medium risk clusters than in high-risk clusters, which is a good sign for the category.

The study also found that since the scope of their operations is very limited in India as compared to other two ownership categories they tend to perform better in certain categories like non-performing assets. However, in order to do more detailed analysis of the various factors which determine the risk profile of foreign banks, the analysis of variance was conducted, which is discussed in the next section of the chapter.

7.2.2.4 Significant variables in risk profiles

After performing the risk profiling of the banks using two types of clustering analysis, it was important to understand which variables are important to risk profile in each category. While some of the variables were significant to a single ownership category of the bank, there were some variables that behaved similarly across the various subgroups. The present section of the chapter discusses the key findings of the ANOVA analysis

conducted on the three banking categories over a period of 13 years and highlights the most and least significant variables emerging out of the same.

Return on Equity

Return on equity is an important profitability indicator for any firm, including banking firms. In the present study, it was found that ROE was a very significant variable when it comes to risk profiling of public sector banks. It was found significant for 11 out of 13 years in clusters of public sector banks. The variable was also significant for 7 out of 13 years in case of private sector banks. However, in case of foreign banks, the variable was not much significant for most years and was only significantly different across clusters in five out of 13 years. The existing literature on the variable indicates that it is an important measure of financial performance of a bank and strong risk management practices adopted by banks lead to increase in the Return on Equity (Saiful & Ayu., 2019). Also, the findings of literature suggest that higher ROE is in turn the result of higher risk taking by the banks to improve their earnings in order to maintain a balance between profitability and capital regulation (Bhattacharya, 2013). In case of public sector banks, there were many banks which were generating negative returns for their shareholders over a period of time, which made them risky to invest and hence they were classified in high-risk clusters. On the other hand, in case of foreign banks, their exposure to equity market itself is very less, thereby reducing the value of ROE in defining the risk profile of the banks.

Loans to Deposit Ratio

Loans to deposit ratio is an indicator of credit capacity of the bank. It appears to be very significant in determining the risk profile of banks in all three ownership categories. LTDR was found significantly different across clusters for 7 out of 13 years in case of public sector banks and 12 years out of 13 years in case of both private sector banks and foreign banks. These findings make it a very crucial variable for understanding the risk of a bank. This ratio is a measure of banks' loans against the total deposit it has from

general public. Lower LTDR indicates inefficient utilization of funds and lack of profitability (Liu, et al., 2020). However, excess LTDR also indicates an aggressive lending policy which might cause an asset-liability mismatch or increase credit risk (Wetmore, 2004). In the current study, it has been observed that the ratio ranges between 60 to 90% in case of public and private sector banks. However, in some cases of foreign banks, the ratio was observed to be more than 100%, especially in the areas near 2008-09 financial crisis. There was one isolated incident where MUFG bank had LTDR of more than 300%. These findings are in agreement with those of (Claessens & Horen, 2012) which stated that foreign banks in emerging economies have higher LTDR as an indication of their ability to mobilize more non-deposit sources of fundings. This indicated a lack of investor confidence and drop in despots as seen in case of Yes Bank in 2020 (Shukla & Joel Rebello, 2020)or in case of aggressive lending by banks. Although banks can increase advances more than deposits by the practice of fractional reserve banking (Calomiris, 2021), it can lead to problems in asset-liability mismatch (Nair, 2015). However, if the bank is able to manage the quality of assets, this high ratio indicates a steady stream of income. Foreign banks also see a huge variation in the range of LTDR as a category as compared to public sector banks which have low LTDR coupled with high Nonperforming Assets indicating poor lending policy. **As a result, the findings of this study highlight the importance of a more detailed study into LTDR of Indian banks to understand their risk profile better**.

Net Profit Margin

The relationship between profitability and risk is well researched, and it has been observed that in order to improve profitability, banks tend to increase credit and market risk (Duho, et al., 2020). However, better profit management increases the profitability margin of banks (Seyedeh & Jalilian, 2017). In the current study, it was observed that like return on equity, profit margin emerged as a crucial variable in case of public sector banks as against private sector and foreign banks. Out of the study period of 13 years, net profit margin varied significantly across clusters for all 13 years in case of public sector

banks as against 6 years in case of private sector banks and foreign banks. The main reason for the same is that during all the years of study, there were few public sector banks that were incurring huge losses, and those losses overshadowed their other financial parameters and placed them in high-risk clusters as against others. Also, losses increased the operating expenses, reduced the return on equity, and reduced reserves and surplus of banking firms, initiating a chain reaction affecting their risk profile.

Deposits to Liabilities Ratio

This ratio also emerged as a very crucial variable in determining the risk profile of sample commercial banks. The ratio varied across clusters for 12 out of 13 years in case of private sector banks, 9 out of 13 years in case of public sector banks and 6 out of 13 years in case of foreign banks. The existing research on this variable and its relationship with the banking risk is very limited. However, deposits are very important source of bank funding, and a very low ratio would indicate that banks are relying on external sources of funding and people are not having much confidence in the bank's performance indicating a higher risk profile. In the current study, it was also observed that deposit ratio was highest in case of public sector banks, which ranged between 60% -90%, followed by private sector banks, where the range was 40% to 70% and was extremely low in case of foreign banks, where some banks had deposits to liabilities ratio of just around 20% as well. **These findings indicate that public sector banks still enjoy more public confidence than other two ownership categories**. However, there is a need to justify such deposit ratio with higher returns to shareholders and better loans to deposit ratio with quality assets. **Also, it was seen that foreign banks in high-risk clusters had high Loans to Deposit Ratio combined with low Deposits to Liabilities Ratio, indicating a possibility of asset-liability mismatch**. There is a need to understand this pattern of these deposit ratios and their effect on banking performance and risk in the Indian context in the future.

Non-performing Assets to Total assets

Non-performing assets are considered an important indicator of credit risk for any banking firm. Indian banks have been facing huge problems of high NPAs for a very long time. Existing research not only points out the negative relationship between credit risk identification and NPAs but has also hinted at more severity of problem in public sector banks as compared to private sector banks (Sharifi, et al., 2019). The findings of the current study state that NPAs vary significantly across clusters for just 5 years in case of public sector banks and 6 years in case of private sector banks. in case of foreign banks, however, the variable was significantly different for just 1 year. The main reason for the same is that for a lot of foreign banks the non-performing assets are nil or negligible. Also, the variable became more significant in the later years of the study since the government and central bank made stricter regulations for asset quality and NPA cleanup, which led to some of the banks reporting exceedingly high non-performing assets. In both the public and private sector banks, banks in high-risk clusters had gross NPAs to the tune of 10% of total assets or more.

Some of the key findings of the second objective of the study are discussed below briefly:

- Public sector banks have a higher risk profile as a category as compared to private sector banks and foreign banks. There were lot of public sector banks that were not performing well during the study period, and hence the overall performance of category was affected. However, these banks have improved their performance and very few banks have been placed in high-risk clusters in later years of the study.
- Bigger private sector banks have consistently performed better throughout the study period. The performance of the category has been affected mainly by shifting of IDBI's ownership structure and the losses earned by some of the smaller private sector banks. In this category, most of the banks have been placed in medium risk category as few big banks perform a lot better than the rest and a couple of the smaller banks constantly generate losses. The performance of these banks is also improving over the period of time.

- Foreign banks scored better than both the other categories in terms of their risk profile. Apart from the period of 2014-17, the banks in low-risk cluster in this category has always been more than those in high-risk category, indicating the overall strength of their risk profile.
- There are some similarities in the results of disclosure scores and the results of risk profiles. The banks which have performed well in risk management disclosure scores have also performed well in their risk profile and vice versa. Some of the banks which performed poorly in both these parameters include UCO Bank, Indian Overseas Bank, IDBI, Jammu & Kashmir bank etc. There is a need to study their management in detail to understand the reasons for their poor risk management practices.
- The most crucial variables in determining the risk profiles came out to be Return on Equity, Deposits to Total Liability Ratio, net profit margin and loans to deposit ratio.
- While the profitability indicators like Return on Equity and Net Profit Margin were significant for risk profile of public sector banks, they were not that crucial in case of other two categories. Similarly, non-performing assets were crucial for public and private sector banks, but not very significant in case of determination of risk profile of foreign banks.

7.2.3 Relationship between risk management disclosure score and risk profile

The third and final objective of the study dealt with establishing the relationship between the risk management and disclosure scores of banks and their risk profiles formed on the basis of selected variables. In order to perform the analysis and validate the hypothesis, OLS fixed effect regression model was used. The model was applied to all three ownership categories and the entire sample of 30 banks. The results indicate that the risk management disclosure is significantly affected by the risk profiling variables of the banks in all four cases. Also, in all four cases, seven out of 10 variables were found to be significantly affecting the disclosure scores of the banks. The R squared measure ranged

between 35-45% in all the models indicating that selected variables explained around 40% of the variation in the disclosure scores of commercial banks during study period. The relationship of different variables with the disclosure scores is discussed in detail in the coming portion of the current chapter.

Profitability indicators

The first set of indicators that were used in the regression model were profitability indicators of ROE and net profit margin. All of them have been found to have significant association with the risk management and disclosure scores of the banks in all ownership categories. However, the direction of the relationship with risk management disclosure is different for all these variables as well as ownership categories. One of the most important theories that explain the relationship between profitability and risk disclosure is signaling theory. This theory suggests that more profitable banks disclose more information to their shareholders to keep them posted about their performance (Elghaffar, et al., 2019). On the other hand, some other researchers suggest a negative relationship between profitability and risk disclosure of banks.

The findings indicate that ROE was found to be negatively associated with risk disclosure score for all ownership categories. Net profit was found to be positively associated with the risk disclosure scores in case of three out of four regression models, which are in support of the signaling theory. As far as the existing research on the relationship between ROE and risk disclosure is concerned, it suggests that increase in disclosure leads to increase in ROE and market performance of the bank (TABASH, 2019). However, not much evidence is there to support that decline in ROE leads to increase in the risk management disclosure. As discussed in the previous chapter, it might be due to the increase in risk taking behavior of the bank, which will ultimately prompt the shareholders to demand more information. There is a scope for more research on the topic in future.

Credit risk variables

The variables indicating credit risk of the banks include LTDR, NPATA and LHTA. Credit risk is an important part of Basel disclosure and one of the most crucial risks for any banking firm. As a result, it is important to understand the relationship of these variables with risk management disclosure scores. While NPATA has a positive relationship with disclosure scores in all three categories as well as in case of entire sample, LHTA is negatively associated with the disclosure score only in case of public sector banks. The relationship of LTDR is more complicated since out of the four regression models. It displays a positive and negative relationship for two models. As a result, there is a need to understand this relationship in more detail in future research.

The positive relationship between bank disclosure and NPAs is quite justified since a major part of disclosure by banks relate to breakdown of loans and bad debts into their various categories and exposure of different industries in these loans (Frolov, 2006). The higher the level of non-performing loans, more disclosure banks have to make because of the regulatory requirements and Basel norms. Also, the increase in non-performing assets is an important indicator of credit risk of bank, which establishes that increase in these assets leads to increase in risk profile of the bank, establishing a positive relationship between risk profile and disclosure scores.

Existing literature has already established a positive relationship between loans to total asset ratio and the provisions for non-performing assets, both of them being indicators of credit risk of the banks (Ozili, 2018). As a result, in most of the cases, the increase in Loans to Total Asset ratio also led to increase in the disclosure scores of the banks, thereby establishing a positive relationship between the two.

The loans to deposit ratio are not just an important indicator of credit risk, but also liquidity risk of the bank. A very high liquidity ratio indicates a possible liquidity issue for the bank (Shi, et al., 2016), which would increase the disclosure requirement for the banks. Indian banks displayed a wide range of LTDR across the ownership categories. This shift in the indicator might have led to more liquidity ratio disclosures by some

banks in quarterly disclosures as against others. A very high LTDR also indicates an aggressive lending policy indicating (Ozili, 2018)an increase in risk profile. On the other hand, the low LTDR indicates credit inefficiency on the part of the bank, which would, in turn, make them want to increase their information disclosure to increase their deposit base. Due to its relationship with various types of risk and association with the risk management disclosure, this variable needs to be studied in more detail.

Other variables

Apart from the above mentioned five variables, there were two other variables which came out as significantly associated with risk management disclosure scores are DEPTL and CRTA.

Capital adequacy is an important aspect of bank regulation and central banks rely on the capital information disclosed by banks in their quarterly disclosure to decide the corrective and preventive action against banks which are undercapitalized or fail to meet the Basel or central bank requirements (Estrella, 2004). As a result, banks try to provide required amount of quantitative information regarding capital adequacy in their annual reports and in Basel disclosures. However, in case of some decline in the capital adequacy, banks provide more qualitative and quantitative information to central banks and other regulators to signal to them of their risk management practices. As a result, there was a negative relationship observed between capital reserves ratio and the scores of risk management disclosures in all regression models except in case of private sector banks. This negative relationship also suggests a positive association in the risk profile of banks and their risk management disclosure practices.

Another variable that appears to be significantly associated with the risk management disclosure score is the deposits to total liabilities ratio. As discussed above, the ratio is an indicator of financing risk of the firm as well as the confidence of investors in the bank. The ratio has shown a positive relationship with the risk management disclosure score in case of public sector and foreign banks, but a negative relationship with the score in case

of private sector banks and all sample banks. Although all the relationships are significant to the model, the direction of this relationship keeps on changing. Decline in deposits to total liabilities indicate a need for external financing and the lack of public confidence in the system, which leads to increase in the risk profile of the bank. Therefore, negative relationship indicates that increase in financing risk of the banks prompts them to disclose more to the stakeholders. On the other hand, positive association indicates that decline in this risk leads to more disclosure by the banks. The main reason for the same can be that while the Basel disclosure do not have the details of the deposits of the bank, but it requires them to give details of other debt and financing instruments in detail. In case these instruments are independent of decline in deposits of the banks in question, negative relationship does not hold true.

Framework for risk management and disclosure practices

In order to guide investors and regulators, a framework was developed establishing relationship between risk management and disclosure score and risk profiling variables. The framework divides the variables into seven different categories. Six categories are the classification of risk as per Basel accord and the seventh category is that of profitability. The theoretical foundation of this framework lies in signaling theory. The theory states that banks performing well use voluntary disclosures as signals to distinguish them from other players (Daniel, et al., 2022). Also, bank disclosures are a signal of prudence by the banks (Hossain, 2008). They can also be used to attract more deposits (Grassa, 2018).

The credit risk variables, namely NPA and LHTA are positively related to risk disclosures along with net profit margin. With increase in profit, banks signal their stakeholders that they are not following any risky line of action (Carlos Corona & Zhang, 2015) and all their risk management activities are in place, which leads to increase in disclosure. The model establishes four variables to be negatively related to risk management disclosure scores. These include ROE, CRTA, DEPTL and LTDR. Decline

in DEPTL and LTDR indicates decline in investor confidence which leads to increase in banks' disclosure. The existing research on ROE and risk disclosure by (Khanifah, et al., 2020), (Aebi, et al., 2012) etc. has considered ROE as a dependent variable and has generated no or positive relationship between ROE and bank disclosure. However, increase in risk profile leads to decline in ROE (Al-Homaidi, et al., 2020), which propels banks to disclose more to signal investors. These findings are consistent with our regression results, which indicate a similar nature of relationship with the risk management disclosures.

The remaining three variables, namely NII, OETA and CHTA deal with liquidity risk, operating risk and market risk need to be looked at in detail by bankers since they are an important part of risk profile of bank and should be reflected in the bank disclosures in detail. The current study identifies the gaps in these disclosures, and hence the framework should be used by banks to not only monitor these indicators closely, but also give more disclosures to stakeholders in case of any shift in them.

This framework will provide a framework to investors to access the financial health and risk profile of the banks and establish a relationship between their risk profile and pillar 3 disclosures, which will in turn strengthen the market discipline.

The key findings related to this objective are as follows:

- There is a statistically significant relationship between the risk profiling indicators and the risk management disclosure score for all three ownership categories as well as the entire sample of 30 banks. all four regression models are significant and explain around 35-45% of the variation in the disclosure scores.
- In all four regression models, seven out of 10 variables were significantly associated with the disclosure scores, three variables, namely non-interest income to interest income, cash holding to total assets and operating expenses to total assets ratio. The main reasons for these variables being insignificant might be the

fact that these disclosures are mostly shown in annual reports and not Basel disclosures.

- Apart from Deposits to total liabilities ratio and LTDR, other variables indicate a clear pattern of positive association between increase in risk profile and the disclosure scores of the banks. However, these two variables indicate a mixed trend in their relationship with the risk management disclosure scores and there is a need to perform more detailed research on their respective relationship with the bank disclosures.

7.3 Theoretical and Managerial implications

The present section of the chapter deals with the key theoretical and managerial implications of the study.

7.3.1 Theoretical contribution

The study contributes to the existing literature on banking risk management in a number of ways. The first contribution is the development of model disclosure scale which is based on Basel 3 disclosures and can be used by investors and regulators to check the quality and quantity of disclosure. The model is developed into different categories of risks as per Basel framework and includes both qualitative and quantitative aspects of risk management disclosure for banks. The second contribution is in terms of research methodology, where we suggest using a clustering mechanism to measure a group of banks' risk profiles over time. The research also suggests a number of variables that are crucial for risk management for each ownership category of Indian banks. These variables can be used by researchers and investors to understand the risk profile of the banks.

The third major theoretical contribution of the study is development of framework establishing the relationship between risk management disclosure and risk profiling variables. The framework divides the risk profiling variables into seven categories of risk profile in alignment with Basel framework. This framework is useful for both investors and bankers. If the investors find any change in these variables, they should look into

relevant disclosure for their explanation. Also, if the bankers see any change in these variables over a quarter, they can adjust their risk management disclosures to give timely information to their stakeholders.

7.3.2 Managerial implications

Along with the above-mentioned theoretical implications, the study has a lot of implications for practitioners and regulators, which are discussed below.

The first implication is for regulators. Since the study highlights the state of disclosure for various ownership categories of banks, the regulators will find out the areas which needs improvement on the part of banks in their quarterly disclosures. For example, the results highlight the need for qualitative information, which can be stressed upon by the banking regulators. They can also use the scale to find out the banks which need improvement and the areas where they need to disclose more in each quarter.

The second implication for the regulators is the identification of important risk management variables and their behavior in different ownership categories. Regulators can not only use these key variables to understand the relative standing of the risk profile of different banks, but they can also take corrective action in time in case these variables reach beyond expected limit. Such exercise can be extremely helpful in the time of economic crises like pandemic or during the time of bank mergers etc. since it will give an idea of the risk profile of the new banking entity which will be formed after the merger. Similarly, stakeholders and regulators can look at the risk profile variables and keep a check on corresponding disclosures. In case they find that the banks are not giving sufficient information about the unfavorable change in risk profiling variables, banks can be asked for clarification by regulators or by stakeholders in Annual General Meetings.

The second category of implications is for banks themselves. The model disclosure scale will help them in improving their quality of disclosures. As of now, banks do not change much in terms of qualitative information. However, the statements in this disclosure scale will help them in improving their disclosure scores. Also, the study will help the banks

understand how their risk management disclosure should be changed in case their risk profile is shifting. The risk profiling variables will also help them in identifying their place in terms of risk in their respective ownership category, but also track their progress over a period of time and take necessary steps to improve their risk profile.

These necessary steps by regulators, investors and bankers can help in the prevention of a future economic crisis.

7.4 Research limitations

The current study suffers from some limitations which are being discussed in the current section. These limitations are as follows:

- The study is performed on a limited sample of 30 banks operating in India. Although the sampling criteria has been chosen carefully, without letting the quality of research to be impacted, yet the results might be affected due to the limitations of the sampling process and the sample itself. The results might have been different had all the banks operating in Indi might have been considered.
- The study covers a period of 2008-2020 only. As a result, the impact of a major global event like pandemic has not been captured in the data collected. COVID-19 might have brought a major shift in the risk profile of the sample banks and as such, needs to be studied in future research. Also, the events happening before the financial crisis of 2008-09 are not reflected in the results of the current study.
- As the study deals with the shift in risk profiles of public sector banks that merged with other banks during the study period, this might have brought a change in the risk profile of public sector banks. This limitation has been overcome to a certain extent by comparing the risk profiles of banks pre- and post-merger. Also, some of the sample banks have been merged into other banks as of now. However, these mergers happened after the study period. Similarly, IDBI's ownership category changed during study period, which was reflected in private sector category's performance.

- Another major limitation is that Basel 3 norms were introduced in 2013-14 in India and some of the banks are still struggling to comply with the set targets by the Basel Committee and the central bank. Due to the introduction of these norms in 2014, the data for 2008-13 could not be used to associate the relationship between the risk profiling variables and the risk management disclosure scores.

7.4.1 Directions for future research

The present study aims to understand the risk management and disclosure practices of Indian banks and track their progress since global financial crisis using the clustering approach of data mining. The future research can be conducted using the same methodology checking the impact of COVID-19 on Indian banks. Not only that, but the methodology can also be tested on the banking system of developed economies like the USA or European economies to find out how they stand in comparison to Indian banking system. Indian banks are unique in many ways- being conservative in regulations, lack of adequacy for Basel 3 norms and other political and economic differences. The studies in different banking landscape will help in proving the robustness of the methodology.

The study also proposes a framework which depicts the relationship between risk management and disclosure scores and risk profiling indicators. The future research can focus on indicators which are less represented in disclosures like operating and liquidity risk and analyze their impact on the performance of banks. These studies will motivate the regulators to lay more focus on risk other than credit risk.

7.5 Recommendations

From the above study, following recommendations can be made to the bankers and regulators:

- Public sector banks need to work on their risk management and disclosure practices as their performance in all the categories is worse than all the other ownership categories of the banks. Since profitability variables emerged as important risk profiling variables in case of public sector banks, they should work

on improving their profit and return on equity. One of the ways in which their earnings can be improved is by increasing their loan portfolio. Public sector banks have lesser loans to deposit ratio, which indicates a possibility to lend more. However, while doing so, the focus should be on the asset quality so as to reduce the level of non-performing assets in their books.

- The current study developed a model scale for measuring disclosure scores which will help the quality of disclosures for Indian commercial banks. All the banks need to improve their disclosure in the quarters ending June and December. As of now, the banks have been proving only the bare minimum required disclosures which is following the same pattern over the years. Banks should try to give as much qualitative information as possible during all four quarters. This will improve their scores in the category and will also increase overall market discipline.
- There is a need to improve the qualitative disclosures regarding operational, liquidity and market risk and not just credit risk. Banks can take the help of a model disclosure scale which will help them identify the areas where their disclosures are lacking. At present, the requirements of qualitative disclosures are pretty general which allows banks to disclose same information over a period of years. Banks should give real time details of their risk management mechanisms and internal control and the legal risks on their balance sheet. Since most banks only disclose mandatory requirements as per RBI requirements, RBI should introduce some concrete elements relating to liquidity and operational risk, which can provide more insights into the risk management of these risks in Indian banks. Also, parameters of qualitative information on risk management should be standardized so that investors get more meaningful insights into the risk profile of banks.
- Credit risk is the most prominent risk faced by Indian banks and banks should work on the variables of credit risk profile. The importance of these variables is relatively different for different ownership categories like NPAs are more crucial

for public sector banks than foreign banks. However, LTDR emerged as an important variable in all three ownership categories. Banks should focus on improving their lending policy in case this ratio is very high or low while working on improving the quality of assets as well. While deposit mobilization of public sector banks is generally better (Patra & Sahoo, 2021), which leads to low LTDR, foreign banks need to work on improving their depositor as well as asset base so as to improve their LTDR. Working on the deposit base will also help in improving another important variable, i.e., DEPTL.

- The banks should use improve their risk management disclosures if they see any change in their risk profiling variables. The model framework designed in the study can be used as a guide to understand the relationship better. For example, in case a bank sees increase in nonperforming assets, they should increase the disclosure so as to assure the shareholders that adequate measures are being taken to control the credit risk.
- Regulators should consider the risk profile of banks before merging them with other banks. In case a bank is not profitable or sound enough to absorb other weak banks, both banks should be given sufficient time to improve their risk profile using the risk management variables identified in the study so that the overall risk profile of the merged entity does not suffer.
- During the times of economic or social crises, banks should improve their risk management activities and give their details in quarterly disclosure to the investors. This will prevent them from facing a decline in depositor confidence. Also, if they feel disciplined to disclose more, it will also help them in regularly monitoring their risk management practices, which will, in turn, improve their asset quality and non-performing assets, which often take a backseat during such crises.

7.6 Conclusion

Banking risk is an important concern for regulators and investors alike. After the financial crisis of 2008-09, this concern has increased even more. The present study deals with the analysis of the risk management and disclosure practices of selected Indian commercial banks. It is important to analyze the risk management disclosures of Indian banks to understand the extent of market discipline exhibited by them. For the purpose of this analysis, a sample of 30 banks was selected from all three ownership categories of banks, namely public sector, private sector and foreign banks. These banks were studied for a period of 13 years from 2008 to 2020 to understand their risk profile and cluster them into high, medium and low risk clusters. A total of 11 financial variables were selected to measure various types of banking risks. However, in order to overcome the limitation of multi-collinearity, one variable, namely ROA was dropped since its VIF was higher than the acceptable limits.

In order to analyze the risk management disclosure practices of the selected banks, a binary scale of 40 items was developed, which covered various quantitative and qualitative aspects of 6 major areas of banking risk as specified by Basel 3 norms. A score of 0 and 1 was awarded on the basis of the presence or absence of each of the component of the scale for each quarter for each bank. Quarterly disclosures by sample banks were analyzed for the period of 2014-2020, in other words, since the introduction of Basel 3 norms in India.

The second objective of the study was to classify the sample banks on the basis of their risk profile into three different risk clusters. In order to do the same, two types of clustering mechanisms were used, namely, hierarchical and k-means clustering. On the basis of values of clustering results, banks were placed into high, medium and low risk clusters. Along with that one-way ANOVA was performed on these clusters to identify variables that were significantly different across the clusters. These variables were the ones primarily responsible for determining the risk profile of sample banks. A

comparative analysis was performed on the clusters of each ownership category to find out their performance since the beginning of the study period.

Results from both these objectives served as the inputs for the third objective of the study, which involved establishing the relationship and association between the risk management disclosure and the risk profile of the sample banks. In order to establish the same, a fixed effect multiple regression model was prepared and tested on entire sample banks as well as the three subgroups of banks. The disclosure score acted as the dependent variable and all 10 risk profiling variables used in second objective were used as predictor or independent variables.

The findings of the study indicate that public sector banks have been performing worse of all the sample banks when it comes to risk management disclosures. Most of the public sector banks disclose only minimum information in the quarters ending June and September as against the private sector and foreign banks. This also reduces their average disclosure scores as compared to other ownership categories. On the other hand, foreign banks performed better than other two categories and majority of them scored above 25 out of 40 on average, while in case of public sector banks, majority of the banks scored between 20 and 24 out of 40. The results also found a significant difference between the disclosure scores of public sector banks with those of foreign banks and private sector banks, but there was no significant difference between the scores of foreign banks and private sector banks. This suggests that public sector banks need to work on their disclosure practices, especially during the quarters ending June and December. In terms of risk types, disclosures were heavily tilted towards credit risk and other areas like liquidity risk, and operating risk etc. were barely covered in the disclosures by the banks.

The findings of risk profiling of banks indicated that more public sector banks got placed in high-risk clusters than private sector or foreign banks. However, the number of banks in high-risk clusters is coming down in case of all three categories over the period. Across the categories, there were few banks that were consistently performing worse than

their peers. These banks included UCO Bank and Indian Overseas Bank in case of public sector banks, IDBI in case of private sector banks and Barclays and DBS bank in case of foreign banks. RBI needs to look into these banks more closely and take the necessary steps to improve their performance. It was also observed that bank-specific factors like scams and internal management issues had a direct impact on their risk profile and put them into high-risk clusters. While comparing the results of banks that underwent merger during the study period, it was observed that mergers did impact their risk profile. However, their performance after merger depended on the financial position of the banks they merged with.

The results of ANOVA showed that few variables proved more significant for specific categories, but there were some variables that were significant for all the ownership categories. Profitability indicators were more significant for public sector banks and NPAs were not much significant for risk profile of foreign banks. Even for public and private sector banks, NPAs became significant for risk profiling only during later years of the study. The most significant variable which was common across all three ownership categories was LTDR. The range of this ratio was also very wide from being very low in case of public sector banks to very high in case of few foreign banks. another variable which was very significant for public and private sector banks was Deposits to Total Assets Ratio. However, in case of foreign banks, only 1 variable was consistent over the study period.

The study also found that there is a positive and significant association with the risk profile of the banks their risk management disclosure scores. All three models were statistically significant and found that seven out of 10 variables were significantly associated with the risk management disclosure scores. Lack of capital adequacy and decline in deposits to total liabilities led to more disclosure and so did the increase in non-performing assets or decline in net profit. However, the behavior of LTDR and DEPTL was inconsistent throughout different regression models. As a result, there is a need to study the association of these variables with the risk management disclosures in

case of commercial banks, especially because these variables were significant in risk profiling of banks. The findings of this chapter were used to develop a model framework for banks to establish a relationship between their risk profile and risk management disclosures.

The study is very useful for investors and policymakers alike. While it will help the investors in understanding the extent of market discipline and risk profile of the banks, it will also help the central banks and regulators to keep a check on the risk profile of commercial banks. Since RBI is concerned about the adoption of international standards in terms of risk management, the scale developed for this study will help in evaluating the areas where less disclosure is provided by banks and taking up steps to improve the same. The study also contributed by providing a new methodology based on data mining in the form of clustering analysis which will help the future researchers in analyzing the risk profile of a group of banks and perform a detailed and comparative analysis. Such analysis is even more important in the current scenario since the world is witnessing a global pandemic and the resulting systemic risk for banks across the globe. Findings from this study can help the banks to improve their risk profile and perform better in time of crisis.

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ANNEXURE

Risk Management disclosure scale

Sr. No.	Item
Capital Structure	
Qualitative	
S01	Disclosed key events which are trigger for risks of banks
S02	Disclosed the details of shareholders' equity
S03	Disclosed the total capital base
S04	Details and amount of Tier -1 capital
S05	Amount of perpetual non-cumulative preference shares
S06	Disclosed the amount of minority interests in the shareholding equity of the subsidiary banking firms
S07	Amount of innovative or complex financial instruments, with the amount and % of total Tier-one capital
S08	Disclosed deductions from Tier-one and Tier-two capital
S09	Disclosed the amount of material deductions from Tier – 2 capital
Both	
S10	Disclosed the details of maturity and call features of complex instruments
S11	Disclosed provisions of capital instruments permitting interest of dividend-deferrals or any other cumulative characteristics, where applicable
S12	Disclosed step-up provisions for capital instruments if they apply
Capital Adequacy	

Qualitative	
S13	Details of internal process for assessing capital adequacy and for setting appropriate levels of capital
Quantitative	
S14	Disclosed the risk-based capital ratio calculated in accordance with the methodology prescribed in the Basel Capital Accord
S15	Disclosed the risk exposure of each off-balance sheet instruments
S16	Disclosed the risk exposure of balance sheet assets (book-value and risk-weighted amount for each bucket)
Both	
S17	Provided analysis of changes in the bank's capital structure and the impact on key ratios and overall capital position
S18	Provided all information relevant to understanding how Basel Capital Accord requirements for market risk under the internal model's approach have been calculated.
S19	Disclosed all information relevant to understanding how Basel Capital Accord requirements for market risk under the standardized approach have been calculated, including disclosure of capital charges for component risk elements, as appropriate.
Credit Risk	
Qualitative	
S20	discussion of the bank's credit policy
S21	Total exposure to credit risk and average total exposure in the period, segmented by type of credit operation.
S22	Disclosed whether credit-scoring is used when granting credit, and if so, provided descriptive information about the credit scoring model and how it is used

S23	Distribution of exposures by sector or type of counterparty, segmented by type of operation.
Both	
S24	Names of external credit assessment institutions and credit rating agencies credit assessments used, in addition to the reasons for any changes
S25	Portfolios subject to standardized or standardized methodology simplified should be highlighted individually.
S26	description of the methods followed for specific provisions and general and statistical methods
S27	Policies and processes for on-balance and off-balance sheet compensation.
S28	Bank objectives in relation to securitization activity, including the extent to which these activities transfer credit risk from exposures securitized by the bank to other entities.
Operational Risk	
Qualitative	
S29	Disclosed the approach (es) for operational risk capital assessment for which the bank qualifies.
S30	Disclosed information about the main types of operational risk and identified and discussed specific capital requirement for the same
S31	Structure and organization of the operational risk management function
S32	Scope and nature of the operational risk reporting system
S33	Operational risk transfer/mitigation/hedging techniques
S34	Internal audit function/internal control system
	Market Risk Internal Modelling
Qualitative	

S35	The general qualitative disclosure requirement for market risk including the portfolios covered by the standardised approach.
Quantitative	
S36	The capital requirements for: • interest rate risk; • equity position risk; and • foreign exchange risk;
Other Risks	
Qualitative	
S37	Provided qualitative disclosures of interest-rate risk in the banking book
Quantitative	
S38	Disclosed legal contingencies (including pending legal actions) and discussed possible liabilities Both
S39	Provided quantitative disclosures of interest-rate risk in the banking book
S40	Disclosed quantitative and qualitative information and strategies for managing liquidity risk

Source - (BSBC, 2003), (Naz & Ayub, 2017)