THE IMPACT OF NON-PERFORMING ASSETS ON COMMERCIAL BANK HOLDINGS OF LOANS AND SLR INVESTMENTS IN INDIA,

2001-02 TO 2014-15

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CERTIFICATE

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CHAPTER I

INTRODUCTION

One of the major problems currently ailing the banking sector in India is the mounting amount of Non-Performing Assets (henceforth, NPAs) in the books of scheduled commercial banks. According to the recent Financial Stability Report (RBI, 2016) of the Reserve Bank of India (henceforth, RBI), NPAs accounted for around 7.6 percent of total advances in March 2016 which, according to the report, is likely to increase to a level of 9.3 percent by March 2017 if the macroeconomic scenario deteriorates further. According to the RBI's Annual Report 2014-15 (RBI, 2015)**,** such a high level of NPAs has resulted in the recent slowdown of bank credit in India and if not controlled immediately, might pose a serious threat to the functioning of the banking sector, thereby affecting the financial stability of the economy.

For a bank-based economy, like India, sound financial health of the banking sector is a crucial pillar of its overall financial stability and economic development. This is because, in such economies, a well-developed financial system can act as an efficient financial intermediary enabling efficient allocation of resources. Besides, as the banking sector accounts for the major portion of financial intermediation in India, it is the main channel of monetary policy transmission, and credit delivery and the central pillar of the payments system. Hence, stable and sound financial health of the banking system is the key pre-requisite for economic development and financial stability.

There are a lot of parameters which can be used to assess the financial health of a banking institution. Among these, asset quality is considered to be one of the most significant determinants of the financial soundness of the banking system. Non-Performing Assets are an important prudential indicator to assess the asset quality of a bank's asset portfolio. Higher the ratio of NPAs to total assets, worse is the asset quality of the banking system, and higher the threat of financial instability in the economy. NPAs, because they affect the asset quality of the banking system, also

hinder efficient credit risk management and resource allocation in the economy and hence, end up impacting its overall development. Thus, amongst the various desirable characteristics of a well-functioning financial system, the maintenance of a low level of NPAs is an important one.

1.1. NON-PERFORMING ASSETS : AN OVERVIEW

1.1.1. Definition of NPAs

There is no global standard for defining NPAs at the practical level as a lot of variations exist in terms of the classification system of bank assets, and the scope and contents of NPAs across different countries (Hou and Dickinson, 2007). In general, an asset is said to be non-performing when it ceases to generate income for those who own it. Similarly, in the context of the banking sector, NPAs are taken to be those assets or advances (as advances constitute the major portion of bank assets in economies like India) for which either interest or instalments of the principle or both remain unpaid for a certain period beyond the due date of payment.

In India, the definition of NPAs has been changed over time in accordance with the severity of its impact on banking sector operations. The issue of NPAs was brought to the fore when the Narasimham Committee I (set up at the advent of liberalisation in the 1990s) in its report (Narasimham, 1991), highlighted the impact of NPAs on the health of the banking sector. It was under the recommendations of this committee that for the first time in April 1992 a proper definition of NPAs was adopted and prudential norms related to Income Recognition, Asset Classification and Loan Loss Provisioning for advances were introduced by the RBI (2001). RBI issued certain guidelines for treating a credit facility as NPA, which were implemented from the financial year 1992-93. These guidelines were in line with the international practices. According to these guidelines NPA was defined as ‘a credit facility in respect of which the interest and/ or instalment of principal has remained ‘past due[1]’

[1]“An amount due under any credit facility is treated as "past due" when it has not been paid within 30 days from the due date”. (RBI, *Master Circular*, dated 1st July, 2015)

for a specified period of time' (RBI, 2015a). [2]This specified period was then reduced in a phased manner. As on 31st March 1993, the specified period was of four quarters, which was reduced to three quarters from 31st March 1994 and finally to two quarters from 31st March 1995.These guidelines and norms, though highly appreciated at the time, subsequently proved inadequate for controlling rising NPAs. On hindsight, this failure was ascribed to the relative laxity of the prudential norms which were adopted on the recommendations of Narasimham Committee I.

Such weakness of the Financial sector reforms (initiated on the recommendations of Narasimham Committee I (1991) report) resulted in the setting up of a new Committee, again under the Chairmanship of M. Narasimham. The Committee submitted its report in 1998 and is popularly known as the Narasimham Committee II report (chairman: M. Narasimham, 1998). The major purpose of the second committee was to review the progress of the Financial Sector Reforms and to recommend further improvements accordingly.

The recommendations of Narasimham Committee II resulted in a second set of reforms known as the Banking Sector Reforms (1998). Under Banking Sector Reforms (1998) stricter prudential norms regarding Income Recognition, Asset Classification and Loan Loss Provisioning for advances were adopted so as to bring in greater consistency and transparency in the published accounts.

A system for classifying assets on the basis of quality had already existed since 1985-86 in the form of the Health Code System[3]. Narasimham Committee I, however, felt that classification of assets under the Health Code System was not in line with international standards and was not adequately fulfilling its purpose. The Committee was of the view that the assets of the banks should be classified on the basis of objective criteria which could ensure a uniform and consistent application of the norms. Thus, in accordance with the recommendation of the Committee, RBI introduced a refined set of norms for classification of assets by compressing the 8

[2]RBI, *Master Circular-Prudential Norms on Income recognition, Asset Classification and Provisioning pertaining to the Advances*, 1st July, 2015

[3]The Health Code System was introduced by RBI in 1985-86. Under this system banks used to get updated with the information regarding the health of the individual advances, extent of the advances causing concern in relation to the total advances and the quality of the credit portfolio.

subcategories of assets, followed under the Health Code System, into the following four broad categories[4]:

1. Standard Assets
2. Substandard Assets
3. Doubtful Assets
4. Loss Assets

Likewise, the committee also believed that the income recognition norm should be objective and based on the record of recovery rather on subjective considerations. Moreover, the Committee suggested that the provisioning norm should be made on the basis of the classification of assets, which should further be based on the period for which the asset has remained non-performing, and the availability of security and its realizable value.

Since the introduction of these norms in 1992-93, the basic objective of these norms has remained fixed with slight variations from time to time in the regulatory requirements, which are notified by RBI through its various circulars.

As per the current definition [5]given by the RBI, NPAs are defined as follows

'1. An asset, including a leased asset, becomes non- performing when it ceases to generate income for the bank.

2. A non performing asset (NPA) is a loan or an advance where;

i. Interest and/ or instalment of principal remain overdue[6] for a period of more than 90 days in respect of a term loan,

ii. The account remains 'out of order'[7], in respect of an Overdraft/Cash Credit (OD/CC),

[4]Out of these four categories the last three categories are explained in the later part of this subsection.

[5]Current definition taken from- RBI, *Master Circular- Prudential Norms on Income recognition, Asset Classification and Provisioning pertaining to the Advances Portfolio,* dated 1st July 2015.

[6]Overdue-'Any amount due to the bank under any credit facility is 'overdue' if it is not paid on the due date fixed by the bank'. (RBI, *Master Circular*, dated 1st July, 2015)

iii. The bill remains overdue for a period of more than 90 days in the case of bills purchased and discounted,

iv. The instalment of principal or interest thereon remains overdue for two crop seasons for short duration crops,

v. The instalment of principal or interest thereon remains overdue for one crop season for long duration crops,

vi. The amount of liquidity facility remains outstanding for more than 90 days, in respect of a securitisation transaction undertaken in terms of guidelines on securitisation dated February 1, 2006.

vii. In respect of derivative transactions, the overdue receivables representing positive mark-to-market value of a derivative contract, if these remain unpaid for a period of 90 days from the specified due date for payment.'

Based on the period for which the asset has remained non-performing and the realisability of the dues, NPAs have to be further classified into the following categories by the banks.-

- Substandard Assets
- Doubtful Assets
- Loss Assets

1. Substandard Assets

With effect from 31 March, 2005 an asset is considered as substandard asset if it has remained a NPA for a period of less than or equal to 12 months. Such an asset is assumed to have a well-defined credit weakness that can jeopardise the liquidation of the debt and is characterised by the distinct possibility that the banks will sustain some loss, if deficiencies are not removed.

[7]Out of order status-'An account should be treated as **'out of order'** if the outstanding balance remains continuously in excess of the sanctioned limit/drawing power. In cases where the outstanding balance in the principal operating account is less than the sanctioned limit/drawing power, but there are no credits continuously for 90 days as on the date of Balance Sheet or credits are not enough to cover the interest debited during the same period, these accounts should be treated as **'out of order'**.' (RBI, *Master Circular*, dated 1st July, 2015)

2. Doubtful Assets

If an asset has remained in substandard category for a period of 12 months, then that asset is to be considered a doubtful asset. This definition came into effect from March 31, 2005. Besides all the weaknesses inherent in a substandard asset, a doubtful asset is assumed to have some added weaknesses which make its collection and liquidation in full the basis of currently known facts, conditions and values) highly questionable and doubtful.

3. Loss Assets.

A loss asset is one where loss has been identified by the bank or internal or external auditors or on RBI inspection but the amount is not completely written off from the banks official accounts. In other words, such an asset is considered non-realisable and of such little value that its consideration as a bankable asset is not justifiable although there may be some salvage or recovery value.

1.1.2. NPAs in India: Causes and Recent Trends

Various reform measures[8]taken by both the RBI and the Central Government, as per the recommendations of the committees for banking sector reforms, helped to a large extent to restore the Indian banking sector to a resilient position in terms of its asset quality especially in the mid-2000 (Lokare, 2014). The prudential norms recommended under both committee reports led to a decrease in bank NPA levels thereby helping the banking sector to regain its operational efficiency. These regulations can, to some extent, be considered as one of the major reasons why Indian banks could survive the recent global financial crisis relatively unscathed, when at the same time major advanced and emerging economies had to deal with bank failures due to impaired asset quality. However, in recent years, particularly since the

[8]Apart from introducing prudential norms on asset classification, income recognition and loan loss provisioning, RBI along with Central Government's support undertook certain institutional measures (as recommended by Narasamhim Committee I and II) in order to recover the past dues to banks and other financial institutions and to reduce NPAs which had accumulated since the mid-1990s. These measures included setting up of Debt Recovery Tribunals (DRTs), Lok Adalats, and Asset Reconstruction Companies (ARCs), and introduction of Corporate Debt Restructuring (CDR) mechanism. The Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act was introduced in 2002 under which banks were given allowance to issue notices regarding enforcement of security interest without court's intervention.

financial year 2011-12, concerns regarding deterioration in bank asset quality due to rising NPAs have come to the fore. Lokare (2014) pointed out that rate of growth of NPAs increased from around 15 percent in 2010-11 to around 46 percent in 2011-12. Due to such an alarming rate of growth and its implied consequences, NPAs have grabbed attention of both policy makers and academicians alike. This has, therefore, resulted in a lot of empirical studies concerning NPAs.

Many empirical studies on NPAs in India have looked into the causes of NPAs (Rajan and Dhal, 2003; Rajaram and Vaisishtha 2002; Gopalakrishnan, 2005; Siraj, 2014; Agarwal and Mittal, 2012; Vallabh et al., 2007; Chaudhari and Sensarma, 2008). According to most of these studies, there are two broad set of factors which determine the level of NPAs. The first set of factors includes macroeconomic variables like GDP, inflation rate, unemployment rate, asset prices and interest rates. The second set of factors includes bank specific determinants like size, capitalization, region of operation, ownership, profitability and efficiency.

However, some recent studies like those by Samantaraya (2016), Lokare (2014) and Ramanadh and Rajesham (2013), apart from looking into the impact of some of the above mentioned factors, have also tried to look into the impact of pro-cyclical lending behaviour of banks on NPAs. These have attributed the recent rise in NPAs to the excess lending of Indian banks in the period before the recent Global crisis of 2007. According to these studies, due to the pro-cyclical lending behaviour of banks, asset quality gets compromised during a period of high credit growth as banks have a tendency to lend excessively in a boom period without making a proper credit appraisal. Such uninformed decisions of the banks in the past lead to situations of high NPAs in the present, thereby affecting the overall operational efficiency of the banks in the future.

1.2. IMPACT OF NPAs

1.2.1. Impact of NPAs on the Economy and banking sector

A rising trend in NPAs, as argued in the existing literature, is always a matter of concern for all the stakeholders involved. It not only decreases the profitability of

banks by adversely affecting their operational efficinency but, also affects the overall functioning of the economy by hindering the smooth flow of credit. Existence of NPAs increases the probability of bank failures (Chijoriga, 2000; Dash& Kabra, 2010). This happens because high NPAs by adversely affecting the operational efficiency of banks worsen the profitability and liquidity position of banks, which in turn increases the threat of bank failures (Michael et al., 2006). High levels of NPAs impact the profitability of banks through different channels. First, a rise in NPAs leads to decrease in interest income of the banks as a result of which profits and retained earnings of banks get affected. Secondly, the riskiness entailed by high NPAs compels banks to go for high loan loss provisioning, which banks have to do from their retained earnings (Hou and Dickinson, 2007).This further puts stress on the profitability of banks. Due to low profits and bad asset quality the competitiveness of banks in the financial market decreases and hence it becomes difficult for banks to augment capital resources, as mobilising funds now imply higher costs for banks. With low interest income (under high NPAs) and high cost of mobilising funds, the net interest margin of banks get further squeezed leading to a severe blow to their overall profits. All this, in turn, leads to deterioration of banks' liquidity position and credit rating in the market which in turn affects their lending operations thereby, decreasing the overall loan supply in the economy. Therefore, we can say that high NPAs in a way creates a vicious cycle of effects which impacts the financial stability of banks and thus increases the threat of failures.

1.2.2. Impact of NPAs on Credit Growth

The impact of NPAs on credit growth can be conceived as occurring through the following two channels. First, high levels of NPAs affect the willingness of the banks to extend credit in a particular sector where NPAs are very high. Moreover, under high NPAs, the willingness of banks to extend credit decreases in general, mainly on account of the high overall risk posed by high NPAs to the banking business. NPAs by increasing the overall risk in bank asset portfolios, decreases the risk appetite of the banks and, as a result, banks prefer to hold less risky and more liquid assets in their portfolio. This can be referred to as the *asset substitution effect* of NPAs. This shift in asset preferences of the banks due to high NPAs decreases the

overall loan holdings of the banks thereby decreasing the overall loan supply in the economy. The willingness of banks to lend gets further affected in the presence of capital adequacy norms given by the Basel accords (Hou and Dickinson, 2007). This happens because, in the presence of capital adequacy norms, banks become more risk averse. Faced with increased riskiness under high NPAs, in turn makes them even less willing to hold risky assets.

According to the literature, the second channel through which NPAs affect the credit supply in the economy is by affecting the lending capacity of the banks. Banks extend new loans not just on the basis of the resources raised through fresh deposits, but also by recycling the funds paid back by existing borrowers. High NPAs lock these funds in unproductive and unprofitable sectors and thus affect the recycling of credit, in effect hindering the entire credit creation process by the banks. This could lead to a situation of economic stagnation if NPAs keep rising and getting rolled over because it will hinder both, the economy's efficiency in resource allocation as well as its prospects for growth.

There are many empirical studies which have directly looked into the impact of growing NPAs on overall credit growth of the economy (Agung et al., 2001; Hou and Dickinson, 2007; Tracey, 2011; Krueger and Tornell, 1999; Cucinelli, 2015; Tomak, 2013; Lu et al., 2005; Alhassan et al., 2013). Most of these studies were conducted in the context of different financial crises as it is usually in the aftermath of such crises that commercial banks, in the affected regions, start facing a situation of rising NPAs and their economy starts witnessing a slowdown in credit growth due to a reversal in bank lending behaviour. According to these studies, the major reason for decline in credit growth in the post-crisis period was the existence of a 'credit crunch'[9] induced by high bank NPAs in the post-crisis period. In the Indian context, there are a few studies which have looked, into the impact of NPAs on credit growth. Most of the literature on bank NPAs in India, even contributions which have looked into the effects of NPAs, have considered the impact on bank efficiency and profitability rather than on overall loan supply. Although evidence of NPAs having negative impact on credit growth in India can be found in statements of RBI in their

[9] Credit crunch is a situation which arises when banks due to their reluctance to take new risks curtail their lending operations which, in turn, reduces the overall loan supply in the economy (Agung et al. 2001).

various reports (RBI, 2015a; RBI, 2008), Swamy and Sreejesh (2012) and Samataraya (2015) are among the few alternative sources which provide some empirical evidence about the impact of NPAs on lending or portfolio behaviour of Indian commercial banks.

Swamy and Sreejesh while analysing the response of Indian commercial banks to the recent financial crisis inferred a significant negative relation between investment and lending activities. According to them such a negative relation was found because Indian banks, in order to reduce their risk in times of financial instability, tightened their lending activities and shifted to safer investments. Similarly, Samantaraya (2015) while empirically analysing different determining factors of credit supply, used ratio of gross NPA to total assets as one of the control variables. However, his results did not suggest any statistically significant impact of the gross NPA to assets ratio on bank loan supply.

1.3. OBJECTIVE OF THE STUDY

It can be noted from the discussion in the previous section that high NPAs generally lead to a slowdown of credit growth in the economy. While, according to the existing literature, this mainly results from the asset substitution effects of high NPAs on bank asset portfolios which involve substitution of less risky for more risky assets, there has been no direct test of this hypothesis. In the Indian context, Swamy and Sreejesh (2012) have specifically noted the existence of a negative relation between bank lending and investments, the two major categories of income-earning assets, during a period of rising NPAs. With this backdrop, the primary objective of this study is to specifically investigate, in the case of Indian banks, the existence and strength of the asset substitution effect of NPAs on bank asset portfolios, which induces banks to substitute less risky categories of assets like investments in SLR securities[10] for more risky categories like loans.

The existence and strength of the asset substitution effect of NPAs on bank portfolios in the case of Indian banks may, however, depend on the nature of

[10]SLR securities include government securities and other approved securities. Investments in these securities are considered to be most riskless form of asset and are included for calculation of statutory liquidity ratio (SLR) of banks.

ownership of banks. The Indian banking sector includes public sector banks as well as private sector banks. Private sector banks, being more driven by commercial motives and having less probability of getting a government bailout in a situation of insolvency, might be expected to respond with greater alacrity to the increased risks posed by higher NPAs and have greater freedom to adjust their asset portfolios. On the other hand, public sector banks may be more conscious of the social costs of financial instability and, being more socially responsible, treat the threat posed by rising NPAs with greater seriousness. A secondary objective of this study is therefore to examine whether public or private ownership of banks matters in determining the strength of the asset substitution effect of NPAs.

1.4. RESEARCH HYPOTHESES

The two most important categories of income-earning assets in the asset portfolios of Indian commercial banks are Loans (and Advances) and Investments in SLR securities (in brief, SLR investments). The former category of assets can, in general, be considered to carry much greater risk compared to the latter category. Based on the above objectives, therefore, the two hypotheses of the present study are:

Hypothesis 1: An increase in the solvency risks posed by NPAs leads banks to increase the share of SLR investments and reduce the share of loans in their asset portfolios

Hypothesis 2: There is a difference between public and private sector banks in terms of the existence and strength of the asset substitution effect of NPAs referred to in Hypothesis 1.

To test these hypotheses two dynamic panel models have been used, one for each of the two above mentioned asset categories. In the first model the dependent variable, the share of non-priority loans in total assets, has been regressed on the ratio of NPAs to total capital of the banks and some important macroeconomic and bank level variables which can be expected to impact banks' asset. Through the first

dynamic panel model the impact of NPAs on bank loan holdings has been analysed while controlling for other determining factors of banks' asset composition. In the second dynamic panel model the share of SLR investments in total assets of banks, the dependent variable, has been regressed on the ratio of NPA to total capital and a set of macroeconomic and bank level factors similar to that in the first model. Impact of NPAs on the share of SLR investments of the banks has been analysed through this second dynamic panel model where the effect of other determining factors of banks' asset composition are controlled for.

The study has been conducted for a time period 2001-02 to 2014-15 on 46 scheduled commercial banks of India where 26 banks constitute the group of public sector banks and remaining 20 banks constitute the group of private sector banks (Refer to Appendix Table 1).

In order to estimate these two models, GMM estimators have been used. The GMM estimation technique is a dynamic panel model estimation technique which, by taking into consideration the Instrumental Variable approach (as proposed by Anderson and Hsiao (1982)), controls for dynamic panel bias and therefore gives unbiased and efficient results. Between the two GMM estimators- Difference GMM and System GMM estimators- Difference GMM estimator has been primarily used to carry out the estimation of the models and results obtained from it have been used to draw the main inferences of our study. The second hypothesis, however, has been tested by applying the System GMM estimator on the two dynamic panel models, including among the regressors a time-invariant public sector dummy variable and an interaction term between this dummy variable and the ratio of bank NPAs to total capital. Inferences regarding the effect of public ownership on the responses of banks to increased NPAs have been drawn from the estimation results obtained by System GMM estimators.

1.5. ORGANISATION OF CHAPTERS

The study carried out in this dissertation is presented in the following four chapters.

Chapter II discusses the theoretical basis of the present study and reviews the

related empirical literature. The chapter has three subsections. In the first subsection we have briefly discussed the different components of the asset portfolio of Indian commercial banks and the risk and return combinations which these components offer. The Second subsection illustrates the different channels through which NPAs might impact the asset composition of banks. Finally, the third subsection gives a detailed review of the literature relevant for our study.

Chapter III extensively discusses the empirical framework of the present study. This chapter is further divided into four subsections.

The first subsection briefly discusses the motives which drive banks' asset portfolio decisions, thereby, suggesting the basis for our empirical models. The second subsection discusses the different factors, other than NPAs, which can impact banks' optimal asset composition. Some important factors are then included in our econometric model in order to control their effect while analysing the impact of NPAs on bank decisions regarding asset composition. The third subsection discusses in detail the specification of the econometric model used for our study and the econometric tools applied to estimate this model. Finally, the fourth subsection discusses the different data used in the empirical analysis and their sources.

Chapter IV reports and analyses the different results obtained from the estimation of the dynamic panel models.

Finally, Chapter V concludes by looking at the major findings of the study and its implications in terms of the further research which needs to be done.

CHAPTER II

THEORETICAL BASE AND REVIEW OF LITERATURE

The economic development of any country rests to a great extent on the sound functioning of its financial institutions. Among these financial institutions, the commercial banking system, owing to its unique function of credit creation, is one of the prime movers in the process of development. The most important function of commercial banks is to intermediate the flow of funds from the surplus units to the deficit units of the economy, primarily through their deposit taking and lending activities. Banks are, in a way, the custodians of the liquid capital of the country, which they channelize to different sectors of the economy for productive purposes. This way, the banking sector supports the execution of the development plans of the Government, thereby accelerating a nation's economic progress. Due to the central role which banks play in the development process, especially in a developing nation like India, any significant instability in their functions as a financial intermediary has the potential to hamper the financial health of the economy, affect development plans, and impede the financial stability of the banking sector is a pre-requisite for the overall development of the economy and its resilience against financial crisis.

The quality of a bank's asset portfolio is taken to be a prudential indicator of its financial health. As assets are the major source of returns for the banking system, their quality determines to a large extent the overall financial position of the banks. The quality of a bank's asset portfolio comes under stress when most of its assets start turning into Non-Performing Assets (henceforth, NPAs), reflecting high exposure of banks to credit risk. The prevalence of NPAs acts as a threat to the banking sector as it not only increases the riskiness of their asset portfolios in terms of increasing losses but, also worsens operational efficiency by affecting the profitability, liquidity and solvency position of banks, making the banking sector much more prone to a financial crisis. Hence, maintaining the asset quality and profitability of banks are crucial aspects for the survival and growth of a banking sector.

In this backdrop, the main objective of the current chapter is to analyse why and how NPAs can possibly impact the composition of bank asset portfolios. Accordingly, the organisation of the present chapter is set out as follows: The First section of this chapter discusses in general the different components of bank balance sheets paying special attention to the different categories of assets and the combination of risk and return that they offer to the banking sector. The second section then analyses the different channels through which NPAs can possibly impact the asset composition of banks. Finally, the existing empirical literature in this regard is reviewed in the third section.

2.1. BANK BALANCE SHEETS AND THE COMPOSITION OF BANK ASSET PORTFOLIOS

Commercial banks perform a wide range of functions which ensure proper circulation of funds within the economic system. Banks mobilize the savings of the units with surplus funds in the form of deposits and, in turn, absorb the depositor's risk by acting as a custodian of their savings. These savings when pooled together in the banking system, acts as a major source of funds, both for working capital and further long-term investment, in various sectors of the economy. Banks act as an important source of external finance, especially for those who have limited access to other sources. Hence, by bridging the gap between savers and investors, banks not only maintain an adequate flow of finance required for the uninterrupted and stable functioning of the economy but, also improve the efficiency of resource allocation within an economy. Besides, the banking system provides for the smooth functioning of the payments system, which is an essential component of a modern monetary economy. Thus, the three main interrelated functions of the banks are mobilizing savings of the public through different deposit schemes, channelizing funds for productive purposes through different lending and investment schemes and providing a mechanism for payments and transfer of funds to facilitate various productive and consumption activities. Among these various functions, credit creation emerges as a prime function of commercial banks, for it is not only the main mode of finance for productive activity throughout the economy but also the main source of income for banks themselves.

Like any other business enterprise which is currently operational, commercial banks have to make required adjustments in their assets and liabilities in an effort to strike a balance between them and ensure stability in their operations. This state of balance between assets and liabilities is reflected in the bank's balance sheet of Indian commercial banks a typical bank balance sheet as given below in Table 1.1. In Table 1.1, the values given against each component of the assets (liabilities) column represent the percentage share of that component in total assets (liabilities) of Indian scheduled commercial banks as on 31st March 2015.

Table 1.1 Balance Sheet Components of Indian Scheduled Commercial Banks (in percent)

ASSETS			**LIABILITIES**	
Cash in hand and balances with RBI	4.39		Capital & Reserves	17.60
Balances with other Banks	4.01		Deposits	53.69
Loans and Advances (i) Priority Sector loans (ii) Non-priority sector loans	61.39 43.65 17.73		Borrowings	15.77
Investments (i) SLR Investments (ii) Non-SLR Investments	26.34 20.15 5.83		Other liabilities & provisions	12.94
Fixed & other assets	3.87			
Total Assets	100		Total liabilities	100

Source: RBI, *Statistical Tables relating to Banks in India*,2014-15

In general, liabilities represent the different sources of funds which banks use to create a portfolio of assets that helps them earn enough income, to meet their debt obligations on the liabilities side and to make profits which provide an adequate return for their owners.

The major sources of funds which together constitute the liability side of the bank's balance sheet are Deposits, Borrowings, Capital and Reserves. Out of these sources of funds, deposits act as the main source for Indian commercial banks as they account for more than 50 percent of their total liabilities. This is evident from the

above table which shows the share of deposits in total assets to be around 54 percent for Indian scheduled commercial banks in financial year 2014-15. These deposits are mobilized by banks through different deposit schemes designed to suit different sections of the population. Borrowings, on the other hand accounted for only 16 percent of total bank liabilities in 2014-15. This includes borrowings from both inside and outside India. Within India, borrowings include borrowings from RBI, inter-bank borrowings and borrowings from other institutions.

Apart from deposits and borrowings, Capital and Reserves & Surplus appear on the liability side of bank balance sheets. Capital represents the equity contribution of the owners of the bank and thus is taken to be the long term source of funds. The Reserves and Surplus, on the other hand, includes different forms of reserves like statutory reserves, investment fluctuation reserves, revenue reserves, balance in profit and loss account and the capital reserves i.e., the undistributed profits which the banks plough back into their business. Both Capital and Reserves & Surplus act as a cushion for depositors and creditors because it is the most stable resource which can be used anytime at the will of the banks to absorb any losses arising from the risks in bank's business. This can be explained further with the following example of simple balance sheets.

We begin with the simplified balance sheet of two banks – Bank A and Bank B.

Bank A			Bank B	
ASSETS	LIABILITIES		ASSETS	LIABILITIES
Reserves Rs.10	Deposits Rs.80		Reserves Rs.10	Deposits Rs.90
Loans Rs.90	Capital Rs.20		Loans Rs.90	Capital Rs.10

Both the banks have the same balance sheet values, except that the share of capital in total assets is 20 percent for bank A which is higher than the share of capital in total assets of bank B, which is 10 percent. Let us suppose now that assets worth Rs. 15 become worthless for both the banks because of the bad loans. Then in that

case when these bad loans are written off (valued at zero) from the books of the banks, total value of the bank's assets will decrease by Rs. 15 for both the banks. The balance sheet of both the banks will now be the following:

Bank A			Bank B	
ASSETS	LIABILITIES		ASSETS	LIABILITIES
Reserves Rs.10	Deposits Rs.80		Reserves Rs.10	Deposits Rs.90
Loans Rs.75	Capital Rs.5		Loans Rs.75	Capital Rs.-5

This shows that Bank A, with initially greater capital, can absorb the entire loss of Rs. 15 and still maintain its net worth at a positive level of Rs. 5 whereas, for Bank B this loss has led to a situation of insolvency as now, owing to their negative net worth position, they are incapable of paying off the holders of their liabilities (i.e. the depositors).

Together with the structure and size of the different forms of liabilities, as discussed above, banks choose a portfolio of assets, given their expectations about future returns and risks associated with any such portfolio and their preferences over various combinations of risks and returns. Four broad categories constituting the asset portfolio of banks are: Cash in hand and balances with central banks; Balance with other Banks; Investments; and Loans and Advances. Quantitatively, loans and investments, the last two categories, account for the major proportion of the total assets of Indian scheduled commercial banks because they are the most important means of generating income for the banks. This is evident from Table1.1 which shows that in 2014-15, the share of loan Loans and Advances and the share of Investments in total assets of Indian banks was around 61 percent and 26 percent respectively. This makes the lending and investment decisions of the banks of utmost importance in their decision-making exercise.

Among the different forms of assets, mentioned above, Cash in hand and balances with the Central Bank are the most liquid category of assets. Balances with other Banks represent the money lent to other banks on call and short notice, usually

on overnight basis, which are used by other banks to manage short-term liquidity mismatches. These are also short term assets and, thus, fall under the category of liquid assets. Investments mainly include investment in Government and other approved securities. These are the least risky category of major income-earning assets as they are secured by government guarantees. Apart from this, banks also invest in shares, debentures and bonds, equity holdings in subsidiaries and some other forms of private investments. Investment in such private securities falls under the category of investment in non-approved securities and the extent of investment in such forms depends on the development and stability of the market for private securities. However, in India, the major portion of bank investment is restricted to investment in Government and other approved securities which are termed as SLR investments. This is evident from Table 1.1 where the share of SLR investments in total assets is 20.15 percent whereas for Non-SLR investments it is just 5.83 percent.

The last head, Loans and Advances [1]are the most important form of bank assets which consist of bank loans to different sections and sectors of the economy. These assets account for more than 60 percent of total bank assets. Such high share of loans in total assets implies that the loans are the highest source of income for banks. However, a loan, in general, is considered to be less liquid and more risky than most other forms of asset including in particular the other major category of SLR investments. This is because loans cannot be liquidated easily until they mature (except for demand loan) and they usually involve a higher probability of default risks than most other forms of assets.

Depending upon the main motive of lending, Loans and Advances can further be divided into two broad categories- Priority Sector Loans and Non-priority sector Loans. Priority sector loans are the loans which banks are mandated to extend in order to fulfil their social motive, imposed by RBI. On the other hand, non-priority sector loans are the loans other than priority sector loans and are given with a pure commercial motive.[2]Apart from these major categories of assets, there are fixed assets

[1]Although loans and advances are included under the same head, they are slightly different from each other in the sense that the loans are the credit which banks give for a definite purpose and for a predetermined time period, whereas, advances are the credit facility granted by the banks largely for short term purposes. However, in the present study these two terms will be used interchangeably

[2]Further details of these categories are provided in the next chapter

and other assets like interest accrued, deferred taxes etc which are taken to form part of the asset portfolios of banks.

Therefore, from the above discussion and Table1.1, it is clear that there are two major components viz. Loans and Advances and Investments (in particular, SLR investments) which constitute the asset portfolio of Indian scheduled commercial banks. These two components differ from each other in terms of the combination of risk and return that they offer. Loans and Advances are generally considered to be associated with both more risk and more returns. They are considered to be more risky because the major portion of these assets are private liabilities and thus, involve a higher probability of default risk than SLR investments. Due to such high risk and due to the fact that they are mostly used to finance profit-earning enterprises and projects they also turn out be high return generating assets. SLR investments, on the other hand, because they are mostly guaranteed by governments, are considered to be subject to much less credit risk. However, due to the lower risks involved the returns that such SLR investments give are usually less than the returns generated under loans.

Therefore, due to the different risk and return combinations embodied by assets in these two categories, bank asset portfolios with different shares of these two major categories of assets represent different overall combinations of risk and return for banks. A greater share of total assets in the form of loans and advances and a smaller share in liquid assets like SLR investments would imply higher liquidity and credit risk for a bank, but at the same time it will also imply higher returns for that bank.

Consequently, a bank's desire to move to a different configuration of overall risk and return to that embodied in its current asset portfolio would generally lead to a substitution between these two categories of assets in its asset portfolio. The changed composition of the bank asset portfolio would involve a higher share for one asset category and a lower share for the other.

For example, if banks are facing the increased risks of a situation with high NPAs, then banks would be willing to sacrifice some amount of returns to moderate the riskiness of their portfolio and hence will prefer to shift to a composition of assets which would involve less risk, even if it promises lower returns. Such trade-off

between risk and return, therefore, will usually lead to a decrease in the share of loans in the bank's asset portfolio. This is because banks in order to decrease their riskiness in their asset portfolio show a tendency to substitute less risky assets like SLR investments for more risky loans thereby decreasing overall share of loans in total assets.

2.2. THE IMPACT OF NPAS ON BANKS AND THE ECONOMY

The credit creation function of banks is always accompanied by some set of risks, ranging from pure credit risks to risk of over-lending. While pure credit risk arises when the borrower fails to meet its debt obligations, even though adequate precaution has been taken by banks at the time of sanctioning such loans, the risk of over-lending arises when banks extend loans based on an overestimation of future prospects without even making proper credit appraisal and assessment of borrower's repaying capacity. However, both situations can lead to the problem of mounting Non-Performing Assets (henceforth, NPAs) in the books of banks.

Financial soundness of banks ensures the financial stability of the banking sector. The quality of bank assets is a critical determinant of the financial soundness of banks. The quality of an asset is generally defined on the basis of the risk and return combination that an asset involves. Loosely speaking, the greater is the expected value of the rate of return from an asset and less the risk associated with its return; the better is the quality of that asset. The quality of individual bank assets together determine the overall quality of a bank's asset portfolio The overall quality of the asset portfolio of a bank with a high share of NPAs in total assets will be considered to be low. Thus, higher is the share of NPAs in total assets of banks, worse will be the overall asset quality of the banking system and higher will be the threat of financial instability in the economy.

A rising trend of NPAs affects a bank's profitability, liquidity and solvency position adversely thus, increasing the threat of its failure. It has been found in a number of studies on bank efficiency that failing banks tend to be located far from the most efficient frontier (Barr & Siems, 1994; Berger and Humphrey, 1992; DeYoung and Whalen, 1994; Wheelock and Wilson, 1994). This is because such banks do not optimize their portfolio decision by lending less than demanded, thus running into the

risk of over-lending. Also there are evidences which show that even among banks that do not fail, there exists a negative relationship between NPAs and efficiency of performance (Kwan and Eisenbeis, 1994; Hughes and Moon, 1995).

NPAs beyond a certain threshold level are always a matter of concern for all the stakeholders involved, because it hinders the smooth flow of credit which is essential for overall growth and stability of an economy. According to Tracey (2011) NPAs affect credit growth by impacting both willingness as well as the capacity of banks to lend, which manifests itself in the changes in bank portfolios. The willingness of banks to extend credit in a situation of high NPAs is affected primarily through two channels. The first and direct channel is through the deteriorating asset quality of banks which such high NPAs entail. Such deterioration of the asset quality induces banks to trade off some return for less risk and reduces their overall allocation towards more risky but income-generating assets like loans. The second channel through which NPAs can further impact a bank's willingness to lend exists due to the presence of regulatory norms regarding risk based capital requirements. Presence of such norms makes banks all the more risk averse in high NPAs situation and thus decreases their willingness to allocate their funds towards risky assets like loans thereby decreasing the overall shares of loans in bank in bank assets is situations of high NPAs.

In the case of the first channel, high levels of NPAs increase the overall riskiness of bank asset portfolios to a level more than desired. This induces banks to substitute less risky and more liquid assets like SLR investments for more risky assets. Since loans always entail some amount of credit risk, banks prefer to cut down on their loans and allocate the same funds to less risky assets like investment in Government and other approved securities thus, decreasing the share of loans in their asset portfolio and in turn the overall loan supply in the economy.

In case of the second channel, due to the existence of capital adequacy norms banks are all the more risk averse in a situation of rising NPAs. This happens because under capital adequacy norms banks are mandated to maintain a minimum statutory capital to risk weighted asset ratio (CRAR, henceforth), which becomes difficult to maintain if there is a large amount of NPAs on the books of the banks. For a given capital base, a bank's CRAR decreases if the riskiness of its asset portfolio increases. Therefore, when rising NPAs lead to increasing riskiness of a bank's asset portfolio,

CRAR of that bank decreases and the bank, in order to maintain its minimum CRAR, becomes less willing to invest in riskier assets like loans. This in turn decreases the overall share of loans in that bank's total asset base. The broad outlines of the above mechanism can be explained through the following flow chart -

Higher NPAs→ Fall in Asset quality → Increase in overall riskiness of bank assets →Internal consolidation by banks→Substitution of more risky by less risky assets and of less liquid by more liquid assets→Decrease in share of loans in total assets →Decline in credit growth

High NPAs also affect the lending capacity of banks. Banks extends new loans either by raising resources through fresh deposits or by recycling the funds paid back by existing borrowers. Due high NPAs, recycling of funds get affected as such funds under high NPAs get locked in unproductive and unprofitable sectors and thus hinders the entire credit creation process of banks. This could lead to a situation of economic stagnation because if NPAs keep rising and getting rolled over then the economy's efficiency in resource allocation as well as its prospects for growth will be affected.

Apart from this, high levels of NPAs can also impact the lending capacity by decreasing the profitability of the banks. NPAs affect profitability of a bank in various ways. First, a rise in NPAs on the books of a bank implies a fall in the interest income of the bank which would directly hit that bank's profits and retained earnings. Further, because of such high NPAs, the overall riskiness of that bank's asset portfolio increases, which may demand high levels of provisioning against future losses. This has to be done out of the bank's retained earnings. This can put further stress on the bank's profitability. Such low profits tend to reduce a bank's competitiveness which can affect its equity capital base and increase the threat of insolvency for the bank. A worsening solvency position along with a low market value can not only induce bank's depositors to withdraw their deposits but, also make it costly for the bank itself to raise additional funds. This is because, in order to raise additional funds, either by borrowing or by attracting new deposit bank may have to offer a high rate of interest to both its depositors and creditors. Such steady rise in the capital cost along with

declining interest income can severely affect the bank's profitability, which can compress availability of funds and, therefore, bank's lending capacity.

Lending capacity gets further restricted if, as a result of rising NPAs, the CRAR of banks becomes bound to its minimum value as per the capital adequacy norm imposed by the central bank. Under such a scenario any increase in riskiness of the asset portfolio will compel banks to make required adjustments towards less risky and more liquid assets in order to maintain their CRAR and since loans are taken to be riskier assets, banks would have to decrease their extension of loans. The broad outlines of the above mechanism can be explained through the following flow chart:

Higher NPAs →Higher loan loss provisioning→ Lower bank revenues→ Lower funds for new loans→ Decreased lending capacity for further loan creation → Decline in credit growth

Thus, summarizing the impact of NPAs on overall credit growth we conclude that NPAs hinder credit growth in the economy primarily by affecting the supply side factors governing credit. There are two main ways in which it impacts the credit supply in the economy. One is by affecting the willingness of the banks to extend credit and other is by affecting their capacity to lend. With high NPAs bank's willingness to lend decreases because of two major reasons. One reason is high NPAs increases the overall riskiness in bank's asset portfolio which in turn decreases bank's risk appetite thereby decreasing their willingness to hold risky assets like loans. The second reason is that, in the presence of a regulatory norm regarding a capital risk adequacy ratio, rising NPAs reduce the actual value of the capital risk adequacy ratio and increase the risk of not being able to meet the norm. In order to maintain a sufficiently high value of the ratio, banks substitute less risky assets for loans in their portfolios.

High NPAs have an adverse impact on credit supply also because they decrease the lending capacity of banks by restricting the availability of the funds needed for lending. Shortage of funds arises for different reasons. First, high NPAs lock most of the funds in unproductive avenues and thus make recycling of such funds difficult for creating new loans. Second, due to high loan loss provisioning, which

banks are required to make in situations of high NPAs, funds available with banks to extend loans further decreases. Third, high NPAs decrease the interest income of banks and also thereby reduce the retained earnings of the banks. Lastly, lower earnings and higher solvency risk together increase the cost of raising additional funds. In addition, this problem of shortage of funds gets aggravated if banks have an obligation to maintain a minimum capital to risk weighted assets ratio and the existing value of the ratio is close to that minimum.

2.3. LITERATURE REVIEW

In recent years, NPAs, owing to their alarming rate of growth and their implications for the banking sector's stability, have grabbed the attention of both policy makers and academicians alike. NPAs have emerged as a widely discussed topic in the literature related to the banking system. The literature on NPAs can be roughly divided into two broad categories. The first set of contributions includes those studies where the authors have primarily focused on the factors affecting the levels of NPAs on the books of banks. The second category includes studies which have analysed the impact of NPAs on bank operations, specifically the lending behaviour of banks.

The first category includes a lot of empirical research on India as well as other countries, which has looked into the causes of the NPAs and the factors affecting it extensively (Bruno et al., 2015; Klein, 2013; Messai and Jouini, 2013; Farhan et al., 2012; Louzis et al., 2012; Vogiazas and Nikolaidou, 2011; Bofondi & Ropele, 2011; Hoggarth et al. 2005; Rajaraman and Vasistha, 2002; Das and Ghosh, 2005). The results of these studies are broadly similar. According to most of these studies, determinants of NPAs can be placed in two categories. One category is of macroeconomic determinants such as GDP, inflation rate, unemployment and interest rates, and the second category includes bank specific determinants like size of the banks, funding level, capitalization and efficiency of banks.

In the Indian context, certain authors like Samantaraya (2016), Lokare (2014) and Ramanadh and Rajesham, (2013) have also attributed the recent rise in NPAs to the inefficiency implicit in the pro-cyclical lending behaviour of Indian banks in the pre-crisis period. Asset quality gets compromised due to bank inefficiency as banks

have a tendency to lend excessively in a boom period without making a proper credit appraisal.

A lot of empirical research, forming part of the second group of studies on NPAs, has examined the relationship between increasing bank vulnerability and rising NPAs. Most of such studies have been carried out in the context of different financial crisis, as it is usually in the aftermath of such crises that commercial banks, in the affected regions, start facing a situation of rising NPAs and their economy starts witnessing a slowdown in credit growth due to a reversal in bank lending behaviour. Such a situation then reinforces the pre-existing credit crunch in such crisis hit countries.

Agung et al. (2001) in their study on Indonesian banks have tried to assess the major factors which had led to the slowdown in their credit growth in the aftermath of the 1997 Asian Financial Crisis. In particular, they wanted to analyse whether it was the overall low credit demand in the economy or the unwillingness of the banks to lend which was playing the dominant role in this post crisis slowdown in credit uptake. For this they conducted an empirical analysis using both macro (aggregate) and micro (bank specific) level panel data and found that the continuing slow growth of credit from Indonesian banks was more due to supply side factors. On the basis of both empirical results as well as a bank level survey, they further suggested that such a credit crunch existed mainly because of the capital crunch that the Indonesian banks were facing in the aftermath of crisis and the high credit risk in the business sector, which ultimately resulted in high growth of NPAs in the banking sector.

In order to analyse the impact of the financial position of banks on their lending behaviour they conducted a separate regression exercise where they divided the total number of banks into two groups depending on whether they were re-capitalised or not. Those banks which were facing the capital crunch problems were represented by the group of banks recapitalised by the state, and the other set was of non-capitalised banks, which did not need to be recapitalised because of their resilient capital position at the time of the crisis. In this regression exercise they used NPLs (non-performing loans) as one of the parameters to capture the impact of high credit risk on the lending behaviour of two different groups of banks where they measured the lending behaviour by the credit growth of the banks. The estimated coefficients on the NPLs ratio were found to be negative and significant for both the groups, thus

indicating a negative relation between NPLs and lending behaviour of banks, irrespective of their capital position. Krueger and Tornell (1999) confirm the existence of the credit crunch phenomenon for Mexico after the 1995 crisis and attribute increasing bad loans as one of the primary reason for such a credit crunch problem. They point out that banks were incapable of providing fresh funds for new projects because they were burdened with high NPA.

Similar kinds of studies were performed in the context of Italian and Chinese Banks by Cucinelli (2015) and Lu et al. (2005) respectively. Doriana Cucinelli examined bank lending behaviour during the post financial crisis period and chose 2007 to 2013 as the study period. In her study she intended to determine the relationship between NPAs and bank lending behaviour by examining whether the increase in credit risk after the financial crisis of 2007 had induced banks to reduce their lending operations or not. For this she regressed the growth of gross loan rate on different macro and bank-specific variables using a fixed effects regression model. Her empirical results were in line with her expectations as the coefficients of variables measuring credit risk (measured by two different ratios, NPLs to total loans ratio and loan loss provisioning ratio) were found to be negative and significant. In addition, her results also suggested that commercial and cooperative banks showed the same kind of behaviour in terms of their lending in high credit risk situations. Thus, based on these results she concluded that an increase in credit risk during the post-financial crisis period induced an attitude of risk aversion among all the Italian banks irrespective of their type, as a result of which banks moved away from riskier assets like loans, resulting in an overall slowdown in loan growth.

Lu et al. (2005) undertook a similar kind of study based on data on a sample of China's public listed companies for time period 1994-97. Besides, analysing the relationship between NPAs andbank lending behaviour , they tried to empirically observe if there exists any kind of bias in bank financing in favour of state owned enterprises (henceforth, SOEs). Their results suggested the existence of systematic lending bias among the Chinese banks in favour of SOEs which has enabled these SOEs to borrow, even with their high default records, larger amounts than other low risk firms. According to the authors such systematic bias in lending arises from the expectation of banks that the Government is going to bailout SOEs in times of trouble.

An empirical study was also conducted on banks of Ghana by Alhassan et al. (2013) where the researchers looked into the possible relation between bank lending behaviour and asset quality of Ghanian banks. For their study they employed a random efficient estimator technique with bank level panel data on 25 banks for the period 2005-2010. In their paper they examined the persistence of the impact of changes in three different measures of quality of assets (namely loan loss ratio, doubtful loan ratio and substandard loans ratio) on bank lending operations by running four regressions with the ratio of loans to total assets as the dependent variable in each regression. In the first regression they used the ratio of total non-performing loans to gross loans as a proxy for the overall asset quality. In the other three regressions one of the above mentioned three measures of asset quality were used. This was done to to check the robustness of their findings with respect to the choice of the measure of asset quality. On the basis of their empirical exercise, they found that deteriorating asset quality does have a persistent, and not contemporaneous, effect on bank lending operations. In addition, they found ratio of deposits to total liabilities, intermediation spread and the ratio of bank equity to total assets to have a significant impact on the lending behaviour with expected signs of coefficients.

There are a lot of other studies (Djiogap & Ngomsi, 2012; Keeton 1999; Berrospide and Edge, 2010; Stiglitz and Weiss, 1981; Tomak, 2013)which have contributed one way or the other to the existing pool of literature on the intertemporal relation between loan growth and bank risk, especially credit losses following high NPAs. However, we briefly discuss the work of Hou and Dickinson and Mark Tracey as their studies are among the few which have focussed on the cross country differences in that relation.

Tracey (2011) carried out an empirical analyses to assess the impact of growth of non-performing loans on loan growth for two Carribean countries, namely, Jamica and Trinidad and Tobago in the aftermath of 2007 global financial crisis. He followed a different kind of approach in the sense that he derived a threshold range for the ratio of NPL to total loans by using an OLS regression technique by which he estimated the minimum and maximum threshold points of the NPL ratio at which banks become risk averse in their disbursal of loans. This was done in order to examine if banks react differently to different levels of NPLs ratio across the threshold range. For his

empirical analysis he modeled loan growth on the lagged growth rate of the NPL ratio and the growth rate of other balance sheet variables like deposits, other earning assets etc. He chose a quaterly data set which spanned the time period of 1996 Q1 to 2011 Q2 and 1995 Q3 to 2010 Q4 for Jamaica and Trinidad and Tobago respectively. The results obtained through his empirical analysis supported the existence of differential loan behaviour of banks depending on the level of the NPLs. At high levels of NPLs in the threshold range banks were found to display more risk aversion in loan disbursal than at low levels of NPAs. Differences were also found across countries in terms of this risk averse behaviour of banks implying that although NPLs do have a negative impact on loan creation, the degree of influence differs across jurisdictions.

Hou and Dickinson (2007) conducted a similar kind of study where they applied the same threshold technique but, instead of a threshold range they estimated a threshold level of NPL to carry out their analysis across different country groups or regions. The different countries or regions that they included in their study were the USA, Japan, the group of countries hit by the Asian Crisis, France (as a representative of Western Europe) and a group of Eastern European countries. Such a large data set was chosen by the authors so as to capture and explain region-specific effects on the relationship between NPAs and bank lending behaviour. Empirical results for almost all the regions suggested a negative non-linear effect of NPL on loan supply of the banks and were in line with the findings of the previous paper that the extent of this negative effect of NPAs on bank credit does differ across different regions depending on their internal financial and legal settings.

There is, thus, almost unanimous evidence that the supply of bank credit is adversely affected in high credit risk situations. An increase in NPAs is expected to reduce the share of loans in bank asset portfolios thereby negatively impacting the overall growth of loan supply in the economy.

In the Indian context, however, this relationship between NPAs and bank lending behaviour has been explored less thoroughly. There are only a few contributions in the literature, which have, in particular, used econometric techniques to analyze the impacts of NPAs on the lending or portfolio behaviour of Indian commercial banks. Most of the Indian literature on NPAs has been in the form of informal discussions focused either on the trends in and causes of NPAs in the Indian banking system or its potential threats for bank efficiency and risk management, often

ending in suggestions about various policy measures which could be taken to control their high growth.

Swamy and Sreejesh (2012) tried to provide insights into how banks in the emerging economies respond to financial crisis, especially in terms of their credit supply, and empirically analyse the major determinants of such response. Their empirical study was mainly focused on the behaviour of Indian banking system during the global financial crisis of 2007 for which they used weekly data on commercial banks of India and used the technique of co-integration to carry out their empirical exercise. For their empirical analysis they regressed the outstanding credit of banks (taken in logarithmic form) on different bank balance sheet components (like deposits, investments, borrowings), different rates of interests (lending rate, call money rate etc) and on the credit to deposits and investment to deposits ratios.

Further, in order to analyse the overall impact of the 2007 financial crisis on bank lending behaviour they estimated the above model for three distinct and comparable time periods which captured three different phases of a business cycle i.e. pre-recession period or boom period (December 2006- July 2008), recession period (August 2008-March 2010) and the recovery period (April 2010-March 2011). On the basis of their empirical results they concluded that, in the aftermath of the financial crisis, bank credit showed a declining trend in the Indian economy. This implied that lending behaviour of Indian banks was in line with the stylised facts on bank behaviour during a crisis period. In addition, their empirical results implied that borrowings have a positive and significant relation with bank lending. The authors argued that such a positive relation could be the result of a decline in bank deposits during the crisis period.[3]

Apart from this, Swamy and Sreejesh (2012) found lending rates to have a positive but insignificant impact on bank lending, indicating that the role of lending rates weakens during a crisis period. Lastly, they found a negative and significant relation between investment and lending activity of the banks. This was expected as, during times of financial instability, banks adopt a more risk-averse attitude and

[3]During financial crisis usually depositors prefers to hold more of cash or other real assets than holding them in deposits because of the high risks that such crisis entails for the banking system. As a result, bank deposits which are the main source of funding for the banks, decreases which in turn increases bank's reliance on borrowings for lending and investing purpose.

tighten their lending activity thereby increasing their investment in safer assets. While Swamy and Sreejesh (2012) considered lending behaviour in and after a period of financial crisis, other studies like Samantaraya (2015), RBI (2015a) and RBI (2008) while determining the factors affecting the lending behaviour of banks directly examined a possible negative effect of NPAs on bank lending decisions.

RBI, in its annual report of 2014-15, attributed the recent credit slowdown in the Indian economy to the deteriorating asset quality of the banks resulting from high NPAs. They further suggested that the high ratio of NPAs to total advances in public sector banks have resulted in a sharper decline in their credit growth compared to their private counterparts. According to the RBI such decline in credit growth was a result of the risk-averse attitude which banks adopted in a situation of high NPAs. Based on quarterly data since 2010-11 aggregated over all banks the report also suggested a statistically negative correlation of 0.8 between credit growth and ratio of NPAs to total assets.

Samantaraya (2015) attempted to analyse different factors determining the flow of bank credit in the Indian economy. For this he used a simultaneous equation model (including equations on loan supply, loan demand and deposits demand by public) which was estimated for the time period of 15 years starting from 1996-97 to 2010-11. In his loan supply equation he used the ratio of gross NPAs to total assets as one of the independent variable to analyse the impact of NPA linked provisions on bank loan supply. The loan loss provisioning occasioned by NPAs could be expected to affect bank's lending capacity negatively and could, in turn, decrease loan supply of the banks. However, his empirical results did not suggest any statistically significant impact of the NPAs ratio on loan supply.

Lastly, we should also mention that the RBI in its '*Report on Currency and Finance* (2006-08)' (RBI, 2008), without employing any econometric tool but, by analysing the trend of different available data on credit and NPAs, suggested that NPAs were one of the factors affecting growth of bank credit.

Therefore, from the above review on existing literature on NPAs, we can conclude that say that, there seems to be convincing evidence in favour of a pervasive, though not universal, effect of NPAs on the growth of bank credit. The present study complements the existing literature by examining one of the major components of the

theoretical argument linking slow credit growth to NPAs: the assumption that banks adjust their asset portfolios in respect to higher NPAs by shifting from more risky to less risky categories of assets. This effect of NPAs on the asset composition of banks is analysed in terms of the share of the two major categories of assets in the portfolios of Indian commercial banks, viz. loans and advances and SLR investments. Further, it also considers whether there is any difference between public sector and private sector banks in the sensitivity of portfolio adjustments to NPAs.

CHAPTER III

DATA AND METHODOLOGY

3.1. INTRODUCTION

A portfolio of assets, depending on the risk and returns attached to its various categories of assets, involves a particular combination of risks and returns for banks. Banks while choosing their asset portfolio, from amongst the feasible set of alternatives, try to choose that portfolio option which gives them an optimal combination of risk and return. This set of different risk and return combinations, available to banks corresponding to different feasible asset portfolios, changes if the given level of NPAs in the books of the banks increases. This is because with a higher level of NPAs among existing asset holdings, owing to the decline in asset quality, riskiness of every feasible portfolio of assets increases which, in turn, alters the risk and return combinations which they offer. Due to this change in the choice set of feasible risk and return combinations, a bank's optimal choice of asset portfolio will also change as risk-averse banks would now, in general, prefer to go for those portfolio choices which are considered to be less risky even at the cost of sacrificing some amount of return. This trade-off that banks finally carry out determines their optimal composition of asset portfolio. Therefore, it can be said that high NPAs lead to a high risk situation for the banks which in turn compels them to shift to a portfolio of assets which provides them less risk as well as less returns. Thus, as banks trade off some return for less risk they end up altering their portfolio composition.

However, the extent of this trade off and the magnitude of changes in bank holdings of various categories of assets do not depend on the level of NPAs alone. There are several other aggregate and bank specific factors which governs the extent of this trade-off between risk and return for banks, which ultimately determine bank's optimal composition of asset portfolio. Some of such factors are the state of loan demand in the economy which influences both the expected returns (lending rates) and the riskiness associated on an average with loan proposals; the cost of liquidity in the economy which influences the additional risks associated with holding more illiquid assets; regulatory measures imposed by the RBI, etc. (these factors are

discussed later in this chapter). Thus, in order to analyse the impact of NPAs on a bank's asset compositions, the effects of other factors, affecting bank's portfolio decisions, have to be controlled for. Therefore, with this aspect in mind, the current chapter specifies a dynamic panel model which has been used in the present study to empirically analyse the impact of NPAs on asset composition of Indian commercial banks while controlling for some important aggregate and bank level factors.

The effect of NPAs on the composition of the asset portfolios of banks is studied by considering its effect on the shares in total bank assets of two of the largest categories of bank assets in India – loans and advances, on the one hand, and government and other approved securities, on the other. While both categories of assets generate incomes for banks, loans and advances are usually considered to be, on average, the most risky category of assets in bank portfolios whereas, government and other approved securities are considered to be less risky assets. The rise in the riskiness associated with bank portfolios following from a higher volume of NPAs in relation to bank capital should *cet. par.* result in a lower share for loans and advances in total assets and a higher share for government and other approved securities.

Keeping in mind the above discussion, the main objective of this chapter is to set up an empirical framework suitable to analyse the impact of NPAs on banks' two major components of asset portfolio viz. Loans and SLR investments. Accordingly, the current chapter has been divided into the following sections: The Second section of this chapter i.e. 3.2 discusses the different factors, other than NPAs, which by affecting the portfolio decisions of banks, affects the overall asset composition of banks. Among these factors some important factors are then included in the econometric model specified in third section. The Third section of this chapter i.e. 3.3 specifies the econometric model used for our analysis and discusses in details the specification of that model and also the econometric method applied in its estimation. Finally, different data used for carrying out the empirical analysis and its sources have been discussed in section four i.e. 3.4, of this chapter.

3.2. FACTORS AFFECTING COMPOSITION OF BANK ASSET PORTFOLIOS

As mentioned above, there are several factors other than NPAs which impact the extent of the trade-off between risk and returns, which determine the optimal composition of assets for banks. Since, in this dissertation, the asset composition of banks is studied in terms of the shares of loans and advances and of investments in SLR securities the more important of these factors can be broadly divided into the following four categories:

1. Various interest rates
2. Regulatory and prudential measures imposed by RBI.
3. State of loan demand in the economy.
4. Ownership of banks (Public sector and private sector)

The first set of factors influencing the asset composition of banks is various interest rates. This set of factors may include a bank's lending rate, the rates of return on other alternative assets, the Repo rate and the call money rate. Lending rates determine the earning prospects for the banks as loans are one of the major sources of income in banking business. The higher is the lending rate, the greater will be the prospects to earn income and thus, the greater will be a bank's incentive to increase their share of loans in total assets. Lending rates impact the extent of trade off that banks face between risk and return. High lending rates increases banks prospects of earning high returns which, in turn, decreases *cet. par*. their incentive to substitute less risky assets like SLR investments for more risky assets like loans when burdened with higher of NPAs . Given the state of loan demand facing banks, a bank's choice of a lending rate is, however, the same as the choice of an optimal value for its loans to assets ratio. Thus, lending rates are only apparently an exogenous factor determining the composition of banks' asset portfolios but, like the latter, they also are ultimately determined by other factors, which are exogenous in nature.

Rates of return on alternative assets like investments represent the opportunity cost of lending activities. Higher are the rates of return on other assets higher is the opportunity cost that banks have to bear in order to hold their assets in the form of

loans and, thus, less will be the incentives of the banks to hold loans in their asset portfolio. Therefore, interest rates on alternative assets like SLR investments are expected to have a negative impact on proportion of loans in total assets because any increase in such rates motivates banks to hold more of their funds in alternative assets. On the other hand, a rise in the return on an alternative category of assets like SLR investments should *cet. par*. increase the share of that category in the total assets of banks.

The Repo rate and Call money rate, on the other hand, represent the cost of liquidity for banks. Repo rates and Call money rates are the terms on which a bank borrows from RBI and other commercial banks respectively. RBI targets the call money rate and uses the Repo rate as its main instrument of monetary policy to maintain a stable liquidity state in the economy. They are taken as the liquidity costs for the banks because these rates determine the cost of short term borrowings for banks which needed to meet their temporary liquidity requirements. These rates impact the asset composition of banks by impacting a bank's ability to obtain liquidity. If these rates are higher, banks will show a tendency to hold more of liquid assets in their asset portfolio. This happens because, any increase in such rates increases bank's cost of obtaining liquidity and hence in order to avoid any liquidity mismatch problems banks prefer to hold more of liquid assets in the form of excess reserves or SLR investments in their asset portfolio. Such an increase in proportion of liquid assets decreases the proportion of illiquid assets like loans in total assets for banks. Therefore, it can be said that cost of liquidity while impacting the SLR investments positively, affects the proportion of loans negatively in total assets.

These costs of liquidity impact the asset composition, also, by impacting the trade-off between risk and return arising in a situation of rising NPAs. With low costs of liquidity the extent of substitution of less risky for more risky (or higher return) assets in response to higher NPAs is weaker. This is because with low cost of liquidity banks will have an easy alternative option to manage their liquidity risks arising with higher NPAs and hence will be less willing to compromise on their returns by substituting low risk assets for risky assets generating higher returns. On the other hand with high costs of liquidity the extent of this substitution will be greater. This is because, in this case, banks will find it more costly to raise liquidity to manage their liquidity problems under rising NPAs and hence would prefer to substitute more of

liquid assets for illiquid assets so as to maintain a stock of liquidity as a buffer against further asset deterioration.

The second set of factors which impact a bank's asset composition are the regulatory and prudential measures imposed by RBI. This includes the need to maintain legally mandated values of the Cash Reserve Ratio (CRR), the Statutory Liquidity Ratio (SLR), priority sector lending norm and certain capital adequacy norms. The required CRR defines the level of reserves which commercial banks are legally required to maintain with RBI against their net demand and time liabilities. The idea behind the CRR is to maintain a minimum percentage of bank liabilities in the form of liquidity stock, i.e. reserves, so that it could act as a buffer against any unforeseen liquidity risks for the bank. The higher the value of CRR that banks have to maintain less will be the funds available with the banks for allocation to alternative categories of assets and, thus, less will be the overall share of loans and investments in banks' asset portfolios.

The SLR, on the other hand, stipulates the statutory minimum percentage of net demand and time liabilities which banks have to hold in the form of gold (current market value), cash (book value) or government and other approved securities as these are considered to be the least risky forms of assets. The idea behind the SLR requirement is to maintain a minimum portion of a bank's assets in the form of relatively low risk and liquid assets. As government and other approved securities are backed by a government's guarantee and are easily marketable[1], banks are mandated to hold a statutory minimum amount of their assets as investments in such securities apart from holding cash and gold. Like the CRR, the SLR can also be expected to impact total loan holdings negatively because the higher is the value of SLR imposed by the RBI, less will be the funds available for allocation in other non-SLR asset categories. However, unlike the CRR, SLR can be expected to a have a positive impact on the share of SLR investments[2] . This is because, with an increase in the value of the SLR, banks will be bound to increase their holdings in gold, cash and

[1] Marketable securities are those which have well developed markets for their transactions and hence can be easily converted to liquid form as and when required.

[2]SLR investments refer to investment in securities approved for SLR purposes like government and other approved securities.

SLR investments at least to the minimum required level, which, in turn, might increases the overall proportion of SLR investments to total assets.

A capital adequacy norm for banks was introduced under the Basel Capital Accord I in 1998, with the motive of developing a standardised risk based capital requirement for banks across different countries. This was done in order to protect banks from running into a situation of insolvency. The major capital adequacy norm imposed on banks is the need to maintain a minimum capital to risk weighted assets ratio (CRAR)[3] as prescribed by the RBI. Presence of such a minimum regulatory capital requirement restricts a bank's ability to opt for an asset portfolio combining high risks with high returns. This affects the bank's optimal choice of asset composition. Higher values of the CRAR would tend to favour asset portfolios with a smaller share of total assets in the form of loans and advances, which usually carry higher risk weights, and a greater share in the form of SLR investments, which carry lower risk weights.

Priority sector loans and advances consist of loans and advances which banks grant to some specific sectors[4], (defined as *priority sectors* of the economy by RBI), at concessional rates. As per the instructions of RBI all scheduled commercial banks are mandated to allocate around 40% of their adjusted net bank credit or credit equivalent of off balance sheet exposure (whichever is higher) towards priority sector lending. Therefore, due to such mandatory lending banks' in a way get restricted in their optimal asset allocation decision as the total amount of funds available with the banks, which they can allocate to attain an optimal value, decreases in the presence of priority sector lending regulation.

The third set of factors refers to the state of loan demand in the economy which includes those factors which affect a bank's asset composition by affecting the demand for credit in the economy. One major determining factor, independent of current portfolio decisions of banks, is the state of business and consumer

[3]Capital to risk weighted assets ratio is arrived at by dividing the capital of the bank with aggregated risk weighted value of assets, with weights for credit risk, market risk and operational risk. The higher the CRAR of a bank the better capitalized it is. (RBI, Master Circular, 2013)

[4]According to recent notification of RBI dated May10, 2016 sectors defined under priority sectors are: (i) Agriculture (ii) Micro, small and medium enterprise (ii) export credit, (iv) education (v) housing (vi) social infrastructure (vii) renewable energy (viii) others.

expectations about economic activity. This, can be argued, is primarily influenced by recent experience regarding GDP growth. Higher GDP growth, in general, indicates better macroeconomic conditions. This increases firms' expectations about future prospects, stimulates animal spirits and induces them to demand more credit. At the same time, independent of its influence on the state of expectations of firms and consumers (which results in a greater quantity of loan applications), better macroeconomic conditions (reflected in higher GDP growth) also leads, from the banks' perspective, to a better average quality of loan applications in terms of the ability of borrowers to repay loans at any given lending rate. The lower risks and higher returns associated with loans and advances following this overall improvement in the state of loan demand can induce banks to expand credit and increase the proportion of loan holdings in their asset portfolio. This increase can, in turn, lead to a decrease in the share of other asset categories in total bank assets.

Finally, the fourth factor taken into account is the nature of the ownership of banks. Public sector and private sector banks are the two major categories of commercial banks in the Indian banking sector. Owing to the difference in their ownership, it is possible that they might exhibit different behaviour while deciding on their optimal asset composition. Private sector banks are generally considered to be driven by more commercial motives, be subject to more market oversight and have less probability of being bailed out by the government in situations of insolvency. They may, therefore, be more responsive to any changes in the level of returns and risks attached to their asset portfolios. The behaviour of public sector banks, on the other hand, may be more driven by the policy objectives of the government and the central bank and less by the calculus of risk and return.

For example, because non-priority loans generally hold higher prospects of income than SLR investments, private sector banks may be expected to hold a higher share of loans in their asset portfolio even if it entails higher risks. However, if the central bank is trying to stimulate bank lending in a situation of declining growth, public sector banks might be more willing to expand lending than private sector banks. Similarly, in a situation of high NPAs private sector banks might, in order to control further risk, try to decrease their share of loans significantly and shift to less risky and more liquid assets. Public sector banks may be less flexible in making any adjustments in portfolio of assets according to changing risk prospects. At times, in

order to fulfil governments' social objectives these banks have to extend loans at very low rates to comparatively risky ventures. Such political influences in a way may put a constraint on these banks' portfolio decision thereby giving them less flexibility in making adjustments required to attain an optimal asset composition. In a situation of high NPAs these banks may find it more difficult than their private counterparts to decrease their share of loans, behaviour which might be encouraged by the implicit guarantee of a government bailout. A government concerned about financial stability may, however, induce public sector banks to adopt more risk-averse behaviour than private sector banks. Therefore, given the above arguments, we can expect the nature of bank ownership to have some effect on asset composition of banks.

3.3. MODEL SPECIFICATION

Taking into consideration the factors discussed above, the final empirical models for the two important categories of assets viz. loans and SLR investments are specified by equations (1) and (2) respectively:

$$L_{i,t} = \alpha_0 + \alpha_1 L_{i,t-1} + \alpha_2 YrD_t + \alpha_3 PubD_i + \alpha_4 NPA_{i,t-1} + \alpha_5 PubD_i NPA_{i,t-1} + \alpha_6 CRAR_{i,t-1} + \alpha_7 GDPgr_{t-1} + \alpha_8 REPO_t + \alpha_9 SLR_t + \alpha_{10} Groi_t + \alpha_{11} TDgr_t + \varepsilon_{it} \quad (1)$$

$$I_{i,t} = \beta_0 + \beta_1 I_{i,t-1} + \beta_2 YrD_t + \beta_3 PubD_i + \beta_4 NPA_{i,t-1} + \beta_5 PubD_i NPA_{i,t-1} + \beta_6 CRAR_{i,t-1} + \beta_7 GDPgr_{t-1} + \beta_8 REPO_t + \beta_9 SLR_t + \beta_{10} Groi_t + \mu_{i,t} \quad (2)$$

Subscripts '*i*' and'*t*' stand for the i^{th}bank and the t^{th} year respectively. α_0 and β_0 are the intercept terms for equation (1) and (2) respectively. The α_j 's(j = 1, 2, …, 11) represent the partial slope coefficients for equation (1) and the β_j 's represent the partial coefficients for equation (2). $\varepsilon_{i,t}$ and $\mu_{i,t}$ denote the stochastic disturbance terms for equations (1) and (2) respectively. Here $\varepsilon_{i,t}$ and $\mu_{i,t}$ can be written as

$\varepsilon_{i,t} = \tau_i + u_{i,t}$ and $\mu_{i,t} = \eta_i + v_{i,t}$

Where $\boldsymbol{\tau_i}$ and $\boldsymbol{\eta_i}$ denotes the unobserved bank-specific effects[5] which remains fixed over time, i.e.a time invariant error term. $\boldsymbol{u_{i,t}}$ and $\boldsymbol{v_{i,t}}$ are known as idiosyncratic disturbances which are assumed to vary across time but not across individuals.

The variables in the equations are defined as follows.

$L_{i,t}$: The ratio of non-priority loans to total assets for the i^{th} bank in the t^{th} period;

$I_{i,t}$: The ratio of SLR investments to total assets for the i^{th} bank in the t^{th} period;

$NPA_{i,t-1}$: The ratio of gross non-performing assets to total capital for the i^{th} bank in the $t\text{-}1^{th}$ period;

$CRAR_{i,t-1}$: The capital to risk weighted assets ratio for the i^{th} bank in the $t\text{-}1^{th}$ period;

$GDPgr_{t-1}$: The rate of growth of GDP at $t\text{-}1^{th}$time period;

$REPO_t$: The RBI's real REPO rate at t^{th} period;

SLR_t: The statutory liquidity ratio at t^{th} period;

YrD_t: The year dummy for financial year 2008-09;

$PubD_i$: A dummy variable for public banks;

$Groi_t$: The real rate of interest for alternative assets at t^{th} period

$TDgr_t$: The overall rate of growth of deposits in the economy at t^{th} period.

$L_{i,\,t}$ in equation (1) denotes the proportion of non-priority sector loans to total assets. Non-priority advances are calculated by deducting priority sector advances from total advances of the banks. Only share of non-priority sector loans have been considered as a dependent variable in this study because it is that portion of loans and advances whose share in total bank assets is actually decided by banks themselves. The extension of priority sectors loans, on the other hand, is largely determined by the requirement of priority sector lending stipulated by the RBI and represents the mandatory contribution of banks towards a social objective. Thus, in order to control for the impact of such mandatory lending by the banks, priority sector loans have been deducted from total advances so as to arrive at non-priority sector loans. Share

[5]These are bank specific effects which cannot be observed and remain constant over time e.g. bank's internal management system, work environment, quality of staff etc.

of these non-priority loans in total assets is then taken as the dependent variable in the present study.

The dependent variable $I_{i,\ t}$in equation (2) represents the share of SLR investments (investments in government securities and other approved securities) in total bank assets. A bank's investment operations are represented by SLR investments because SLR investments account for the major portion of the investments of scheduled commercial banks in India and are considered to be the least risky form of earning assets. They serve, therefore, as the primary alternative to more risky loans.

The independent variable $NPA_{\ i,t-1}$represents the ratio of gross non-performing assets to total capital [6]of banks. This ratio is used here in order to measure the extent of risk that is posed to a bank's solvency by a particular level of NPAs. It is well known that NPAs raise the riskiness associated with the asset portfolio but the extent to which it increases the level of riskiness for a bank will depend on the capital position of that bank. The greater is the value of bank capital for a given level of NPAs, the less is the risk implications of such NPAs for that bank. For example suppose two banks have the same level of NPAs but, different levels of capital base. With the same level of NPAs, the risk implications for the bank with the lower capital base will be higher than that for the bank with the higher capital base. This happens because, with sufficient capital, banks can, if necessary, write off the portion of NPAs which become worthless, liquidate bank assets and still meet all external liabilities. However, with a low capital base, if a significant portion of NPAs become valueless, the external liabilities of a bank may not be met by liquidating bank assets and the bank can become insolvent. In these model a lagged value of NPAs has been chosen, which is indicated by the lagged value of the time index *t-1*. The reason for choosing a lagged value is that banks are assumed to make their portfolio decisions for a particular period say't' taking into account the existing level of NPAs. This existing level of NPAs is nothing but the amount of NPAs existing at the end of the period *t-1* or the beginning of period *t*. Since the previous year's figure for NPAs impacts the current year's portfolio decisions, the lagged NPA value is chosen as an explanatory variable in our model.

[6]Total capital is defined to consist of the sum of two items in the liabilities column of a bank's balance sheet: bank's own capital (equity ownership) and bank's capital reserves, which contains bank's undistributed profits.

$CRAR_{i,t-1}$represents the difference at the beginning of a period *t* between the actual capital to risk weighted assets ratio that banks maintain and the minimum capital to risk weighted assets ratio which banks are required to maintain as per the guidelines of RBI. This takes into account the impact of the regulatory capital norm on a bank's asset portfolio decision. A higher value of actual CRAR at the beginning of a period with respect to its minimum required value reflects a better condition of a bank in terms of its risk exposure and/or capital base. This in turn, reflects a better existing solvency position of the bank. Due to the better solvency position a bank will be less fearful of not being able to meet their regulatory norm and thus will be willing to lend. This will increase the proportion of loans in total assets thereby, implying a positive coefficient for the $CRAR_{i,t-1}$ variable in the loans equation (given by equation 1). On the other hand, this difference can be expected to impact the proportion of SLR investments negatively. This is because, with a lower CRAR, risk-averse banks will have a greater incentive to increase their holdings of SLR investments, which are a less risky category of assets, at the expense of loans and advances, even if loans have the potential to generate more return for the banks than the latter. A higher CRAR can similarly be expected to induce a shift away from a less risky category of assets like SLR investments to asset categories which promise greater returns.

SLR_t, the statutory liquidity ratio, is the variable used to capture the impact of RBI's regulatory measures on bank portfolio decisions in these models. It is expected to have a negative impact on the proportion of loans and a positive impact on the proportion of SLR investments as discussed earlier. Here SLR has been chosen over CRR because of two main reasons. One reason is that SLR has direct implications for the holding of SLR investments and thus for the substitution between loans and SLR investments. Second reason being value of the CRR in terms of total liabilities is very small as compared to SLR holdings and might not be very effective in capturing the impact of regulatory restrictions on banks' asset composition.

The variables $REPO_t$ and $Groi_t$ are used to represent the group of different interest rates where Repo is used to capture the impact of cost of liquidity on bank portfolio decisions while $Groi_t$, which represents the average annual rate of interest on government securities, is used as a proxy for the return on alternative assets in the loans model (equation 1) and the rate of return on the asset itself in the SLR investments model (equation 2). Both $Repo_t$ and $Groi_t$ are expected to impact

proportion of loans negatively. Repo is chosen over call money rate because repo shows a more stable trend than Call money rate. Call money rate being decided on daily basis, shows high fluctuations in their value which in a way makes it less appropriate to be used for a study, based on yearly data. Again, Repo rate being set by the Central Bank can be considered to be more independent of bank decisions than Call money rate which is determined by the supply and demand for loans in the Call money market.

$GDPgr_{t-1}$denotes the rate of growth of GDP in period *t*-1which is used as a proxy for the state of loan demand in the economy and is included as a control variable in order to capture the impact of demand for loans on asset composition of banks. A lagged value of the growth rate is used in this model because of two main reasons. The first obvious reason to use a lagged value of GDP growth is to avoid the problem of endogeneity which may arise due to possible dependence of GDP growth on credit growth as credit is an important determinant of current economic activity. Another important reason for taking lagged GDP growth term, however, is that the expectations of businesses, consumers and banks about economic conditions in the current and in future periods, which determines the demand for credit in the current period, has to be based on the experience of economic conditions which have prevailed in the recent past. A higher rate of growth of GDP in the previous year makes both borrowers and lenders more hopeful about the future prospects of the economy. Owing to more positive expectations about prospects in the current and in future periods, borrowers will demand more loans and bankers will be willing to lend more in the current period. This will increase the overall proportion of loans in total assets of the current period. Hence, the lagged value of $GDPgr_t$ is expected to impact loan proportions positively. On the other hand, it can be expected to impact the proportion of SLR investments negatively because of the substitution effect, where with a rise in the relative returns and a fall in relative riskiness of loans, the proportion of SLR investments decreases.

The models also include two dummy variables[7] viz. YrD_t and $PubD_i$. YrD_t denotes a year dummy for 2009 which is defined as follows-

[7]Dummy variables are binary variables which divides the entire sample into two groups depending on a particular characteristic.

YrD = 1, if t = 2009

YrD = 0, otherwise

The year dummy for year 2009 basically denotes a dummy for financial year 2008-2009. One reason for choosing a year dummy for financial year 2008-09 was to control for the impact of the uncertainty caused by the 2007 global financial crisis on bank portfolio behaviour. While the year 2007-08 had witnessed problems in global financial markets, almost all commentators agree that the collapse of the financial services firm, Lehmann Brothers, in September, 2008, was the watershed event which precipitated a full fledged financial crisis, having generated widespread shock and uncertainty in financial markets. The impact of these events on expectations of economic agents is not captured by the lagged GDP growth variable and so a year dummy has been used to capture the same. Another reason for choosing year dummy for 2009 is to take into account the possible impact that transition from the Basel I to the Basel II [8]norm would have had on bank portfolio behaviour.

The Basel I norms for standardized risk based capital approach was recommended by the Basel Committee on Banking Supervision (BCBS) in 1988, was implemented in India in 1992 under the guidelines of RBI. The main focus of Basel I was to protect the banks from credit risk. It was successful in its motive of establishing a new discipline for banks in their management of credit risk and was adopted by more than 100 countries. However, the major shortcoming of Basel I was that it could not take into account the threat imposed on banks due to other forms of risks like operational risk, market risks, interest rate risk etc. This necessitated the introduction of Basel II by BCBS in June 2004. The Major objective of Basel II was to provide a more risk sensitive approach in calculation of risk based capital. Under Basel II, CRAR is calculated by taking into consideration not only the credit risk but also the market and operational risk. Apart from maintaining a minimum CRAR, Basel II also aims at 'supervisory review of an institution's capital adequacy and internal assessment process' and 'market discipline through effective disclosure to encourage safe and sound banking practices' (RBI, 2010a)

[8] Financial year 2008-09 is considered as the major transition period for Basel norms because by March 2009 all scheduled commercial banks were declared Basel II compliant (RBI, Annual Policy Statement, 2009-10)

$PubD_i$ is a public bank dummy which is being used to distinguish between public and private sector banks. It is defined as follows-

$PubD_i$ = 1 if *i* represents a public sector bank

$PubD_i$ = 0 if *i* represents a private sector bank

The purpose of using such a bank specific dummy is to account for the potential difference between public and private sector banks in terms of their asset portfolio behaviours. The coefficients of $PubD_i$ capture the difference in portfolio behaviour of public and private sector banks, holding all the other terms constant.

$PubD_iNPA_{i,\ t-1}$represents an interaction term between the public sector dummy and the $NPA_{i,t-1}$ variable. The coefficient of such a variable accounts for the difference between public and private sectors banks in terms of the NPA's impact on their asset composition. In a way it represents the slope difference with respect to the $NPA_{i,t-1}$ variable between public and private sector banks.

However, it may be noted that apart from the above discussed independent variables, a lagged value of the dependent variable is being used as an independent variable in both the models. Such use of a lagged value of the dependent variable makes the above models (given by equations (1) and (2)) a dynamic panel models. The present study allows for the possibility that, because of costs associated with portfolio adjustments, banks, seeking to build an optimal portfolio, may only carry out a partial adjustment of their portfolios during the period. Hence to allow for the modelling of such a partial adjustment mechanism, dynamic panel models have been used for empirical analysis.

In the present study commercial banks are assumed to optimise their decisions regarding portfolio allocation so as to achieve an optimal combination of risk and return. The two dependent variables which have been used in this study are the proportion of loans to total assets and proportion of SLR investments to total assets which represents the two most important components of the asset portfolio which banks targets to optimise. In this optimisation exercise they decide on an optimal level of these components which they target (or desire to achieve) in order to attain their optimal risk and return combination. In order to achieve the optimum level of a component, a bank is required to make a certain adjustment with respect to its value in the previous year which is given by $(Y_{i,t}^{*} - Y_{i,t-1})$, where the desired value of the

component in the current period is $Y_{i,t}^{*}$ and the actual value of the component in the previous period is $Y_{i,t-1}$. If a bank could make costless adjustments then, it will lead to a situation of perfect adjustment so that

$$Y_{i,t} - Y_{i,t-1} = Y_{i,t}^{*} - Y_{i,t-1}$$

where the left hand side expression denotes the actual adjustment achieved by the i^{th} bank.

In the presence of significant adjustment costs, however, banks would achieve only a part of their required adjustment so that

$$Y_{i,t} - Y_{i,t-1} = \lambda_t \ (Y_{i,t}^{*} - Y_{i,t-1}) \qquad (3)$$

where λ_t, measuring the degree of adjustment would usually lie between 0 and 1, making perfect adjustments a rare phenomenon.

One of the most important factors affecting the cost of portfolio adjustments and, therefore, the value of λ_t is the rate of growth of deposits in the economy which has been included in our model as an explanatory variable given by $TDgr_t$.

$TDgr_t$ denotes the growth rate of deposits in the entire banking system which remains same across the banks but varies across time. In a way it represents the degree of flexibility that banks have while making required adjustments to their previous year's asset composition, so as to achieve an optimal level this year. It is expected to have a negative coefficient because the average value of the loan to total asset ratio that can be achieved, for a given optimal value, will be higher in the case of low deposit growth than in the case of high deposit growth. This statement can be further explained through an example.

Let us suppose $Y_{i,t}^{*}$ is the optimal level of loans to total assets that a bank want to achieve in year t and let $Y_{i,t}^{*} > Y_{i,t-1}$ the ratio of loans to assets for the bank in the previous year. Now, in order to achieve its optimal value this year the bank has to increase its loan to total assets ratio by $Y_{i,t}^{*} - Y_{i,t-1}$ amount. With high deposit growth it is easier for the bank to increase its loan to total asset ratio by simply allocating more funds towards loans. Even with low deposit growth it can still increase its loan to total assets ratio by allocating a larger portion of its asset base into loans which will require high substitution of loans for other asset components. Therefore, under the

situation where positive adjustments have to made, rate of growth of deposits doesn't pose much of a constraint as cost of adjustment is not very high under this situation.

However, if $Y_{i,t}^{*} < Y_{i,t-1}$, where negative adjustments will be required to achieve its optimal level, then rate of growth of deposits may emerge as constraint for the banks as lower the rate of deposit growth, the higher will be the cost of adjustments in this case. This arises because of the downward rigidity in the amount of loans outstanding on the books of banks. Loans cannot be decreased easily as to decrease total amount of loans banks have to either call in their existing outstanding loans or have to stop renewing old loans in addition to restricting issues of new loans. Calling in existing loans or denying renewal of old loans or denying new loans to solvent existing customers will, in general, disrupt a bank's long term relationship with its customers, which will adversely impact their business in the long run.

Given this downward rigidity of loans, the only practicable way to decrease the loan to total assets ratio significantly is, by increasing their total asset size by a larger amount with respect to total loans. This increase in total asset size gets easier if the rate of growth of deposits is high. With high rate of growth of deposits banks can increase their total asset size without increasing their loans allocation proportionately, which will then decrease the overall loan to asset ratio. On the other hand, with low deposit growth the scope for such expansion of assets is limited and hence, banks will have to go for costly adjustments like denying renewal of old loans or recalling outstanding loans. This will make downward adjustment of the ratio of loan to total assets difficult in a situation of low deposit growth. Thus, it can be concluded that for a given optimal value, banks, owing to the downward rigidity in the quantity of loans extended, will have a higher average ratio of loan to total assets under low deposit growth than under high deposit growth.

The possibility that if, the required adjustment is negative, greater adjustment is, in general, possible in situations of high deposit growth can be represented very simply by the assumption that, if *y* represents the loans to assets ratio in (3), the degree of adjustment λ_t , is a linear function of the ratio of deposit growth in the economy to the required adjustment in the bank loans to asset ratio.

$$\lambda_t = \gamma_1 + \gamma_2 [TDgr_t / (Y_{i,t}^{*} - Y_{i,t-1})] \quad (4)$$

where $\gamma_1 > 0$ and $\gamma_2 < 0$

This equation suggests that if the required adjustment is negative i.e. $Y_{i,t}^{*} - Y_{i,t-1} < 0$, then the rate of adjustment would be more with the deposit growth than with low deposit growth. On the other hand if the required adjustment is positive i.e. $Y_{i,t}^{*} - Y_{i,t-1} > 0$ then rate of adjustment will be greater in the situation of low deposit growth. This is because in the case positive adjustments, in order to increase the loan to asset ratio, banks have to increase their loans more than proportionately to their assets, which is comparatively easy to do if the rate of growth of deposits is low.

Using (4) to substitute for λ_t in (3) we get

$$Y_{i,t} = (1 - \gamma_1)Y_{i,t-1} + \gamma_1 Y_{i,t}^{*} + \gamma_2 TDgr_t \quad (5)$$

The above equation shows that the actual asset shares that banks finally achieve for their different assets depend on the previous year's level of these assets and their optimal value, which in turn can be thought of as being determined by the various other factors discussed above. If $Y_{i,t}$ represents the loan to asset ratio then writing the optimal value $Y_{i,t}^{*}$ in (5) as a linear function of the independent variables used in equation (1) (other than the deposits growth and the lagged dependent variable), in fact, allows us to exactly derive the linear form in equation (1). Note that $\boldsymbol{\alpha_1}$, the coefficient of the lagged dependent variable in (1), is equal $(1 - \gamma_1)$, the intercept term for the degree of adjustment in (4), and $\boldsymbol{\alpha_{11}}$ the coefficient of the deposit growth variable in (1), is equal to γ_2, the slope coefficient in (4). It is also important to note that due to our assumption of $\gamma_2 < 0$ the coefficient of $TDgr_t$ is assumed to have a negative relationship with the actual ratio of loans to assets. Note that even if in the case of a positive desired adjustment in the loans ratio, we assume that the degree of adjustment is not dependent on the rate of deposit growth, the relationship between deposit growth and loan to asset ratio can be expected to be negative on average.

If instead of the loans to assets ratio, the variable $Y_{i,t}$ in (3)-(5) is used to represent the ratio of SLR investments to assets, then the presence of the lagged dependent variable on the right hand side of equation (2) can be justified on the basis of (3) and (4) in a similar manner, except that the constant γ_2 in this case is to be set equal to zero. This follows from the assumption that, because deposit growth does not have a direct effect on the cost of adjustment of the ratio of SLR investments to assets, it will not significantly affect the degree of adjustment in this case. Note that

$\boldsymbol{\beta}_1$, the coefficient of the lagged dependent variable in (2), is equal to (1- γ_1), where γ_1 is the constant degree of adjustment in (3).

3.4. MODEL ESTIMATION

For estimating the equations (1) and (2), a dynamic panel estimation technique has been used because when a dynamic panel model is estimated with other normal panel estimators like OLS, and GLS, it leads to a problem of dynamic panel bias or Nickell bias. A dynamic panel model, owing to the presence of a lagged dependent variable as one of its explanatory variables, suffers from the problem of endogeneity. The lagged dependent variable $Y_{i,t-1}$, being a function of unobserved individual level effects $\boldsymbol{\tau_i}$ and $\boldsymbol{\eta_i}$, in (1) and (2) respectively, gets correlated with the composite error term and turns into an endogenous variable for the model. Due to the presence of an endogenous variable as one of the explanatory variables, the strict exogenity[9] assumption of the model gets violated which leads to biased and inconsistent results for the coefficients when estimated by OLS and GLS techniques. Even within group estimators (fixed effects) estimators, where demeaning technique [10]is used to remove individual fixed effects, generates biased and inconsistent results for a dynamic panel model. This is the case because, by construction, the transformed lagged dependent variable term still remains correlated with the mean of the idiosyncratic error terms[11]. Therefore, dynamic panel models due to their inherent property of endogeneity cannot be estimated by normal panel regression techniques and, thus, needs to be estimated

[9]**Strict exogenity** assumption in terms of idiosyncratic errors for the regression model $Y_{it}=\mathbf{X}_{i,t}\,\alpha + a_i + u_{it}$ where **X** denotes the vector for k explanatory variables, can be given as follows-

$$E\,(u_{it}|\, X_{k1}, X_{k2}, \ldots X_{kT}, a_i) = 0, \quad t = 1, 2, \ldots, T\,.$$

This assumption implies that the idiosyncratic error *uit*should be uncorrelated with each explanatory variable across *all* time periods

$$E\,(\mathbf{X_{it}} u_{is}) = 0 \text{ for all s, t= } 0,1,2\ldots\ldots T$$

[10] The Fixed effect estimator, in order to remove the impact of individual- specific effect terms, 'a_i', subtract the individual's mean value of Y and each component of X (vector of explanatory variables) from the respective variable. This process of taking deviation with respect to individual means is referred to as the de-meaning process.

[11] The mean of the lagged dependent variable contains observation of Y from period 0 to T-1, and the mean error, which being conceptually subtracted from each u_{it} term, contains values of u_{it} from period 0 to T. As a result by construction the transformed lagged dependent variable still remain correlated with transformed error term as both will be containing their individual terms at t-1th period.

by some other set of estimators, which can control for the endogeneity bias in these models.

Hence, for the present study, the GMM estimator[12] technique has been used which resolves the bias due to both endogeneity as well as unobserved heterogeneity in dynamic panel models by adopting the instrument variable approach as proposed by Anderson and Hsiao (1982)

Anderson and Hsiao (1982), in order to solve the problem of endogeneity in dynamic panel models, proposed the use of second or higher lags of the dependent variable as instruments for the transformed lagged dependent variable. Such instruments could be either in the form of differences of higher lags or in the form of lagged levels. In other words, both $Y_{i,t-j}$ or $\Delta Y_{i,t-j}$ can be used as instruments for $\Delta\ Y_{i,t-1}$ provided $j \geq 2$. The GMM estimation technique exploits all such possible instruments.

Although, there are many regression estimators which use this instrument variable framework to estimate the dynamic panel model, the GMM estimator emerges as the most efficient estimator for dynamic panel model estimation because of the generalized method of moment technique which it uses while estimating the model. By using the generalized method of moment technique, the GMM estimator optimally exploits all the linear moment restrictions that follow from the assumption of no serial correlation in the errors in an equation which contains individual effects, lagged dependent variables and no strictly exogenous variables (Arellano and Bond, 1991). It takes into account all potential orthogonality conditions and hence, gives an efficient estimator even in the presence of heteroscedasticity of unknown form (Baum et al. (2003)). All these characteristics of GMM estimators, therefore, make them the most efficient form of estimator for dynamic panel models.

Apart from being dynamic in nature, there are certain other properties of the current models which necessitate the use of a GMM estimator for their analysis. Firstly, the model under study is based on panel data collected for 46 banks over a time period of 14 years, the number of years being much smaller than the number of panels. Secondly, the model consists of some pre-determined variables like $NPA_{i,t-1}$, $CRAR_{it-1}$and $GDPgr_t$, which are not strictly exogenous as they are expected to be correlated with past realisations of the error terms. And lastly, idiosyncratic

[12] GMM estimators are discussed in details in Roodman (2009)

disturbances of the model are expected to exhibit bank-specific patterns of heteroscedasticity and serial correlation. A GMM estimator, owing to its inbuilt assumptions, allows for such possibilities in the data generating process and hence, emerges as a suitable estimator for the models under estimation.

There are two forms of GMM estimators. One is the Difference GMM estimator which was proposed by Arellano and Bond (1991) and the other is the System GMM which is an augmented form of Difference GMM and was proposed by both Arellano and Bover (1995) as well as Blundell and Bond (1998). Under the Difference GMM estimator, the original model is first transformed using the first differencing transformation to eliminate the unobserved individual specific effect and then generalized method of moments is applied on such transformed regressors to estimate its coefficients. On the other hand, the System GMM estimator works with both the transformed as well as the original model to estimate the coefficients of the parameters. In the process of its estimation, the System GMM estimator in a way builds a system of two equations - the original model equation and the transformed form of it – wherefrom it derives its name. While working with the transformed equation it uses the same technique as the Difference GMM estimator, where it uses the lagged levels of $Y_{i,t-1}$ as instruments for $\Delta\ Y_{i,t-1}$. However, while working with the original model, it uses difference of lagged dependent variable i.e.$\Delta\ Y_{i,t-1}$ as instrument for $Y_{i,t-1}$ for which it makes an additional assumption of no correlation between first differences of instruments and the fixed effect error term i.e. $\boldsymbol{\tau_i}$ and $\boldsymbol{\eta_i}$. Unlike the Difference GMM approach, the System GMM approach, owing to its technique of using a system of equations, allows for the inclusion of time invariant regressors (like $PubD_i$ in (1) and (2)) in the estimation model. This makes it more advantageous to use the System GMM estimator than the Difference GMM estimator.

In the present study the Difference GMM estimator has been primarily used to estimate the empirical models even though use of the System GMM estimator is considered to be more advantageous than that of Difference GMM. This has been done because, the additional assumption that is required for using the System GMM estimator is not necessarily warranted in the current model, thus making its use inappropriate for model estimation. However, to test the second hypothesis of this study that basically analyse the difference between the response of public and private sector banks to NPAs in terms of their asset composition, the System GMM estimator

has been applied for the models with both $PubD_i$ and its interaction term with $NPA_{i,t-1}$ i.e.$PubD_iNPA_{i,t-1,}$ included among regressors.

While applying the Difference GMM method for estimating equations (1) and (2), the dummy variable $PubD_i$ and its interaction term with $NPA_{i,t-1}$i.e.$PubD_iNPA_{i,t-1,}$ are dropped from these equations. This is because $PubD_i$ represents a bank specific characteristic which stays constant over time. Estimating such time invariant fixed effect regressors by Difference GMM estimator is useless as such variables get eliminated in the transformed form of the original model which this estimator finally uses to estimate the coefficients of the model. Even the values of $PubD_iNPA_{i,t-1}$ variable will be zero for all values of *i* corresponding to private sector banks and so those values of $PubD_iNPA_{i,t-1}$ will in a way become redundant in estimation of the first difference form of the equation. When a variable is time invariant across all the cross sections (like *PubDi*) or for most of the cross sections (like $PubD_iNPA_{i,t-1}$) then value of such variables in their first difference form will be zero across all the individual in case of $PubD_i$ and for almost half of the cross section (the private sector banks) in case of $PubD_iNPA_{i,t-1}$. In such case estimation results for the coefficients of these variables will not be precise because the estimated standard errors will be very large compared to the estimated coefficient especially if the sample has been collected for a relatively small time period (Wooldridge, 2012).

Although GMM estimators deal consistently with the endogeneity problem of a dynamic panel data, the consistency of these estimators critically depend upon the assumption that lagged values of dependent and different endogenous explanatory variables are valid instruments for the model in which they are used. Hence to test the validity of this assumption in the present model, the following two tests were performed.

The first is Arellano and Bond's test for no serial correlation in the disturbances, which has been performed to check the validity of the instruments, as the presence of serial correlation among error terms might affect validity of some instruments. This test for autocorrelation is applied on the first difference error terms. This is done to remove the unobserved and perfectly correlated bank specific error term from the composite error. Autocorrelation of order 1, i.e. AR(1), is expected in first differences because $\Delta \boldsymbol{u_{i,t}}$ and $\Delta \boldsymbol{u_{i,t-1}}$(for equation (1)), owing to their common term $\boldsymbol{u_{i,t-1}}$will be correlated with each other. Similarly, $\Delta \boldsymbol{v_{i,t}}$ and $\Delta \boldsymbol{v_{i,t-1}}$ terms for

equation (2) will be correlated because of their common term $\boldsymbol{v_{i,t-1}}$. Therefore, to check for first order correlation in levels, one has to look at the AR(2) values in differences. AR(2) in differences implies that $\Delta\boldsymbol{u_{i,t}}$ and $\Delta\boldsymbol{u_{i,t-2}}$ (for equation (1)) are correlated. This correlation will be possible only if $\boldsymbol{u_{i,t-1}}$and $\boldsymbol{u_{i,t-2}}$will be correlated which would suggest an AR(1) in levels. Therefore, in general to check the autocorrelation of order t in levels, one will have to look into the autocorrelation of t+1 in the differences.

This test is important from the point of validity of instruments used. For example, if autocorrelation of order 2 is found in first differenced error terms then it would imply that in levels these error terms will be exhibit an autocorrelation of order 1. In such case, use of 1st lag term of all predetermined variables ($NPA_{i,t-1}$,$CRAR_{i,t-1}$, $GDPgr_{t-1}$) and 2nd lag term of the dependent variable as instruments of the respective variables will be invalid. This is because now the 2nd lag of dependent variable, i.e. $y_{i,t-2}$, will be correlated with $\boldsymbol{u_{i,t-1}}$term in the $\Delta\boldsymbol{u_{i,t}}$ (for equation 1) and hence will turn invalid as an instrument for $\Delta y_{i,t-1}$. Similarly, 1st lag of all pre-determined variables i.e., $NPA_{i,t-2}$, $CRAR_{i,t-2}$and $GDPgr_{t-2}$, will all be correlated with $\boldsymbol{u_{i,t-1}}$term in the $\Delta\boldsymbol{u_{i,t}}$ and hence will not be a valid instrument for $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$and $\Delta GDPgr_{t-1}$ respectively. A similar argument will hold for the idiosyncratic error term of second model i.e. $\boldsymbol{v_{i,t}}$. Thus, the non-rejection of the null hypothesis of this test (no serial correlation) implies the validation of the instruments used.

The second test in this regard is the Hansen J test of joint validity of the full instrument set, which tests whether the model is over identified or not. Hansen J statistic is the minimized value of the two step GMM criterion function[13] which is robust to heteroscedasticity and autocorrelation of errors within individuals (Roodman, 2009). Under the null hypothesis of this test, all the empirical moments have zero expectation, so the Hansen *J* statistic is distributed in chi square with degrees of freedom equal to the degree of over identification which is given by the difference in number of instruments used and the number of independent variables in the model (Roodman, 2009a). Failing to reject the null hypothesis implies the validity of all instruments used. However, Hansen J test gets weakened with the increase in the instrument count and thus gives an implausible p value of 1 where even an invalid instruments set might appear as valid. Therefore, in order to deal with this problem, robustness of the model has been checked by reducing the number of instruments by

[13]For detailed description refer Roodman (2009), pp 12-13

both restricting the lag length of the instruments used and by using the 'collapse' sub-option (discussed in detail in the next chapter).

It is important to note that, because the explanatory variables $NPA_{i,t-1}$, $CRAR_{i,t-1}$ and $GDPgr_t$ involve lags; they behave as pre-determined variables in the models. While estimating the models they are treated as endogenous variables as they are expected to be influenced by past error terms. Their correlation with the error term may follow from the possible interdependence between these variables and the composition of bank asset portfolios. Loan supply is an important determinant of NPAs (Samantaraya, 2016; Lokhare, 2014). The higher is the loan supply, the higher will be the chances of loans turning into NPAs in the future. This loan supply in turn depends on the asset composition which banks hold in their portfolio, thus making asset composition an important determinant of future NPAs. Similarly, CRAR being a ratio of bank capital to risk-weighted assets gets affected by the level of different components of assets that the banks hold in their portfolio. Since CRAR for a particular year is calculated at the end of that financial year, the asset composition of banks during that financial year will automatically influence the calculated value of CRAR for that year. Lastly, the reason for considering $GDPgr_t$ as partially endogenous arises from the possible dependence of GDP growth on credit growth. High credit growth implies high credit supply in the economy. This supply of credit in turn depends on the composition of the assets that banks hold. Therefore, if banks hold a higher proportion of loans in their asset portfolio then the supply of loans will be greater in the economy and *cet. par.* this can be expected to be associated with a higher rate of GDP growth.

3.5. DATA DESCRIPTION AND ISSUES

For estimation of the models outlined in section 3.3, bank-wise data has been obtained on 46 Indian banks for the period 2001-02 to 2014-15. The first half of the study period primarily represents the period of implementation of the second phase of banking sector reforms which was proposed by Narasimham Committee II and also the period before the onset of the global financial crisis in 2007. During this phase NPAs showed a declining trend, which was somewhat reversed after the financial year 2007-08 (Lokare, 2014). While a longer study period would always have been preferable, the unavailability of data on Repo rates for earlier years meant that the

present study had to be restricted to a time period of 14 years of the 46 scheduled commercial banks, which were selected for the study, 26 banks represent the public sector bank group and the remaining 20 banks forms the group of private sector banks (See Appendix Table No.1). The study was restricted to public sector and private sector banks because these banks account for the major portion of total banking activity as together their assets account for around 90% of total assets of all scheduled commercial banks operating in India. Secondly at present they contribute more than 90% of total bank credits and Investments of scheduled commercial banks in India. (Consolidated Asset and liabilities table for all scheduled commercial banks, RBI)

The dependent variables used in the above two models are the share of non-priority loans total assets and the share of SLR investments in total assets expressed in percent. Both the shares were calculated by taking their outstanding amounts as of end March of every year.

In India, the financial year for banks runs from the 1st of April of a particular year to the 31st March of the subsequent year. Accordingly, the year 2002 corresponds to the period 2001-02 (April – March) and so on, for the other years under study.

The set of independent variables can be divided into two groups - bank-specific variables and macroeconomic or aggregate variables. All the variables are expressed in percentage form. Data for all the bank specific variables were obtained from 'Statistical Tables related to Banks in India' and 'Basic Statistical Return of Scheduled Commercial Banks in India'. These are published annually by Reserve Bank of India and provide the annual audited data on the balance sheet and profit and loss accounts of individual banks. All the macroeconomic variables are obtained from 'Handbook of Statistics on the Indian Economy' which is also published by RBI on annual basis.

Bank-specific variables include the gross non-performing assets to total capital ratio, where total capital for respective banks were calculated as the sum of their capital funds and capital reserves, and CRAR, which denotes the difference between the actual CRAR of respective banks and the minimum CRAR that banks are required to maintain. Initially, the minimum CRAR prescribed by RBI was 8%, which was then increased to 9% from 1st April 1999. Till now this prescribed ratio has been kept fixed at 9% on a continuing basis, though the other norms related to capital adequacy

have been made more stringent with the introduction of the Basel II accord. In India all scheduled commercial banks completely shifted to Basel II norms from the financial year beginning in April 2009 as RBI mandated that all banks had to comply with the Basel II norms completely by 31st March 2009.

Different macro-economic variables considered in the models are the lagged value of the GDP growth rate ($GDPgr_t$) Repo rate denoted by $REPO_t$, SLR rate given by SLR_t, interest rates on government securities denoted by $Groi_t$ and the rate of growth of total deposits which is denoted by $TDgr_t$. These are all bank invariant variables. For calculating $GDPgr_t$, real GDP values at market prices with new base index (2011-12 =100) were used. Data for GDP growth from 2001-02 to 2010-11 were given according to base index (2004-05=100) which was then converted in new base index by applying splicing method. The values of the nominal Repo rate and SLR for a particular financial year were calculated by taking the time weighted average of the different values of these variables prevailing during the year. The weight used for a particular value was the number of days for which the variable assumed that value during the year. The variable $REPO_t$, defined as the real repo rate, was calculated by deducting the WPI inflation rate from this weighted average of nominal repo rates announced by the RBI. $Groi_t$ similarly represents the average real interest rate on dated central government securities. Data on rate of interest on central government securities were available as in the form of weighted average of the nominal rates of government securities for different maturities. These data were then converted to its real value by deducting WPI inflation rate from the weighted average of nominal values.

To analyse the average value, standard deviation, minimum value and maximum value of all the variables that has been used in the present study, refer to Table 2 in the Appendix.

CHAPTER IV

RESULTS AND ANALYSIS

4.1. INTRODUCTION

In the present study, the dynamic panel models, discussed in the previous chapter, were estimated by employing GMM estimators. The GMM estimation technique, as has been discussed before, is a dynamic panel data estimation technique which controls for dynamic panel bias by using Instrument Variable approach as proposed by Anderson and Hsiao (1982). Among the two GMM estimators - Difference GMM and System GMM - Difference GMM has been used for the main exercise of model estimation and the results obtained have been used to draw out the major inferences of the study. However, in order to examine the second hypothesis of our study, that there is a significant difference in the response of public and private sector banks to rising NPAs, the System GMM technique has been used

The Difference GMM procedure was used to estimate the following two equations –

$$L_{i,t} = \alpha_0 + \alpha_1 L_{i,t-1} + \alpha_2 YrD_i + \alpha_4 NPA_{i,t-1} + \alpha_6 CRAR_{i,t-1} + \alpha_7 GDPgr_{t-1} + \alpha_8 REPO_t + \alpha_9 SLR_t + \alpha_{10} Groi_t + \alpha_{11} TDgr_t + \varepsilon_{i,t} \quad \textbf{(6)}$$

$$I_{i,t} = \beta_0 + \beta_1 I_{i,t-1} + \beta_2 YrD_i + \beta_4 NPA_{i,t-1} + \beta_6 CRAR_{i,t-1} + \beta_7 GDPgr_{t-1} + \beta_8 REPO_t + \beta_9 SLR_t + \beta_{10} Groi_t + \mu_{i,t} \quad \textbf{(7)}$$

It is important to note that the above two equations, do not contain the variable $PubD_i$ and its interaction term with $NPA_{i,t-1}$i.e. $PubD_i.NPA_{i,t-1}$. This is because $PubD_i$ is a time invariant variable (whose first difference is identically equal to zero) for all values of i and $PubD_i.NPA_{i,t-1}$ is a time invariant variable for all values of i corresponding to private sector banks. A time invariant variable gets omitted under

the first difference transformation in the Difference GMM procedure. Hence, the estimated results that Difference GMM estimator gives for their coefficients are expected to be bias and unreliable. Similarly, as Roodman (2009) argues, in Difference GMM estimation one should avoid using an explanatory variable such as $PubD_iNPA_{i,t-1}$, which is time invariant for a large number of values of *i,* because it will generate same kind of bias as in case of atime-invariant variable. However, to estimate the effects of these variables, the System GMM estimator has been employed on the original models (given by equations (1) and (2)), as the System GMM estimator, owing to the additional assumptions made in applying it, allows for the inclusion and estimation of such time invariant variables.

4.2. RESULTS FOR THE FIRST HYPOTHESIS

The results obtained from applying the Difference GMM procedure for estimation of equation (6), the loans model, are provided in Tables 4.1 and 4.2, and the results obtained for equation (7), the SLR investments model, are provided in Tables 4.3 and 4.4 While estimating these equations $NPA_{i,t-1}$,$CRAR_{i,t-1}$ and $GDPgr_{t-1}$ were treated as partially endogenous variables[1]and hence were instrumented with suitable lags of their levels variables. Apart from this, all available lagged levels of $L_{i,t}$ were also used as instruments for endogenous lagged $L_{i,t}$. Details regarding the different sets of instruments have been provided in notes to each table. The validity of these instruments has been assessed by means of the Hansen J test of over-identification restrictions and by the Arellano-Bond test for auto-correlation. The p-values of these tests are given in the bottom rows of each table as 'Hansen(p)' and 'AR(q)p' where 'q' denotes the order of auto correlation. The main results of our study are robust to variations in the set of instruments and lags used for estimation. This is indicated through the different columns of each table. The different columns of a table represent estimation results for the same model with different choices of lag lengths used in selecting lagged values as instruments for endogenous variables. All the other variables viz. $REPO_t$, SLR_t, $Groi_t$, $TDgr_t$ and YrD_t are taken as strictly exogenous variables and hence act as their own instruments.

[1]Partially endogenous variable or partially exogenous variables are those which are causally influenced by factors within the model as well as factors outside the model. In other words, we can say that any variable in the model which are partially and not wholly determined by the variables in the model are called partially endogenous variable

Further, to check the robustness of estimation results across one-step and two-step GMM estimators[2], estimation results for equation (6) using the one-step and the two-step Difference GMM estimators have been reported in Tables 4.1 and 4.2 respectively. Similarly, Tables 4.3 and 4.4 respectively gives the estimation results for equation (7) in case of the one-step and the two-step difference GMM estimators. Heteroscadasticity-robust standard errors are reported in all cases. The column (*j*) (*j* = 1, 2,…, 5) in Table 4.1 reports the estimation results for the same specification (and the same choice of instruments) as the column (*j*)of Table 4.2. Similarly, the column (*j*) (*j* = 1, 2,…, 5) in Table 4.3 reports results for the same specification (and the same choice of instruments) as the column (*j*)of Table 4.4. For example, if column (1) of Table 4.1 contains the estimation results for equation (6) using the one-step Difference GMM estimator, where all the available lags of each untransformed endogenous variable have been allowed as instruments of the first difference of that variable, then column (1) of Table 4.2 will contain the results for equation (7) using the two-step Difference GMM estimator, for the same choice of instruments. The results were computed using the xtabond2 command in Stata[3] which allows for the finite sample correction proposed by Windmeijer (2005) for standard errors reported in case of the two-step estimator. Without such correction these standard errors suffer from severe downward bias.

4.2.1. Results for Loans Model

The regression results given for equation (6) in Tables 4.1 and 4.2 below confirm the existence of a negative and statistically significant impact of the ratio of NPAs to bank capital on the share of non-priority loans in bank asset portfolios. These results are in line with our expectation that with an increase in riskiness due to rising NPAs, banks will show a tendency to reduce their loan holdings in relation to their

[2]Two step and one step differs in terms of their construction as both uses different weights for their covariance matrix. Although both one step and two step produces consistent results, two step is considered to be more asymptotically efficient as it uses consistent covariance matrix from one step GMM estimator. However, two-step GMM estimators reports standard errors which are severely downward bias. To correct this downward bias Windmeijer (2005) proposed a correction called finite sample correction which controls this downward bias in Two-step GMM estimator's standard errors.

[3] David Roodman in 2003 introduced the program Xtabond2 which implements both the GMM estimators. It is not an official Stata command but can be installed using SSC. Here it has been used in version 12 of Stata.

total assets. According to the estimated results, an increase in the ratio of NPAs to total capital by 1 percentage point in a particular year will lead to a fall of 0.0001 percentage points in the ratio of loans to total assets in the subsequent year[4]. Although the magnitude of such negative impact is small, the impact seems to be statistically significant at 5 percent level of significance. This implies that there is not more than 5 per cent probability that a mistake is being made by using our results to infer that bank NPAs have an impact on loan holdings. Almost all the specifications in both Tables 4.1 and 4.2 indicate similar results (in terms of both magnitude and statistical significance) for the impact of NPAs on the share of loans. This shows that the estimated results for its coefficient are robust to the choice of instruments and Difference GMM estimators (one step and two step GMM estimators).

With regard to other variables, the lagged value of the GDP growth rate shows the expected positive impact on the ratio of loans to total assets. The results suggest that with a percentage point increase in the GDP growth rate for a particular year, a bank's share of loans increases on an average by around 1.05 percentage points in the subsequent year. This impact of GDP growth, taken as a proxy for the state of loan demand in the economy is statistically significant even if the level of significance is fixed at 0.1 percent.

Again, the estimated coefficients of $REPO_t$ and SLR_t are found to be negative which implies that these variables impose, as expected, a negative impact on a bank's share of loan holdings in total assets. Although the impact of SLR seems to be statistically insignificant at 5 percent level of significance, the impact of Repo rate is found to be statistically significant even at 0.1 percent level of significance. The estimated coefficient of $REPO_t$ suggests that, 1 percentage point increase in the cost of liquidity measured by the REPO rate induces banks to decrease the share of illiquid assets and reduce the ratio of loans to total assets by around 1.8 percentage points.

[4] Ratio of capital to total asset of all banks for our study period lies roughly in the range 0.7 - 2.0. This suggests that on an average 1 unit increase in ratio of NPAs to total capital is roughly equal to 0.74 unit increase in NPAs to Total Assets.

Table 4.1: Estimation Results for Share of Non-Priority Loans
(One-Step Difference GMM estimator)

$L_{i,t}$	(1)	(2)	(3)	(4)	(5)
$L_{i,t-1}$	0.1063	0.1012	0.1054	0.1064	0.1098
	(-0.1050)	(0.1102)	(0.0996)	(0.1022)	(0.1071)
$YrD09_t$	-1.1462**	-1.0063	-1.1130*	-1.1375**	-1.1156*
	(0.5508)	(0.6703)	(0.5757)	(0.5554)	(0.5919)
$NPA_{i,t-1}$	-0.0001**	0.0002**	-0.0002**	-0.0001***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)
$CRAR_{i,t-1}$	0.3903*	0.6304	0.4452*	0.4045*	0.4584
	(0.2078)	(0.4111)	(0.2558)	(0.2200)	(0.3408)
$GDPgr_{t-1}$	1.0573****	1.0455****	1.0540****	1.0560****	1.0506****
	(0.1129)	(0.1120)	(0.1105)	(0.1117)	(0.1119)
$REPO_t$	-1.8380****	-1.8391****	-1.8367****	-1.8370****	-1.8375****
	(0.2954)	(0.3151)	(0.3016)	(0.2975)	(0.3046)
SLR_t	-0.3607*	-0.3729*	-0.3641*	-0.3616*	-0.3578*
	(0.1972)	(0.2070)	(0.1913)	(0.1932)	(0.1955)
$Groi_t$	-1.5378****	-1.4747****	-1.5220****	-1.5332****	-1.5200****
	(0.2706)	(0.3099)	(0.2801)	(0.2734)	(0.2896)
$Tdgr_t$	-0.0855****	-0.0843****	-0.0852****	-0.0854****	-0.0846****
	(0.0147)	(0.0151)	(0.0145)	(0.0146)	(0.0149)
J	246	48	138	183	48
Hansen_df	237	39	129	174	39
Hansen(p)	1	0.290	1	1	0.32
AR(2)p	0.086	0.10	0.088	0.086	0.075
F(p)	0.000	0.000	0.000	0.000	0.000

Notes: **p<0.1; **p<0.05; ***p<0.01; ****p<0.001*

Results given in this table are obtained by employing two–step GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable; different columns represent results with different sets of lagged levels instruments. In Column (1) lag2 and higher (i.e. all available lags) of $L_{i,t}$ are taken as instruments for $\Delta L_{i,t-1}$ and lag 1 and higher (i.e. all available lags) of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ are allowed to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta \text{GDPgr}_{t-1}$ respectively. In column (2) only lag2 of $L_{i,t}$ is used as instruments of $\Delta L_{i,t-1}$ and lag1 of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ is used to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (3), lag2 to lag5 of $L_{i,t}$ and lag1 to lag4 of all predetermined variables are chosen as instruments for $\Delta L_{i,t-1}$ and all first differenced predetermined variables (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$) respectively. Similarly, in column (4) lag2 to lag7 of $L_{i,t}$ and lag1 to lag6 of all predetermined variables are taken as instruments for $\Delta L_{i,t-1}$ and for all first differenced predetermined variables respectively. Lastly, in column (5) all lags available for $L_{i,t}$ starting from lag2 and all lags available for predetermined variables starting from lag1 are taken as instruments but here, unlike in column 1, these GMM style instruments are created with a collapse sub-option; J denotes total count of instruments used in estimation; Hansen_df gives degrees of freedom for Hansen J test of over-identifying restrictions which gives the number of over-identified restrictions used for each specification of lags; Hansen(p) gives p value for Hansen J test; AR(2)p gives p value for Arellano Bond autocorrelation test for absence of second order serial correlation in the first difference residuals; F(p) represents the p value for F test of overall fit of the model. Significant p value suggests the estimated model to be fine.

Table4.2: Estimation Results for Share of Non-Priority Loans
(Two-Step Difference GMM estimator)

$L_{i,t}$	(1)	(2)	(3)	(4)	(5)
$L_{i,t-1}$	0.1148	0.1131	0.1096	0.1136	0.1082
	0.1096	0.1283	0.1039	0.1051	0.1071
$YrD09_t$	-1.1300*	-0.9836	-1.1125*	-1.1046*	-1.1446*
	0.5804	0.7214	0.5914	0.5639	0.6218
$NPA_{i,t-1}$	-0.0001**	-0.0002*	-0.0002**	-0.0002***	-0.0002***
	0.0001	0.0001	0.0001	0.0000	0.0001
$CRAR_{i,t-1}$	0.4015*	0.6280	0.4598	0.4180*	0.4614
	0.2130	0.4157	0.2843	0.2257	0.3477
$GDPgr_t$	1.0519****	1.0260****	1.0492****	1.0523****	1.0384****
	0.1150	0.1365	0.1108	0.1126	0.1111
$REPO_t$	-1.8414****	-1.8721****	-1.8370****	-1.8311****	-1.7982****
	0.3048	0.3767	0.3109	0.3093	0.3079
SLR_t	-0.3466*	-0.3500	-0.3533*	-0.3673*	-0.3769*
	0.2009	0.2428	0.2076	0.2042	0.2139
$Groi_t$	-1.5308****	-1.4938****	-1.5149****	-1.5121****	-1.4886****
	0.2797	0.3458	0.2890	0.2872	0.2891
$Tdgr_t$	-0.0848****	-0.0834****	-0.0847****	-0.0844****	-0.0830****
	0.0149	0.0163	0.0146	0.0146	0.0146
J	246	48	138	183	48
Hansen_df	237	39	129	174	39
Hansen(p)	1	0.29	1	1	0.32
AR(2)p	0.088	0.14	0.10	0.08	0.11
F(p)	0.000	0.000	0.000	0.000	0.000

Notes: **p<0.1; **p<0.05; ***p<0.01; ****p<0.001*

Results given in this table are obtained by employing two–step GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable and are corrected by Windmeijer finite sample correction; different columns represent results with different sets of lagged levels instruments. In Column (1) lag2 and higher (i.e. all available lags) of $L_{i,t}$are taken as instruments for$\Delta L_{i,t-1}$and lag 1 and higher (i.e. all available lags) of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ are allowed to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (2) only lag2 of $L_{i,t}$is used as instruments of $\Delta L_{i,t-1}$ and lag1 of $NPA_{i,t-1}$,$CRAR_{i,t-1}$, and $GDPgr_{t-1}$ is used to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (3), lag2 to lag5 of $L_{i,t}$ and lag1 to lag4 of all predetermined variables are chosen as instruments for $\Delta L_{i,t-1}$ and all first differenced predetermined variables (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$) respectively. Similarly, in column (4) lag2 to lag7 of $L_{i,t}$ and lag1 to lag6 of all predetermined variables are taken as instruments for $\Delta L_{i,t-1}$ and for all first

differenced predetermined variables respectively. Lastly, in column (5) all lags available for $L_{i,t}$ starting from lag2 and all lags available for predetermined variables starting from lag1 are taken as instruments but here, unlike in column 1, these GMM style instruments are created with a collapse sub-option; J denotes total count of instruments used in estimation; Hansen_df gives degrees of freedom for Hansen J test of over-identifying restrictions which gives the number of over-identified restrictions used for each specification of lags; Hansen(p) gives p value for Hansen J test; AR(2)p gives p value for Arellano Bond autocorrelation test for absence of second order serial correlation in the first difference residuals; F(p) represents the p value for F test of overall fit of the model. Significant p value suggests the estimated model to be fine.

The estimation results imply that the rate of interest on government securities given by $Groi_t$, imposes a negative impact on the ratio of loans to total assets. This result is in line with our expectation because $Groi_t$, taken as a proxy for the rates of return on alternative assets, represents the bank's opportunity cost of holding loans. The estimated values of the coefficient of $Groi_i$, suggest that if the rate of interest on government securities increases by a percentage point then banks will decrease the share of loans in their asset portfolio by around 1.5 percentage points because now their opportunity cost of holding loans will be high. These results for $Groi_t$ are also found to be statistically significant at 0.1 percent of level of significance.

Finally, the estimated coefficient for $TDgr_t$ shows a negative sign which is in line with the theoretical assumption that the degree of adjustment of the actual to the optimal value of the loan to asset ratio is negatively related to the ratio of the growth rate of deposits to the required amount of adjustment (given by $\boldsymbol{\alpha_{11}} < 0$)**.** The rate of growth of deposits, as mentioned in the previous chapter, represents the primary factor affecting a bank's cost of adjusting the share of loans in its portfolio. Higher is the rate of growth of deposits in the economy, lower will be the average ratio of loan to asset ratio that a bank can attain for a given optimal value. Also, the estimated results are statistically significant at 0.1 percent level of significance.

Apart from the above variables, for the variable $CRAR_{i,t-1}$, the estimated values of the coefficient have the expected positive sign but, are not statistically significant at 5 per cent level with any set of instruments. Again, the estimated coefficient of the year dummy $YrD09_t$ is negative, which suggests that the share of bank loans in bank asset portfolios decreased in the financial year 2008-09. The negative sign can be explained if we allow that the global financial crisis of 2007 and the transition to a new set of Basel norms might have induced banks to decrease their share of loan holdings, as loans entail more risk. However, $YrD09_t$ is found to be statistically

significant at only 10 percent level of significance in three of the five specifications for the one-step estimator and in almost all specifications for the two-step estimator which suggest that probability that the inference made regarding such impact of year 2008-09 might be incorrect is 10 percent.

The coefficient of the lagged dependent variable shows the speed of adjustment for the banks when there is no growth in bank deposits. The lower is this coefficient; the higher is the speed with which banks can adjust to their desired levels of the loan to assets ratio. From the point of view of stability this coefficient should be less than unity and should lie within or near the dynamic stability range[5]. According to the results in Tables 4.1 and 4.2, the estimated value of the coefficient, in almost all the specification, is less than unity and lies near the dynamic stability range which is given by (0.113-0.182). This shows that the model under study is stable. However, the implication of this value being not significant at 5% level in all specifications suggests that the speed of adjustment in the loans to assets ratio is almost proportional to the rate of growth of bank deposits.

Overall, the diagnostic test results for this model are satisfactory. From the AR(2)p values we can infer that there is no second order auto-correlation in first differenced error terms. This implies absence of first order correlation in errors in their levels. This validates the inclusion of the second lag of $L_{i,t}$ and the first lag of all predetermined variables ($NPA_{i,t-1}$, $CRAR_{i,t-1}$, $GDPgr_t$) in different sets of instruments used for estimation. Again, the Hansen J test p value, for all the instrument specifications, suggests that we cannot reject the validity of over-identifying restrictions. However, with proliferation of instruments Hansen test gets weakened and produces implausible p-values close to 1 as in case of the p-values in columns 1, 3 and 4 in both the tables. Therefore, to improve the functioning of Hansen J test and to check whether the results obtained with no restrictions on the number of

[5]Dynamic stability range is defined by the coefficient value of the lagged dependent variable obtained in OLS regression and fixed effect regression. The upper limit of this range is given by the value of the coefficient obtained in the OLS regression because under OLS regression, owing to the positive correlation between the lagged dependent variable and the error term, this coefficient possesses an upward bias whereas, the lower limit of this range is given by the coefficient obtained under fixed effects regression as with fixed effects this coefficient possesses a downward bias due to the presence of the negative sign of u_{it-1} in the transformed error term. Given the opposite directions of the bias present in the estimation results for these two estimators, the consistent estimate for the lagged dependent variable should lie between these two values or near the range defined by these two values. (Roodman, 2009)

instruments are robust, we estimated the same model by restricting our set of instruments to lag 2 of $L_{i,t}$ and lag 1 of all predetermined variables (results given in column 2 of each table) and also by using the collapse sub-option [6] for GMM style instruments (results given in column 5 of each table). The results obtained under these two lag specifications have satisfactory Hansen-p values of 0.29 and 0.32 respectively, which suggests the non-rejection of the validity of our instruments. It is also important to note that the results obtained under these two cases are similar to the results obtained under other lag specifications where the number of instruments used was high. This suggests the robustness of our results to various choices of lag lengths. Overall, the results obtained for One-Step and Two-step GMM estimators are also similar as can be seen by comparing the results of Tables 4.1 and 4.2.

4.2.2. Results for SLR Investments Model.

The estimation results for equation (7) are given in Tables 4.3 and 4.4. While the positive coefficient of $NPA_{i,t-1}$ is expected as it indicates that a higher NPA to capital ratio in a particular year leads to higher share of SLR investments in a bank's asset portfolio in the subsequent year, the positive value of the coefficient signifying such an impact is not statistically significant at 5 percent level of significance. Further, from the estimated results it seems that only $GDPgr_{t-1}$, $REPO_t$ and $CRAR_{i,t-1}$have a statistically significant impact on the share of SLR investments in a bank's asset portfolio. $GDPgr_t$ as expected has a negative impact on the share of SLR investments and this impact is significant even at 0.1 percent level of significance. Again, the estimated coefficient of the $REPO_t$ variable is positive and is statistically significant at 5 percent level of significance under most of the lag specifications. A positive sign for its coefficient suggests that any increase in the cost of liquidity, by inducing banks to hold more liquid assets, increases the share of SLR investments in a bank's asset portfolio.

[6] 'Collapse' sub-option collapses the instrument matrix into single column. "It embodies the same expectation but conveys slightly less information since it generates single moment condition given by $\sum_{i,t} y_{i,t-2}\, \hat{u}_{it}^{*}=0$ " (Roodman, 2009) This helps to manage the count of instruments as under un-collapsed form number of instruments generated are quadratic in T (total time period). This is because in standard, un-collapsed form, each instrumenting variable generate one column for each time period and lag available for that time period. Here collapse option is been used to manage the instruments count as proliferation of instrument count weakens the Hansen J test. Therefore, the p value of Hansen J test obtained in column (5) is primarily used to report the validity of the instruments used.

Table 4.3: Estimation Results for share of SLR investments
(One-Step GMM estimator)

$I_{i,t}$	(1)	(2)	(3)	(4)	(5)
$I_{i,t-1}$	0.18853	0.19486	0.18687	0.18967	0.19520
	(0.12060)	(0.13028)	(0.12538)	(0.12240)	(0.12704)
$YrD09_t$	0.43766	0.37206	0.41055	0.43780	0.38253
	(0.83361)	(0.96069)	(0.85851)	(0.84069)	(0.92070)
$NPA_{i,t-1}$	0.00001	0.00035*	0.00007	0.00002	0.00005
	(0.00023)	(0.00019)	(0.00024)	(0.00023)	(0.00023)
$CRAR_{i,t-1}$	-0.32065**	-0.50393	-0.37650**	-0.32694**	-0.52477**
	(0.15404)	(0.31080)	(0.18391)	(0.15733)	(0.25720)
$GDPgr_t$	-0.74891****	-0.70648****	-0.74245****	-0.74666****	-0.73133****
	(0.12326)	(0.11527)	(0.12262)	(0.12302)	(0.12451)
$REPO_t$	1.02898**	1.01690*	1.03077**	1.02827**	1.05350**
	(0.46401)	(0.52933)	(0.47415)	(0.46685)	(0.49731)
SLR_t	-0.23092	-0.20064	-0.22596	-0.22990	-0.23702
	(0.21264)	(0.21877)	(0.21206)	(0.21324)	(0.21773)
$Groi_t$	0.40841	0.36403	0.39713	0.40702	0.38305
	(0.44453)	(0.51313)	(0.45368)	(0.44762)	(0.48465)
J	246	48	138	216	48
Hansen_df	238	40	130	208	40
Hansen(p)	1	0.37	1	1	0.32
AR(2)p	0.12	0.07	0.09	0.12	0.09
F(p)	0.000	0.000	0.000	0.000	0.000

Notes: **p<0.1; **p<0.05; ***p<0.01; ****p<0.001*

Results given in this table are obtained by employing one –step GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable; different columns represent results with different sets of lagged levels instruments. In Column (1) lag2 and higher (i.e. all available lags) of $I_{i,t}$ are taken as instruments for $\Delta I_{i,t-1}$and lag 1 and higher (i.e. all available lags) of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ are allowed to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (2) only lag2 of $I_{i,t}$is used as instruments of $\Delta I_{i,t}$ and lag1 of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ is used to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (3), lag2 to lag5 of $I_{i,t}$ and lag1 to lag4 of all predetermined variables are chosen as instruments for $\Delta I_{i,t-1}$ and all first differenced predetermined variables (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$) respectively. Similarly, in column (4) lag2 to lag9 of $I_{i,t}$ and lag1 to lag8 of all predetermined variables are taken as instruments for $\Delta I_{i,t}$ and for all first differenced predetermined variables respectively. Lastly, in column (5) all lags available for $I_{i,t}$ starting from lag2 and all lags available for predetermined variables starting from lag1 are taken as instruments for their respective variables. However, here unlike in column 1, these GMM style instruments are created with a collapse sub-option; J denotes total count of instruments used in estimation; Hansen_df gives degrees of freedom for Hansen J test of over-identifying restrictions which gives the number of over-identified restrictions used for each specification of lags; Hansen(p) gives p value for Hansen J test; AR(2)p gives p value for Arellano Bond autocorrelation test for absence of second order serial correlation in the first difference residuals; F(p) represents the p value for F test of overall fit of the model. Significant p value suggests the estimated model to be fine.

Table 4.4: Estimation Results for share of SLR investments
(Two-Step GMM estimator)

$I_{i,t}$	(1)	(2)	(3)	(4)	(5)
$I_{i,t-1}$	0.18674	0.19713	0.18565	0.18677	0.19415
	(0.12075)	(0.14703)	(0.12911)	(0.12158)	(0.13034)
$YrD09_t$	0.43602	0.43876	0.41541	0.41873	0.38021
	(0.83807)	(0.92708)	(0.86790)	(0.84527)	(0.94704)
$NPA_{i,t-1}$	0.00001	0.00035*	0.00006	0.00002	0.00005
	(0.00023)	(0.00021)	(0.00023)	(0.00023)	(0.00023)
$CRAR_{i,t-1}$	-0.30973*	-0.48624	-0.36323*	-.31879**	-.52805**
	(0.15585)	(0.29722)	(0.18122)	(0.15716)	(0.25866)
$GDPgr_{t-1}$	-.74448****	-.69515****	-.73165****	-.74128****	-.72431****
	(0.12362)	(0.11556)	(0.11991)	(0.12188)	(0.12359)
$REPO_t$	1.03595**	1.04970**	1.01024**	1.03213**	1.05056**
	(0.46265)	(0.49893)	(0.47799)	(0.46695)	(0.49944)
SLR_t	-0.23695	-0.23329	-0.21746	-0.23372	-0.24647
	(0.21351)	(0.20811)	(0.21494)	(0.21428)	(0.22584)
$Groi_t$	0.41692	0.40883	0.39144	0.41217	0.38050
	(0.44347)	(0.47814)	(0.45853)	(0.44553)	(0.48393)
J	246	48	138	216	48
Hansen_df	238	40	130	208	40
Hansen(p)	1	0.372201	1	1	0.323943
AR(2)p	0.089369	0.087775	0.086929	0.088129	0.113082
F(p)	0.000	0.000	0.000	0.000	0.000

Notes: **p<0.1; **p<0.05; ***p<0.01; ****p<0.001*

Results given in this table are obtained by employing one –step GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable and are corrected by Windmeijer (2005) finite sample correction; different columns represent results with different sets of lagged levels instruments. In Column (1) lag2 and higher (i.e. all available lags) of $I_{i,t}$ are taken as instruments for $\Delta I_{i,t-1}$and lag 1 and higher (i.e. all available lags) of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ are allowed to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (2) only lag2 of $I_{i,t}$is used as instruments of $\Delta I_{i,t}$ and lag1 of $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$ is used to instrument $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$ respectively. In column (3), lag2 to lag5 of $I_{i,t}$ and lag1 to lag4 of all predetermined variables are chosen as instruments for $\Delta I_{i,t-1}$ and all first differenced predetermined variables (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$) respectively. Similarly, in column (4) lag2 to lag9 of $I_{i,t}$and lag1 to lag8 of all predetermined variables are taken as instruments for $\Delta I_{i,t}$ and for all first differenced predetermined variables respectively. Lastly, in column (5) all lags available for $I_{i,t}$ starting from lag2 and all lags available for predetermined variables starting from lag1 are taken as instruments for their respective variables. However, here unlike in column 1, these GMM style instruments are created with a collapse sub-option; J denotes total count of instruments used in estimation; Hansen_df gives degrees of freedom for Hansen J test of over-identifying restrictions which gives the number of over-identified restrictions used for each specification of lags; Hansen(p) gives p value for Hansen J test; AR(2)p gives p value for Arellano Bond autocorrelation test for absence of second order serial correlation in the first difference residuals; F(p) represents the p value for F test of overall fit of the model. Significant p value suggests the estimated model to be fine.

Lastly, the estimated coefficient of $CRAR_{i,t-1}$ has a negative sign, which is in line with our expectation. This negative coefficient implies that with a fall in the difference between actual CRAR and required CRAR, banks, in order to decrease the extent of their solvency risk, would prefer to increase the share of SLR investments in their total assets. However, by comparing across different columns of the Tables 4.3 and 4.4., it can be seen that estimated value of the coefficient for $CRAR_{i,t-1}$ is quite sensitive to the choice of instrument sets used for estimation. The estimated value is also not significantly different from zero for some of the instrument sets when the two-step Difference GMM estimator is applied. This suggests that the results obtained for $CRAR_{i,t-1}$ are not particularly robust to either the choice of lag lengths of instrument sets or to the choice of the Difference-GMM estimator (one-step or two-step GMM estimator). Therefore, the negative impact of CRAR on the share of SLR investments cannot be taken to have been conclusively established.

Apart from the variables discussed above, $YrD09_t$, $Groi_t$ and SLR_t do not seem to have any statistically significant impact on the share of SLR investments. Although the coefficients of $Groi_t$ and $YrD09_t$ possess the expected positive sign, the coefficient of SLR_t, contrary to our expectation, possesses a negative sign. As discussed in the next chapter, such a negative sign of the SLR_t coefficient might exist due to the lack of any binding effect of SLR regulations on bank decision regarding SLR investments.

Finally, the results reported in Tables 4.3 and 4.4, indicate that the coefficient of lagged dependent variable $I_{i,t-1}$, for almost all the instrument specifications, is less than unity and lies near the dynamic stability range, which for this model is given by (0.1819 - 0.2122). This shows that the second model is fine from the point of view of stability.

The overall results of the diagnostic tests seem to be satisfactory. The p-value for the Hansen test is plausible (and in the desired range) when the instruments count is reduced drastically either by using a restricted instrument set (as in column (1) of Tables 4.3 and 4.4) or by using the 'collapse' sub-option (as in column (5) of Tables 4.3 and 4.4). In these two cases the Hansen p-value is 0.37 and 0.32 respectively which supports the validity of the instruments used at 5 percent level of significance. For other specifications, given the implausibly large p-values, we can conclude that the Hansen test loses its power due to the large instrument count. However, note that there is no significant variation in results across the five specifications.

The p-values for the Arellano-Bond autocorrelation test (given by AR(2)p in each table) suggests that there is no second order correlation in first differenced error terms therefore, implying the absence of any first order correlation between errors in the levels. This validates the inclusion of the second lag of I_{it} and the first lag of all predetermined variables ($NPA_{i,t-1}$, $CRAR_{i,t-1}$, $GDPgr_t$) in different sets of instruments used for estimation.

Therefore, surveying the estimation results for the second model (given by equation 7) we can say that from the point of view of stability of the model and the validity of the instruments used, the results of the model are satisfactory. However, if we compare the results across different columns and also across different tables then we can see that the estimated coefficients of the variables do not seem to be very consistent in their values. This suggests that the second model even though stable, is less robust in terms of its results when compared to the first model (given by equation 6) of our study.

4.2. RESULTS FOR THE SECOND HYPOTHESIS

The second objective of our study was to examine whether or not the strength and validity of the asset substitution effect of NPAs gets affected due to the difference in the nature of bank ownership. This analysis has been done in the context of private and public sector banks of India and accordingly the following hypothesis has been tested.

H_0: There is a difference between public and private sector banks in terms of the existence and strength of the asset substitution effect of NPAs.

This represents the second hypothesis of our study. To test this hypothesis, the present study has applied the two-step System GMM procedure for estimation of equations (1) and (2) (given in chapter III). The results obtained from estimation of equation (1) are given in Table 4.5 and results from estimation of equation (2) are given in Table 4.6.

Table 4.5: Estimation Results for Loans to Asset Ratio

$L_{i,t}$	(1)	(2)
$L_{i,t-1}$	0.1712	0.0892
	(0.1381)	(0.0804)
$YrD09_t$	-1.3271*	-1.0411
	(0.5405)	(0.6639)
$PubD_i$	2.6086*	3.1608*
	(1.2847)	(1.2802)
$PubD_i.NPA_{i,t-1}$	-0.0015*	-0.0016**
	(0.0007)	(0.0006)
$NPA_{i,t-1}$	-0.0002***	-0.0001***
	(0.0000)	(0.0000)
$CRAR_{i,t-1}$	0.1042	0.4890
	(0.0853)	(0.3659)
$GDPgr_{t-1}$	1.0079***	1.0290***
	(0.1370)	(0.1120)
$REPO_t$	-1.7520***	-1.7370***
	(0.3958)	(0.3260)
SLR_t	-0.3547	-0.4548*
	(0.1981)	(0.1973)
$Groi_t$	-1.5233***	-1.3948***
	(0.3621)	(0.3134)
$Tdgr_t$	-.07671***	-.08055***
	(0.0194)	(0.0144)
Constant	40.535626***	41.832402***
	(8.0210)	(5.5279)
J	285	54
Hansen_df	273	42
Hansen(p)	1	0.48
AR(2)p	0.064	0.075
F(p)	0.000	0.000

Notes:*p<0.1; **p<0.05;* **p<0.01; ****p<0.001*

Results given in the above table are obtained by applying two-step System GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable and are corrected by Windmeijer (2005) finite sample correction.. In Column (1) lag2 and higher (i.e. all available lags) of $L_{i,t}$are being used to instrument $L_{i,t-1}$ in its first differenced form i.e. $\Delta L_{i,t-1}$whereas to instrument $L_{i,t-1}$in its level equation first differenced term of $L_{i,t-1}$itself i.e. $\Delta L_{i,t-1}$is being used. Similarly, for all predetermined variables (i.e. $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$) lag 1 and higher of these variables are being used to instrument these variables in their respective first differenced form whereas,their respective first differenced forms (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and $\Delta GDPgr_{t-1}$)are being used to instrument them in their level form in level equation. In column (2) for both first differenced equation and level equation same lag specification as used in column (1) is being used here for all the

endogenous variables (both lagged dependent variable i.e.$L_{i,t-1}$and predetermined variables $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$). However, unlike column (1), here the instrument set used for first differenced equation for each endogenous variable has been collapsed by using 'collapse' sub-option. This has been done to check the robustness of the results to lag length of the instruments.

Table 4.6: Estimation Results for SLR Investments to Asset ratio

$I_{i,t}$	(1)	(2)
$I_{i,t-1}$	0.1898	0.1538
	(0.1212)	(0.0990)
$YrD09_t$	0.4870	0.2837
	(0.8101)	(0.8250)
$PubD_i$	1.0837	0.9997
	(0.8472)	(0.7504)
$PubD_i.NPA_{i,t-1}$	0.0019***	0.0019****
	(0.0006)	(0.0005)
$NPA_{i,t-1}$	-0.0001	-0.0001
	(0.0002)	(0.0002)
$CRAR_{i,t-1}$	-0.1857*	-0.4108**
	(0.1037)	(0.1775)
$GDPgr_{t-1}$	-0.7500****	-0.7656****
	(0.1289)	(0.1259)
$REPO_t$	1.0584**	1.0777**
	0.4431)	(0.4445)
SLR_t	-0.1948	-0.1719
	(0.2258)	(0.2098)
$Groi_t$	0.4414	0.3859
	(0.4332)	(0.4254)
Constant	17.665***	19.637****
	(5.1399)	(4.5882)
J	285	54
Hansen_df	274	43
Hansenp	1	0.46
AR(2)p	0.084	0.059
F(p)	0.000	0.000

Notes:*p<0.1; **p<0.05;* **p<0.01; ****p<0.001*

Results given in the above table are obtained by applying two-step System GMM estimator; Asymptotic robust standard errors are reported in parenthesis below the estimated coefficient value of each variable and are corrected by Windmeijer (2005) finite sample correction.. In Column (1) lag2 and higher (i.e. all available lags) of $I_{i,t}$are being used to instrument $I_{i,t-1}$ in its first differenced form i.e. $\Delta I_{i,t-1}$whereas to instrument $I_{i,t-1}$in its level equation first differenced term of $I_{i,t-1}$itself i.e. $\Delta I_{i,t-1}$is being used. Similarly, for all predetermined variables (i.e. $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$) lag 1 and higher of these variables are being used to instrument these variables in their respective first differenced form whereas,their respective first differenced forms (i.e. $\Delta NPA_{i,t-1}$, $\Delta CRAR_{i,t-1}$ and

$\Delta GDPgr_{t-1}$)are being used to instrument them in their level form in level equation. In column (2) for both first differenced equation and level equation same lag specification as used in column (1) is being used here for all the endogenous variables (both lagged dependent variable i.e.$I_{i,t-1}$and predetermined variables $NPA_{i,t-1}$, $CRAR_{i,t-1}$, and $GDPgr_{t-1}$). However, unlike column (1), here the instrument set used for first differenced equation for each endogenous variable has been collapsed by using 'collapse' sub-option.

From the results reported in Table 4.5 it can be seen that there exists a statistically significant difference between public and private sector banks with respect to the share of loans in their asset portfolios. The positive coefficient of $PubD_i$ in Table 4.5 suggests that public sector banks hold a higher fraction of their total assets in the form of loans than private sector banks, if all other factors are taken to be the same for both bank groups.

However, according to the results reported in Table 4.6 for the share of SLR investments, no such significant difference can be seen between private and public sector banks in terms of the share of SLR investments in their asset portfolios. The estimated values of the coefficient of $PubD_i$ in equation 2 are not significant at 4.5 percent level for either of the choices of the instrument set.

The estimated values of the coefficient of the interaction term $PubD_iNPA_{i,t-1}$ (in both the Tables 4.5 and 4.6) indicate that there also exists a statistically significant difference between public and private sector banks in terms of the impact of NPAs on the asset composition. A negative sign for $PubD_iNPA_{i,t-1}$ in Table 4.5 suggests that an increase in the ratio of NPAs to bank capital by 1 percentage point decreases a public sector bank's loans to asset ratio by approximately 0.0015 percentage points more than for a private sector bank. Given that the size of the reduction in the loans to assets ratio for a private sector bank is approximately in the range of 0.0001-0.0002 percentage points, this suggests that the responsiveness of public sector bank for loan shares to NPAs is roughly 10 times that of private sector banks.

On the other hand the results in Table 4.6 suggest that, while public sector banks do not have higher shares of SLR investments in their asset portfolios and NPAs have no significant effect on the share of SLR investments held in asset portfolios of private sector banks (the coefficient of the $NPA_{i,t-1}$is not statistically significant), an increase in the ratio of NPAs to bank capital by 1 percentage point increases a public sector bank's share of SLR investments by approximately 0.0019 percentage points more than for a private sector bank. Both these differential impacts

of NPAs on asset shares of public sector banks are statistically significant at 5 percent level of significance. Therefore, from the given results, we can say that the asset substitution effect of NPAs seem to be much stronger for public sector banks than for private sector banks or, in other words, the impact of NPAs on asset composition seems to be higher for public sector banks than for private sector banks in India.

CHAPTER V

CONCLUSION

The present study contributes to the existing literature on NPAs by analysing some aspects of the relationship between NPAs and asset portfolio behaviour of banks in India. In recent years, India has been experiencing a slowdown in credit growth. According to the statement given in RBI (2015) such slowdown in credit growth has primarily resulted from the deteriorating asset quality of the commercial banks, itself a result of the mounting Non-Performing Assets on the books of these banks. The existing literature assumes that such a negative relation between NPAs and credit growth generally arises from the asset substitution effect of NPAs which induces banks to shift from more risky assets like loans to less risky assets like SLR investments. This reduces bank loan holdings and thus, decreases the overall loan supply in the economy. Although this argument of an asset substitution effect of NPAs has been used in almost all existing studies to explain the negative relation between NPAs and credit growth, the relevance of the argument has not been particularly tested in these studies. Thus, in order to complement existing studies on the impact of NPAs in India, the present study represents an attempt to empirically test the relevance of the argument regarding asset substitution effect of NPAs in the context of India.

With this in view, the primary objective of the study was to investigate the existence and strength of the asset substitution effect of NPAs on the asset portfolio of Indian commercial banks during the period 2001-02 to 2014-15. The asset substitution effect of NPAs was examined by considering the effect of NPAs on the shares of the two major categories of income earning assets, namely, Loans and SLR investments, in the asset portfolio of Indian commercial banks. Besides this primary objective, a secondary objective of the study was to examine whether the strength and validity of the asset substitution effect of NPAs depend on the nature of ownership of banks i.e. whether a bank was publicly owned, being a part of the public sector, or privately owned, being a part of the private sector.

To meet the above objectives dynamic panel data models were used to examine the following two hypotheses-

Hypothesis 1: An increase in the solvency risks posed by NPAs leads banks to increase the share of SLR investments and reduce the share of loans in their asset portfolios

Hypothesis 2: There is a difference between public and private sector banks in terms of the existence and strength of the asset substitution effect of NPAs referred to in Hypothesis 1.

To test the above hypotheses two dynamic panel models were set up (given by equations (1) and (2) in Chapter III,pp.40). In the first dynamic panel model (given by equation (1)), the ratio of bank loans to total assets was regressed on the ratio of gross NPAs to total capital controlling for macroeconomic and other bank specific variables which were expected to affect a bank's asset composition. Similarly, in the second dynamic panel model (given by equation (2)), the ratio of SLR investments to total assets was regressed on the same set of independent variables as in first model, except for deposits growth in the banking system, which was assumed not to have any direct and, therefore, significant impact on the cost of adjustment of the share of SLR investments in total assets.

These dynamic panel models were estimated using GMM estimators. The major inferences of our study are based on the estimation results obtained by applying Difference GMM estimator on equations (6) and (7) (refer chapter IV, pp.58) which are reported in Tables 4.1, 4.2, 4.3 and 4.4 of the previous chapter. However, to draw an inference regarding the second hypothesis, results (given in Tables 4.5 and 4.6) were obtained by applying the System GMM estimator on equations 1 and 2 (refer chapter III, pp.40). Summarizing the estimation results obtained for equations (6) and (7) and reported in Tables 4.1, 4.2, 4.3 and 4.4 of the previous chapter, we can say that the increased risk posed by bank NPAs (measured by the ratio of NPAs to bank capital) has, as expected, very different effects on the share of loans and the share of SLR investments in bank asset portfolios. On the one hand, an increase in the ratio of NPAs to bank capital decreases the share of a bank's loan holdings in its total assets,

while, on the other hand, the estimated coefficient of the NPAs ratio in the second model suggests that the same increase in NPAs leads to a rise in the share of SLR investments in total assets. This appears to substantiate the theoretical prediction of the asset substitution effect of rising NPAs on banks asset portfolios, involving substitution of less risky for more risky assets.

However, such an asset substitution effect does not seem to be particularly strong for Indian commercial banks. This is because, the results obtained, even while indicating a significant negative impact of NPAs on the share of bank loan holdings in total assets, indicates that the positive impact of NPAs on the share of SLR investments is not statistically significant even at the 10 percent level of significance. This weakens the argument for the existence of an asset substitution effect of NPAs on bank asset portfolios in the case of Indian banks at least during the period under consideration. Therefore, given the regression results for major Indian commercial banks, one can conclude that, even though the impact of NPAs on the share of a more risky asset category like loans in bank assets is in the expected direction, the absence of any significant positive impact of NPAs on the share of a major category of less risky assets like SLR investments, suggests that the asset substitution effect of NPAs is relatively weak in the Indian context.

There can be various possible reasons for the absence of a strong asset substitution effect of NPAs on bank asset portfolios. One such reason could be that banks in a situation of rising NPAs, instead of increasing their total share of SLR holdings of various maturities, might substitute more risky long term assets in general (both long-term loans and SLR investments with long maturity periods) by less risky short term assets, including SLR investments of shorter maturities but not including short term loans. This may, for example, be inferred from a relatively recent report by the RBI (2015b) where it has been pointed out that on the asset side of bank balance sheets, the share of long term assets has declined and the share of short term assets has marginally increased for scheduled commercial banks.

It might also be possible that banks in order to decrease the overall riskiness of their asset portfolio, might allocate a greater portion of their funds to other liquid assets including other SLR holdings like gold or they might simply hold a greater amount of excess reserves. Any or all of the above possibilities may have weakened

the impact of rising NPAs on the quantities of SLR investments held by Indian commercial banks during the study period.

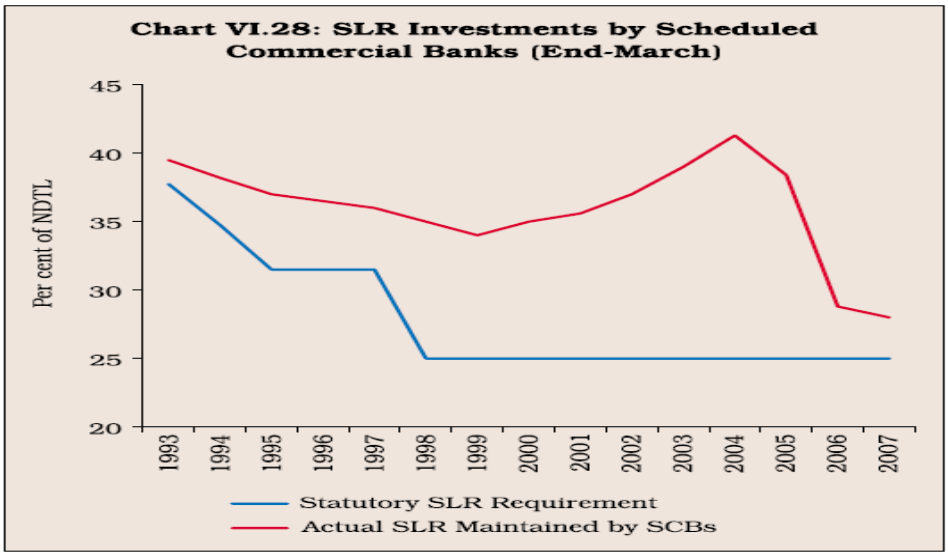
In contrast to NPAs, the rate of growth of GDP seems to have a strong significant impact on both the share of loans and the share of SLR investments in bank assets, inducing the expected substitution of loans for SLR investments. This signifies that loan demand plays an important role in determining the asset composition of bank portfolios.

Even the REPO rate seems to have such an asset substitution effect to some extent. The estimation results for the coefficient of $REPO_t$ in the models are as expected and indicate that real Repo rates have a statistically significant impact on a bank's overall asset composition. It shows that a high cost of liquidity by increasing bank incentives to hold more liquid assets leads to an increase in the ratio of SLR investments and a decrease in the ratio of loans to total assets. Such significant impact of REPO on bank's asset composition also signifies the effectiveness of REPO rate as a monetary policy instrument which RBI uses to manage the amount of liquidity in the economy.

Changes in other explanatory variables like $Groi_t$ and $CRAR_{i,t-1}$ do not seem to induce any significant amount of substitution between loans and SLR investments. Even though the results on $Groi_t$, indicate a statistically significant positive impact of the real rate of return of government securities on the share of loans in bank assets, they do not show any such significant impact on the share of SLR investments. The coefficient of $CRARi_{t-1}$ has the expected sign in both the loans model and the SLR investments model but, the impact of $CRAR_{i,t-1}$ on the loans to assets ratio is statistically significant only at 10 percent level and that too for some specifications of instrument sets. This suggests that any inference of a significant impact of $CRAR_{i,t-1}$ on share of loans is not particularly robust. Even for the SLR investments to assets ratio, impact of $CRAR_{i,t-1}$ is found to be statistically significant only at 10 percent level of significance. Although the impact of CRAR on SLR investments are found to be statistically significant at 10 percent level for most of the specification of instrument sets, the estimated coefficient value seems to be sensitive to the choice of lag lengths. This means that any inference of a significant impact of $CRAR_{i,t-1}$ on the share of SLR investments cannot be conclusively made on the basis of the results

obtained as such results do not seems to be consistent in their values across different lag specifications.

While, the estimation results for coefficient of SLR_t indicate that the effect of the required SLR on shares of loans in total assets is statistically significant only at 10 percent level of significance, the impact of the required SLR on SLR investments in total assets are statistically insignificant even at 10 percent level. This suggests that at least during the period studied the required SLR did not have any significant impact on the composition of bank asset portfolios. However, the absence of a positive relation between the value of the required SLR and the share of SLR investments in bank assets is particularly surprising. To some extent this can be explained in the light of the evidence regarding bank's investment operations provided by RBI (2008). In this report, the RBI noted that Indian commercial banks, even after the reduction of the required SLR to 25 percent in 1997, continued to hold SLR investments much higher than required. The following graph is reproduced from a RBI report (RBI, 2008):



It is evident from this chart that during the first half of our study period (2001-02 to 2006-07) the required SLR did not have any binding effect on the actual SLR of banks. This might have resulted in the insignificant impact of SLR. Again, as per the data available on the required SLR, the second half of our study period (2007-08 to 2014-15) witnessed a declining trend in the required SLR. This was because, in the wake of global financial crisis, RBI, in order to revive the economy from a slowdown,

started injecting liquidity through different means, reduction of the required SLR being one of them. However, because, during this period, banks might have became more risk-averse, bank SLRs might have not fallen significantly or gone up, even if the required SLR was decreased by RBI.

Even the year dummy $YrD09_t$ for financial year 2008-09, the peak of the financial crisis and the year of a shift to more stringent Basel norms, does not seem to have a statistically significant effect on the share of the two most important categories of assets, even though the estimated coefficients of $YrD09_t$ all possess the expected signs. This implies that the neither the financial crisis nor the transition to the new Basel regime led to any significant substitution between loans and SLR investments.

Analysing the results for the second hypothesis reported in Tables 4.5 and 4.6 of Chapter IV we can say that, while there exists a statistically significant difference between public and private banks with respect to the share of loans in their asset portfolios, no statistically significant difference could be inferred in terms of their share of SLR investments at 5 percent level of significance. Again, the estimated results for the interaction term $PubD_iNPA_{i,t-1}$ in both Tables 4.5 and 4.6 indicate that there exists a statistically significant difference between public and private sector banks when analysed in terms of the impact of NPAs on their asset composition where asset substitution effect of NPAs seems to be stronger for public sector banks than private sector banks. This is evident from the estimated values of the coefficient of $PubD_iNPA_{i,t-1}$ in Table 4.5 and 4.6. Its value in Table 4.5 suggests that the responsiveness of public sector banks to NPAs in terms of the share of loans in total assets is roughly 10 times more than that of private sector banks. In Table 4.6 its value suggests that with a rise in ratio of gross NPAs to total capital by one percentage point, the share of SLR investments for public sector banks increases by about 0.0019 percentage points more than that for private sector banks. Both these impacts of NPAs on asset share of public sector banks are statistically significant at 5 percent level of significance.

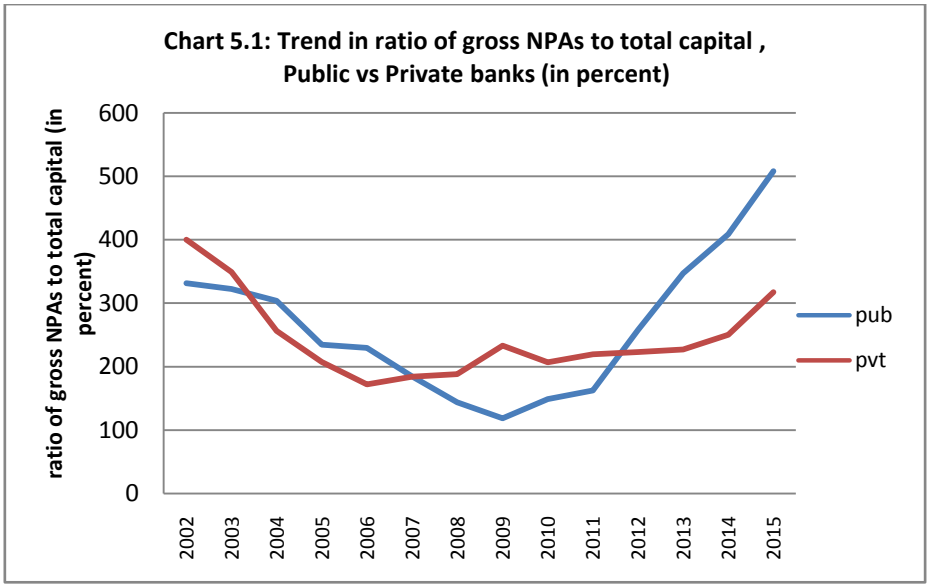
Therefore, on the basis of the results obtained for both the hypotheses we can infer that, while overall asset substitution effect of NPAs on bank asset portfolio in India appear to be relatively weak, once we distinguish between public and private sector banks we can see that this effect is much stronger for the public sector banks than private sector banks. This is a paradoxical result if one assumes that private

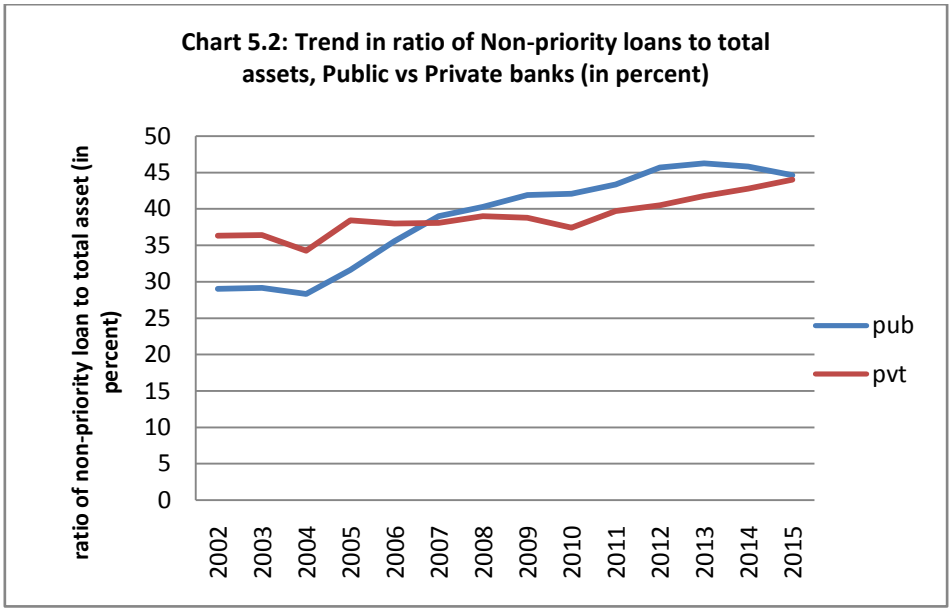
sector banks respond to changes in conditions relating to risks and returns much faster than public sector banks because there is greater market oversight of their operations and also because they do not have the luxury of approaching the State for capital in the event of any risk to their solvency.

However, such a result might exist due to various reasons. One such reason could be that the Central Bank and the Government, being extremely vigilant about financial stability in the context of an ongoing global financial crisis, might be able to enforce stricter discipline on public sector banks. This could have led public sector banks faced with NPAs to reduce the overall riskiness of their asset portfolios much more aggressively by carrying out asset substitutions.

Another reason might be that the strength of the asset substitution effect might vary positively with the existing value of the NPAs to capital ratio or, there might exist a threshold value of this ratio above which the asset substitution effect is valid. This can occur if the risks posed by NPAs to the solvency of banks increases nonlinearly with a rise in the value of the ratio. This would imply that, if the existing value of the NPAs to capital ratio was higher for public sector banks over the period under study, the asset substitution effect would be much stronger for these banks.

The above appears to be a plausible hypothesis in the light of the evidence provided by the Annual Report of the RBI for 2014-15 (RBI, 2015). In that report the RBI argued that in recent years public sector banks, because of their higher share of NPAs in total advances have been facing a higher decline in credit growth than private sector banks. The following charts 5.1 and 5.2 support this claim. It is evident from Chart 5.1 that since financial year 2011-12, public banks have been recording a much higher average value of the ratio of NPAs to bank capital compared to private sector banks, which have maintained an almost constant average ratio of NPAs to bank capita. From Chart 5.2 it can be seen that the ratio of non-priority loans to total assets of public sector banks has decreased since financial year 2011-12, whereas for private sector banks the same ratio has in fact showed a marginal increase since 2009-10.





The evidence presented in the current study and summarised in this chapter raises interesting questions and provides scope for further research. One of the findings of this study was that for Indian commercial banks, in general, NPAs did not seem to have a significant effect on the share of SLR investments in bank asset portfolios. While discussing this finding we argued that this might be due to two possible reasons. One, a shift to more liquid and less risky assets in response to rising NPAs might have involved, predominantly, a shift from loans to other categories of liquid

and short-term assets than SLR investments. Two, the substitution of more risky assets by less risky assets might have also involved a substitution of SLR securities of longer maturities by those of shorter maturities. Both these hypotheses can, in principle, be examined by, in the case of the first considering a broader set of less risky assets than simply SLR investments and, in the case of the second, analysing the impact of NPAs on the maturity composition of holdings of SLR investments and loans. The results of these exercises will, hopefully, provide a clearer understanding of the one of the more puzzling finds of the present study.

One of the more interesting conclusions of the current study were the contrasting results obtained for public sector banks and private sector banks in terms of the strength of the asset substitution effects of NPAs. As suggested above, there could be two possible reasons for the relatively high asset substitution effect of NPAs in the case of public sector banks. One, it might be that the strict disciplinary action of the RBI and Central Banks compelled public sector banks to respond so aggressively to NPAs by substituting assets. The second reason could be that the extent of risks posed by NPAs to the solvency of banks increased nonlinearly with the ratio of NPAs to bank capital and the level of NPAs for public sector banks being higher, as suggested by Chart 5.1, even the same marginal increase in the ratio of NPAs to total capital for public sector banks could increase the threat of insolvency for those banks much more than for private sector banks. A crucial component of this argument is, of course, the implied non-linear relationship between the ratio of NPAs to bank capital and its impact on the asset composition of banks. In our study, however, the possibility of a non-linear impact of NPAs on the shares of major categories of assets in bank portfolios has not been explored and provides scope for further research in this area.

Apart from the above suggested extensions one can also consider analysing the impact of NPAs on the liabilities of banks. Banks can seek to moderate the overall riskiness of their position in a situation of high NPAs not only by altering the composition of their assets but, also by substituting between different categories of liabilities. In a situation of high NPAs, one might, for example, expect banks to buffer themselves against liquidity risk by shifting from short term to long term liabilities and by shifting from borrowings to fixed deposits. Extending the analysis to cover

bank liabilities will provide a better understanding of the impact of NPAs on the overall balance sheet of Indian banks.

APPENDIX

TABLE 1: BANKS USED IN THE EMPIRICAL ANALYSIS

PUBLIC SECTOR BANK	PRIVATE SECTOR BANKS
ALLAHABAD BANK	CATHOLIC SYRIAN BANKLTD
ANDHRA BANK	CITY UNION BANK LIMITED
BANK OF BARODA	DCB BANK LIMITED
BANK OF INDIA	DHANLAXMI BANK
BANK OF MAHARASHTRA	FEDERAL BANK
CANARA BANK	HDFC BANK
CENTRAL BANK OF INDIA	ICICI BANK
CORPORATION BANK	INDUSIND BANK
DENA BANK	ING VYSYA BANK
IDBI BANK LIMITED	JAMMU KASHMIR BANK LTD
INDIAN BANK	KARNATAKA BANK LIMITED
INDIAN OVERSEAS BANK	KARUR VYSYA BANK
ORIENTAL BANK OF COMMERCE	LAKSHMI VI;AS BANK
PUNJAB AND SINDH BANK	NAINITAL BANK
PUNJAB NATIONAL BANK	SOUTH INDIAN BANK
SYNDICATE BANK	TAMIL NAD MERCANTILE BANK LTD
UCO BANK	THE RATNAKAR BANK LTD
UNION BANK OF INDIA	
UNITED BANK OF INDIA	
VIJAYA BANK	
STATE BANK OF BIKANER AND JAIOUR	
STATE BANK OF HYDERABAD	
STATE BANK OF INDIDA	
STATE BANK OF MYSOR	
STATE BANK OF PATIALIA	
STATE BANK OF TRAVANCORE	

TABLE 2: SUMMARY STATISTICS OF ALL THE VARIABLES USED IN THE STUDY

Variable	Mean	St. deviation	Min	Max
$L_{i,t}$	37.484	13.77	4.64	328.03
$I_{i,t}$	24.81	11.921	0	276.02
SLR_t	5.267	1.11	3.91	7.50
$REPO_t$	6.40	1.94	1.93	9.57
$Groi_t$	2.01	2.37	-1.64	6.51
$TDgr_t$	23.52	22.05	11.24	101.8
$CRAR_{i,t-1}$	4.12	3.64	-9	47.41
$NPA_{i,t-1}$	630.324	2689.63	0	38858.43
$GDPgr_{t-1}$	7.23	2.15	3.8	10.26

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