DETERMINANTS OF PROFITABILITY OF INDIAN COMMERCIAL BANKS, 2004-05 TO 2015-16 – A STUDY WITH SPECIAL FOCUS ON MACROECONOMIC CONDITIONS

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CERTIFICATE

This is to certify that the dissertation entitled "Determinants Of Profitability Of Indian Commercial Banks, 2004-05 To 2015-16 – A Study With Special Focus On Macroeconomic Conditions" submitted by ANJALI SAINI in partial fulfilment of the requirement for the award of **Master of Philosophy** has not been previously submitted for any other degree of this or any other university.

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We recommend that this dissertation be placed before the examiners for evaluation.

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Contents

Chapter-I

Introduction

1.1 Introduction

In development of a nation, banks play an integral part. They act not only as the custodians of the wealth of a country but are themselves resources of the country. Capital formation occupies a position of strategic importance in any plan of economic development. Therefore, the role of financial intermediaries comes into play, which is primarily carried out by the banking system in India. Bank branches all over the country helped in mobilization of savings over a large area for productive purposes. Credit creation by banks is instrumental in increased production, employment and sales. This consequently increases the pace of economic development. Besides, in India, lending operations of commercial banks are subject to the control of the RBI, so that bank lending is not determined solely by commercial motives. There are some norms such as priority sector advances which banks have to follow in order to achieve social objectives. Therefore, banks in India have helped in a variety of ways in the overall economic development of the nation.

But like any other economic entity banks also need to earn incomes or profits for their survival. A profitable banking sector with a good capital base is better able to survive negative shocks and add to the stability of the financial system. Since banks are the primary financial institutions in most developing economies including India, the health of the banking sector is crucial for the health of the general economy at large and any harm caused by the instability of the banking industry is a serious reason for worry. Moreover, as banks today are moving away from their traditional banking activities and offering more diversified services they face increasing competition not only within the banking sector but also from non-banking companies and capital markets. Relaxation in barriers to entry of new players in the market has amplified the level of competition (Sinha & Sharma, 2016). As is well known, competition generally drives down the profits that any individual firm can make, at least in the short run. Therefore, determinants of profitability of banks have attracted the increasing interest of academicians and research students.

A consideration of the impact of macroeconomic and bank specific factors on profitability of Indian commercial banks is the broad aim of this dissertation as well.

In the next section of this chapter, the recent history of the Indian banking industry is discussed briefly. Then in the third section, measures of profitability are discussed with recent trends. Finally, in the last section of this chapter, the objectives and a brief outline of this study are presented.

1.2 History of Indian Banking Industry

India has a long history of banking dating from the early 1700s. But if we look at the history of modern Indian banks, they originated in 1921 when the Imperial Bank of India was formed. It later became State Bank of India in 1955 which is still the largest and oldest bank in existence today. Before the establishment of RBI in 1935 under the Reserve Bank of India Act, 1934, the presidency banks had acted as quasi-central banks for many years. In 1934 under the Banking Regulation Act, RBI was given the right to inspect, control and regulate the banks. In addition, the State Bank of India was given control of eight state-associated banks in 1960. Moreover, the Indian government nationalized 14 major private banks in 1969 and 6 banks in 1980. Due to their large size and widespread networks, the majority of lending in the Indian economy is done by these public sector banks. They played a very important role in the economic growth of the country as people reposed their faith in these banks because of their full public ownership.

1991 marked an important year in the history of the Indian financial sector as, following the BOP crisis of 1991, structural reforms were initiated that changed the prevailing economic policy regime completely. Those reforms not only affected the real sector of the economy but the financial sector as well. Some major reforms were taken in order liberalize the financial sector of the economy such as interest rates were deregulated, the priority sector norms were relaxed, statutory retrictions were reduced, and entry barriers for both domestic and foreign players were also lowered.

Deregulation of hitherto administered interest rates was one of the major components of these reforms. Deregulation was done with a view to improve allocative efficiency of resources, strengthen competitive forces and strengthen the transmission of monetary policy. The process of deregulation was started in the early 1990s and by October 1997 it had largely been completed. Another major step was taken in October 2011 when RBI deregulated interest rate on savings accounts.

Because of the reduction in entry barriers, competition has drastically increased in the banking sector since the beginning of the 1990s. Seven new private banks entered the banking sector between 1994 and 2000. Since 1994, 20 new foreign banks were also added to the banking industry of India. As a result, by March 2004, combined share of the new private sector banks and the foreign banks was almost 20% of total bank assets (RBI, 2004).

Besides the high level of statutory pre-emptions, another major reason for the below average profitability of Indian banks was identified as priority sector advances. The Narasimham Committee set up in the 1990s to suggest financial sector reforms, therefore, recommended a reduction of priority sector advances from 40% to 10%. But, the recommendation of this committee was not implemented and the targets of net bank credit for domestic banks and for foreign banks as priority sector advances have remained the same at 40% and 32% respectively. “While the nominal targets have remained unchanged, the effective burden of priority sector advances has been reduced by expanding the definition of priority sector lending to include, for example, renewable sources” (Roland, 2005).

After the post-1991 financial sector reforms, the Indian banking industry has changed a lot. It has moved from a strongly regulated environment to a largely deregulated environment. Because of liberalization, banks faced intense competition and were exposed to various kinds of financial and non-financial risks. “Both expected and unexpected events may have an adverse impact on a bank's capital and earnings. While the expected losses are generally taken care of by suitable pricing methodology, the risk of unexpected losses, both on account of the exposure on individual assets and that of the whole portfolio in entirety, is borne by the bank itself and hence has to be taken care of by having the requisite capital. Hence, the need for suitable capital structure and sufficient capital adequacy requirements is felt” (Raghavan, 2004).

International norms on capital adequacy for banks were introduced in 1988 in Basel, Switzerland, in order to regulate bank capital and to standardize banking practice relating to bank capital across all countries. The focus of Basel 1, i.e. the Basel Accord 1988, was on credit risk and appropriate risk-weighting of assets. Under these norms, banks assets were classified and grouped into five categories according to credit risk, carrying different risk weights. Banks which have an international presence were required to have capital adequacy ratio (CAR) of 8% - at least 4% in Tier I capital[1] (equity capital + retained earnings) and more than 8% in Tier I and Tier II[2] capital. Later in 2004, the Basel II norms were introduced with the objective to supersede those under the Base I accord. Guidelines for capital adequacy (with more refined definitions), risk management (market risk and operational risk) and disclosure requirements were laid down under Basel II norms. Basel II norms were criticized for allowing banks to take on different kinds of risk, which were included among the causes of the US subprime financial crisis that started in 2008. Basel III, therefore, intended to strengthen bank capital requirements by increasing bank liquidity and decreasing bank leverage[3].Under Basel III norms, the requirement of minimum Tier 1 capital has been increased to 6%. A new buffer called as capital conservation buffer with Tier 1 capital needs to be maintained at 2.5% of the risk-weighted assets. The total "capital adequacy ratio" requirement has been maintained at 8%. A new measure called leverage ratio [4]is introduced. A minimum value of 3% for the ratio is to be maintained.

1.3 Measures of Profitability and Recent Trends

In accordance with most of the literature on the determination of bank profitability, in this dissertation, to measure the performance of a bank we have used return on assets and return on equity. Net income is not used here because net income gives us an idea of how well a bank is performing, but it does not adjust for bank size. Thus it becomes difficult to

[1]Tier 1 capital is composed of core capital, which consists primarily of common stock and disclosed reserves (or retained earnings).

[2] Tier 2 Capital is supposed to supplement Tier 1 capital, and includes heads like revaluation reserves, undisclosed reserves, hybrid instruments and subordinated term debt.

[3]Leverage is a way of using borrowed funds for a purchase with the expectation that returns from that purchase will exceed its borrowing cost.

[4] Leverage ratio is the proportion of Tier 1 capital to the total exposure of the bank.

compare how well a bank is performing compared to another. Return on assets, however, is calculated as follows:

$$\boldsymbol{ROA = \frac{Net\ Profits}{Average\ Total\ Assets}}$$

ROA corrects for the size of the bank and gives an idea and indicates the effectiveness with which bank management can deploy its assets to generate income. But return on assets does not provide all the required information regarding bank profitability to the bank's owners (equity holders). As equity holders are more concerned about their earnings they are more interested in return on equity (ROE) as that ratio will give them an idea how much the bank is earning on their equity investment. (Mishkin, Stanley, & Eakins, 2009).Therefore, return on equity (ROE) is also measured. It reflects the effectiveness of bank's management in transforming every unit of shareholder's equity into profit. It is calculated as follows:

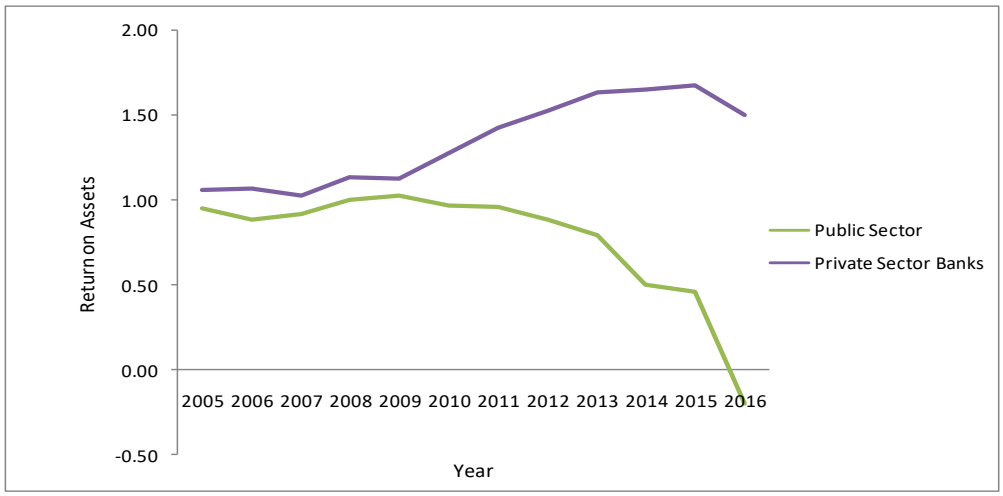
$$\boldsymbol{ROE = \frac{Net\ Profits}{Average\ Total\ Equity}}$$

As we know in balance sheet of banks, assets are equal to liabilities and shareholders' equity. Therefore, if financial leverage or debt of a bank is zero, its assets and shareholders' equity will be the same. It follows from the above formulae then that their ROA and ROE would also be the same. However, if ROA is low because of high levels of debt, a high ROE can give investors a wrong impression about the financial health of the bank.

Therefore in order to give a more complete idea of banks' performance, both measures of profitability are used.

Now, we can have a look at recent trends in bank performance measures, viz. return on assets and return on equity, for public and private sector banks respectively. It can be seen that while return on assets in both public and private sector banks show a similar trend till 2009, return on assets of private sector banks was higher throughout. After 2009, return on assets of public sector banks started showing a declining trend but the opposite was true for private sector banks for at least till 2015, as can be seen in Figure 1.3.1.

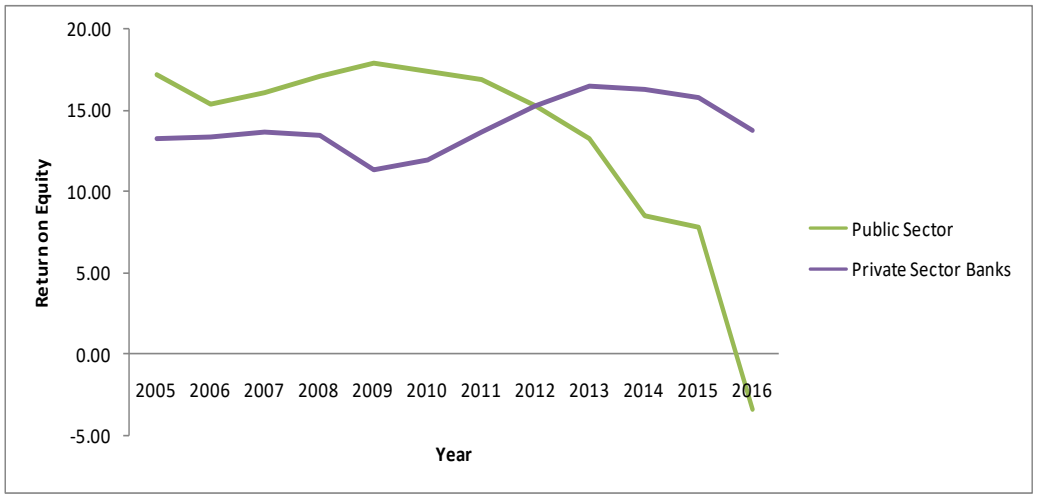
Figure 1.3.1: Return on assets of commercial banks for time period 2005-16



Source: Statistical Tables Relating to Banks in India, RBI.

From Figure 1.3.2 it can be seen that 2012 onwards return on equity of both sectors start showing a declining trend; however, the decline is sharper for public sector banks. Also, before 2012 return on equity of public sector banks was higher than that of private sector banks but, there was a reversal in the trend 2012 onwards.

Figure 1.3.2: Return on equity of commercial banks for time period 2005-16



Source: Statistical Tables Relating to Banks in India, RBI.

The Financial Stability Report for 2013 published by the Reserve Bank of India (RBI, 2013), points to a rise in the vulnerability of the banking system in India, as indicated by the movement of the Banking Stability Indicator (BSI), since 2010. According to a RBI report (2016), scheduled commercial banks which had a share of 37 percent in total assets had negative return on asset in financial year 2015-16. Moreover, return on asset was lies between 0 to 0.25 percent for seven banks which had a share of 5 percent in total assets. (RBI, 2016). This gives us a strong reason to identify the factors responsible for variation in bank profitability in India in recent years.

1.4 Objective and Brief Outline of the Study

We have noted in the preceding discussion that banks are an integral part of the Indian economy and a continuous and steady flow of profits is required for their survival and stability. We have also seen that in the last decade, after a period of stable or rising bank returns there has been a period of declining and low returns. Consequently, it becomes important to evaluate what are the possible factors that affect the profitability of commercial banks in India and how they affect the profitability of Indian commercial banks. Therefore, the main rationale for this dissertation is the need to empirically evaluate the major explanatory factors that might have had an effect on bank performance in India in recent years. The main focus in this study is on macroeconomic variables viz. growth rate of GDP and inflation. However, three important bank specific variables are also considered in this study to capture the specificity of banks viz. nature of bank ownership (public or private) ratio of net NPAs to net advances and relative size of a bank. The effect of these macroeconomic and bank specific factors on bank performance is investigated through regression analysis.

This study uses data for 45 scheduled commercial banks of India and covers the time period 2004-05 to 2015-16. Out of the banks considered, 26 are public sector banks and 19 are private sector banks. (Refer to Table 1)

Return on assets and return on equity are the two most widely used measures of profitability of banks and gives us a clear picture of the health of banks. These are the dependent variables of this study. The variables whose effects on bank performance have

been considered in the study are the following: The growth rate of real GDP and the rate of inflation (macroeconomic variables), the nature of bank ownership (Public/Private), relative bank size and the share of Non-Performing Assets (NPAs) in total assets (bank specific variables).

The effects of these variables on bank rates of return have been evaluated through estimation of dynamic panel data models. These models are estimated using the System GMM technique. GMM estimation has been used in the study because the number of banks in the data panel is greater than the number of years, a lagged value of the dependent variable is one of the independent variables, and the independent variables include some which are potentially endogenous or predetermined. The last is, however, also one of the reasons we have had to restrict the number of potential determinants of bank profitability considered in our study. A proliferation of instruments could lead to spurious test results relating to the validity of instruments. System GMM estimation rather than difference GMM estimation has been used because the data series for some of the regressors including the lagged dependent variable were found to be persistent in nature and a time invariant regressor such as a dummy variable indicating nature of bank ownership had to be included in the analysis.

The study is organized as follows. The theoretical base and existing literature is discussed and reviewed in Chapter II. The empirical framework of the present study is comprehensively discussed in Chapter III. Results are reported and analysed in Chapter IV. Finally, in Chapter V conclusion of this dissertation is presented.

Chapter-II

Theoretical Base and Literature Review

2.1 Introduction

Banks are an integral part of our economy; our economy could not function without them. Banks are like the oil that keeps the wheels of the economy turning. Soundness and stability of banking system are very crucial for economic development of any country. But we know that a sound and stable banking system needs some minimum flow of profits to be maintained. Therefore it becomes important to see the impact of various factors on the profitability of commercial banks.

As per existing studies, the determinants of profitability of banks can be divided into two main groups. The first group include those determinants of profitability that are specific to each bank and therefore, in many cases, are the direct result of decisions taken by management. In the second group industry specific and macroeconomic factors are considered. These are the factors within which banks operate such as relative size of the bank, economic growth and inflation.

Research on these factors affecting the profitability of banks has generally been done by forming a panel of different countries i.e. as a cross-country analysis. Some of these studies are Islam and Nishiyama (2016), Goddard, Molyneux and Wilson (2004), Molyneux and Thornton (1992), Bashir (2003), Kunt and Huizinga (1999), and Bikker (2002). However, country specific studies have also been done, such as Sinha and Sharma (2016), Vyas, Singh and Yadav (2008), and Berger et al.(1999).

Accordingly, this chapter is organized as follows: In the second section of this chapter i.e. section 2.2, the theoretical framework of this dissertation is discussed. Section 2.3 then reviews the studies on determinants of profitability of banks in countries other than India. In section 2.4, the literature relating to India is reviewed in detail. Finally, we comment on some aspects of the existing literature in the last section of the chapter.

2.2 Theoretical Framework

The profitability of banks can be broadly conceived as the resultant of five kinds of forces:

1. Bank objectives
2. Bank-specific constraints on choice variables
3. Regulatory constraints
4. Monetary policy variables
5. Macroeconomic factors

Any organization starts with an objective and in order to fulfill those objectives it has to take some decisions subject to certain constraints. Similarly, banks have their objectives with regard to which decisions are taken by the management of banks. For example, public sector banks in India are required not simply to earn profits but, meet social objectives by catering to the needs of the underprivileged and weaker sections of the society, providing support to agriculture and other priority sectors and preventing concentration of wealth in the economy. On the other hand, the main objective of private sector banks is to earn profits.

This difference in objectives of different banks can influence decision making. Although services offered by both public sector and private sector banks are almost the same, charges differ and so do the quality and time duration for the services provided. For example, private sector banks are known for providing better customer service, however, they charge for the extra services provided by them. Moreover, the customer base of the two banks is also different. For example, while government employees and the economically disadvantaged find it easier to open their bank accounts in public sector banks, corporate employees are targeted by private sector banks in India. Given the macroeconomic environment and external constraints faced by banks, different decisions by bank managements can then lead to different values for various outcome variables.

Therefore, factors specific to a bank which shape its objectives during a particular period are important determinants of profitability. Most notable among these factors would be the nature of ownership of the bank, the capital position of the bank and the existing relative size of the bank in the industry**.** We have already explained how the nature of bank ownership i.e. whether a bank is privately or publicly owned, can influence a bank's objectives. The relative size of banks matters because large banks may be willing to take up relatively greater risks because the probability of a public bailout in the case of bank failure may be positively related to the size of the bank. A bank with a sound capital position is better able to withstand unexpected losses. Banks subject to greater capital risk, signaled by a high proportion of nonperforming assets in total advances or a low value of the capital adequacy ratio, will be much more risk averse in decision making. A high NPA ratio would, for example, constrain the bank in taking up more risky positions and therefore influence the bank's portfolio and hence profitability. If a bank has a higher NPA ratio at the beginning of a period, it will be more cautious in lending in that period. Therefore it will avoid assets associated with higher risks. Since higher risks are associated with higher returns this leads to lower profits. Not only this, a higher existing NPA ratio also implies lower earnings and higher chances of capital loss and therefore lower profits in the current period.

The second set of forces which determine choices made by banks within a period are the internal and external constraints which are specific to a bank. Some of the factors which shape these constraints are also those which influence its objectives. We have already explained how the nature of bank ownership i.e. whether a bank is privately or publicly owned, can influence a bank's objectives. It is, however, also necessary to recognize that the nature of bank ownership can also potentially influence the set of internal and external constraints on bank actions. Political interference can at times force public sector banks to be more lax in extending loans and in loan recoveries. Private sector banks *may* adopt greater diligence in assessing the creditworthiness of borrowers because they know that in the case of financial difficulty no government will turn up to bail them out. On the other hand, as employees of public sector banks have secure and stable job tenure they will be more cautious as they know if they were caught in wrong acts, they will have to face severe punishment which can even be losing their jobs. However, they also know that as these banks are publicly owned, the public has more faith in them regarding their stability as in the case of bank failure, the government can bail them out.

Similarly, the higher the relative size of a bank in the industry the greater might be its market power and the greater the freedom it has in choosing its actions. Larger banks may enjoy economies of scale but, may also suffer from operational inefficiency due to more agency[5] and bureaucratic problems and "too big to fail reasons"[6]. Therefore, while it is clear that the constraints faced by a specific bank may be influenced by its relative size, the direction of this influence cannot be predicted beforehand.

Other than these factors, the nature of the banking business itself constrains decision making by banks. For example, most of the existing term loans and term deposits or borrowings of the bank are contracted at fixed rate of interests for a fixed tenure. Therefore banks cannot recall loans, refuse to renew existing loans of long-term customers or prematurely close term deposits whenever they want to do so. This can hurt their image and lead to the loss of long-term credit-worthy customers. Since banks cannot adjust their asset portfolio and liabilities as per their desire without considering implications for the long-term profitability of the bank, we would expect to find some degree of persistence in the time series for measures of bank profitability.

The third set of forces determining bank profitability is bank regulations. These are mostly regulatory and prudential measures imposed by RBI on banks which they have to follow. These measures include, for example, maintenance of a mandated Statutory Liquidity Ratio (SLR), maintenance of the Cash Reserve Ratio (CRR), conformity with capital adequacy and priority sector norms.

In India each scheduled commercial bank is supposed to keep minimum cash balance with the Reserve Bank as cash reserve ratio (CRR). Reserve Bank prescribes this ratio as a percentage of the net demand and term liabilities (NDTL) of banks relating to the second preceding fortnight. If banks are supposed to maintain higher cash balances as CRR with RBI, then availability of funds with banks for allocation to alternative categories of assets

[5]In any relationship when one party is expected to act in another's best interests, a conflict of interest arises, which is popularly known as agency problem. In banking sector, agency problem could arise if *bank* managers are unwilling to increase risk to the level that would maximize shareholder value.

[6] "Too big to fail" describes the idea that if a bank is too large its failure can have an adverse impact throughout the economy. Therefore government will provide assistance to prevent its failure.

would be lower. CRR does not earn any income for the banks, and is, therefore, a drain on the profitability of banks.

On the other hand, in terms of Section 24 of the Banking Regulations Act, 1949, "scheduled commercial banks have to invest in unencumbered government and approved securities a certain minimum amount as statutory liquidity ratio (SLR) on a daily basis". The SLR forces banks to hold a minimum fraction of their deposits in the form of government securities. Because of this banks may have to forego higher interest rates which they can get by investing in private sector loans and securities. Consequently, it can have a negative impact on bank balance sheets and therefore on profitability.

Those sectors of the economy which do not get timely and adequate credit in the absence of special consideration are referred as priority sectors. According to a recent notification of RBI dated May 10, 2016, these are loans for agriculture and allied activities, micro, medium and small enterprises, education, housing, export credit, social infrastructure, renewable energy and others. Scheduled banks operating in India have to lend 40 percent of adjusted net bank credit or credit equivalent amount of off-balance sheet exposure, whichever is higher to priority sector. Due to priority sector lending norms a restriction is imposed on banks in allocation of assets which in turn influences their profitability.

Monetary policy variables like the repo rate constitutes a fourth set of variables explaining the profitability of commercial banks. The repo rate, for example, is the rate at which central bank of a country, in effect, lends money to commercial banks and is used by the RBI, for example, as its primary instrument of monetary policy. In theory, an increase (decrease) in the repo rate should have a contractionary (expansionary) effect on bank lending the holding of other relatively illiquid assets because it increases the cost of liquidity for banks. Since the rate of return is greater on relatively illiquid bank assets, this has implications for bank profitability.

Finally, the last set of factors includes macroeconomic factors. Among the broad macroeconomic factors which can impact the profitability of commercial banks in India economic growth and inflation in the economy deserve primary attention.

Economic growth measured by the growth rate of real gross domestic product (GDP) can have both negative as well as positive impact on bank profitability. Higher GDP growth[7] implies higher production and consumption in the current period and it also promotes investment in the economy, thereby increasing the demand for bank credit because of which banks generate interest income, and hence have increased profits[8]. However, at the same time, economic growth can adversely impact bank profitability as measured by ROA or ROE. Islam and Nishiyama (2016) argue that economic growth of a country reflects soundness and stability of the economic environment of the nation. In a growing economy, environment in which banks operate is relatively relaxed and less risky and therefore can charge less from their customers. Thota (2013) also argued that higher GDP growth improves the business conditions and reduces barriers to entry. This increase in competition reduces bank profitability.

There is, however, a more fundamental reason why bank profitability measures may be negatively related to current economic growth. Current economic growth will lead to increase in demand for credit in the economy. Assets of the bank will increase but, banks might not get interest on all of these increased assets in the current year as most of the loans contracted pay fixed interest rates annually. Therefore loans which were given in July of current year may fetch interest income in July of next year. Hence growth in the numerator of the return on assets ratio might be less than the growth in its denominator, which can result in a negative relation between measures of profitability and current economic growth.

Moreover, as banks will need more funds for this increased credit demand, they might increase their deposits or borrowings. As banks have to pay interest on both deposits and loans there will be a drain on their net incomes which will tend to reduce their measures of profitability.

The impact of inflation on profitability of commercial banks depends on the extent to which inflation is anticipated. To the extent that banks can anticipate movements in the inflation rate they can accordingly adjust interest rates in order to have their revenues higher

[7]When dependent variable is expressed in relative terms it is more appropriate to explain changes by relative variation in explanatory variables. Therefore GDP growth is more appropriate here than level of GDP.

[8]Goddard, Molyneux and Wilson (2004), Sinha and Sharma (2016), Karimzadeh (2013), Capraru and Ihnatov (2015), and Trujillo and Ponce (2013) present this viewpoint.

than their costs and therefore acquire higher profits. If inflation is not anticipated by banks correctly it could have an adverse impact on profitability as their costs could be higher than their earnings. Therefore, there is a possibility of inflation having a positive impact on profits of banks as well as an adverse impact.

As discussed in this section there are various determinants of bank profitability whose impact can be studied. But we will have to restrict the number of explanatory variables used in this study. The reason for restricting the number of variables is the methodology used in this study. As discussed above, most of the determinants of profitability of banks are predetermined in nature because of which GMM[9] estimation technique is used in this study. The generalized method of moments uses instruments to get rid of predetermined variables and with an increase in the number of variables, the number of instruments also increases. This can lead to a problem of instrument proliferation which can lead to unreliable results. Hence, we have to the number of independent variables used in this study.

2.3 Review of literature based on studies done outside India

There exist many empirical studies on determinants of bank performance. Out of these, studies which focus mainly on countries other than India include Bashir (2003), Gul et al. (2011), Trujillo and Ponce (2013), Huizinga and Kunt (1999), Pan and Pan (2014), Duraj and Moci (2015), Islamand and Nishiyama (2016), Staikouras and Wood (2011), Athanasogloue al. (2008), Albertazzi and Gambacorta (2009), Bikker and Hu (2012), Kiganda (2014), Wang and Wang (2015), Capraru and Ihnatov (2015), Goddard, Molyneux & Wilson (2004), Agbeja et al. (2015) and, Dietrich and Wanzenried (2011).

We have divided this section further based on different methodologies used in different papers. The First subsection, i.e. 2.3.1, discusses those papers which have used the ordinary least squares method as the estimation technique. In subsection 2.3.2 papers which have used within effects (or fixed effects) transformation method are discussed. Finally, in subsection 2.3.3 those papers are discussed which have used GMM technique.

[9] Refer to section 3.4 for details of GMM estimation method.

2.3.1 Studies which have used OLS technique for estimation

Ordinary least squares (OLS) as the name suggests is a method used to estimate the unknown parameters in a linear regression model, with the goal of minimizing the sum of the squares of the error term[10].

Kiganda (2014) presented a case study of Equity Bank Limited of Kenya to analyze the impact of macroeconomic factors on bank profitability. Equity Bank Limited is the holding company of the group's banking subsidiaries in Uganda, Southern Sudan, Rwanda and Tanzania. The estimation technique used in this study was the ordinary least squares method. The time period covered in this study was five years from 2008 to 2012. Return on assets was the dependent variable in this study. Independent variables include annual rate of GDP growth, inflation and exchange rate. The study found insignificant effects of all macroeconomic factors on bank profitability.

Wang and Wang (2015) studied 2897 banks in the USA for the time period 2002 to 2014. Return on assets and return on equity were the dependent variables used in this study. Independent variables included bank size, capitalization, loans to total assets ratio, financial structure, the ratio of nonperforming loans to gross loans, the cost to income ratio and revenue diversification. An index of revenue diversification was calculated as follows

$$DIV = 1 - (SH_{NET}^2 + SH_{NON}^2),$$

where SH_{NET} is the share of net operating revenue from net interest sources and SH_{NON} is the share of net operating revenue from non-interest sources. It was found that banks which are larger in size have higher ROA but lower ROE. Capitalization was also found to positively impact ROA and negatively impact ROE. The coefficient of the loans-to-total-assets ratio was, unexpectedly, found to be significantly negative. The positive and significant impact of the deposits to total liabilities ratio was explained by authors with the argument that banks might be offering high interest rates in order to attract more deposits, which in turn reduces their profitability. This argument is not convincing as it suggests more the deposits lower the

[10]Error term is defined as the difference between the observed values of explanatory variables and those predicted by a linear function of a set of explanatory variables.

profitability which contradicts the authors' argument. Then nonperforming loans to total loans ratio is negatively related as expected. Efficiency, measured by the cost to income ratio, was, as expected, found to be positively related to profitability. Finally, diversification was also found to be positively related to the profitability of banks. One limitation of this paper, mentioned by the authors themselves, is that some of the explanatory variables used in the model, such as capitalization, might be endogenous. More profitable banks may have higher capital. If this is the case then estimating the model with OLS will produce biased results.

Agbeja et al. (2015) studied the impact of CRAR on bank profitability. This study was conducted using data on five Nigerian banks for five years i.e. from 2010 to 2014. The authors addressed the following three questions:

i. Does a bank's capital adequacy ratio positively influence bank profitability?

ii. Is there any relationship between the extent of bank loans and advances and bank profitability?

iii. What is the relationship between capital adequacy ratio and bank's exposure to credit risk?

A significant positive relationship was found between capital adequacy ratio and bank profitability. Loans and advances had a significant effect on bank performance. Finally, bank's exposure to credit risk was found to erode the adequacy of capital significantly.

Gul et al. (2011) examined the factors affecting bank profitability in Pakistan over the period 2005-09. Pooled ordinary least square (POLS) method was employed in this paper to investigate the impact of bank size, ratio of equity capital to total assets, ratio of total loans to total assets, ratio of total deposits to total assets, GDP, inflation (measured by consumer price index) and market capitalization on major profitability indicators i.e., return on asset (ROA), return on equity (ROE), return on capital employed (ROCE) and net interest margin (NIM) separately. The reason given by the authors for using pooled OLS estimation is the stability of variables across cross section units. Other than the ratio of equity capital to total assets and market concentration, all variables were found to be positive and significant when ROA was the dependent variable. For ROE, loan ratio had a negative but insignificant relationship, whereas coefficients of all other variables were significant and positive except capital ratio

and market concentration which had negative coefficients. When ROCE was used as dependent variable, the coefficients of deposit ratio and inflation were found to be positive but, insignificant, whereas GDP had a negative but insignificant effect. Bank size, capital ratio and market concentration had an insignificant relation with NIM. GDP and capital ratio had negative and significant impacts on NIM whereas loan ratio and inflation had significant positive impacts. The use of current values of the ratio of total loans to total assets and the ratio of total deposits to total assets as regressors for the various profitability measures, especially ROA, however, suggests that there might be a serious problem of endogeneity in the analysis. The problem is more serious because the influence of unobservable bank characteristics like the quality of bank management is not taken into consideration. The inclusion of fixed effects in the model takes care of this problem. Papers which have used fixed effects estimation are discussed in the next subsection.

2.3.2 Studies which have used fixed effects model for estimation

A simple fixed effects model can be defined as a model that represents time independent effects for each entity that are possibly correlated with the regressors. These models assist in controlling for unobserved heterogeneity by demeaning the variables. This is also known as within transformation. As banks also have some unobserved specific characteristics which differentiate one bank from another, a fixed effects model is assumed to be better suited for this study than simple OLS method. Some of the papers which have used within transformation are discussed here.

Regehr and Sengupta (2016) tried to analyze how bank profitability changes with bank asset size after accounting for other factors that affect bank profitability. Sample period for their study was 2001-14 which was divided into three sub-periods: the pre-crisis expansion from 2001 to 2006, the crisis period during 2007–09, and the post-crisis recovery period from 2010 to 2014. Their sample comprised of 8,315 community and regional banks of U.S with assets less than $100 billion (valued at 2014 U.S. dollars). They measured bank size as the natural logarithm of total assets. Square of the logarithm was also introduced in the model to capture changes in the size-profitability relationship as bank size changes. Return on average assets was used as the dependent variable. They found that profitability increases with bank size but at a decreasing rate. They also found that larger banks had higher returns during the pre-crisis and post-crisis periods but, smaller banks saw higher returns

during the crisis. It was also found that even after incorporating bank specific and market specific factors this relationship held. The problem with this study is that the authors in accounting for other factors that might affect banks' profitability have missed an important factor which is lagged value of profits. It is an important variable as the ability of bank managements to realize profits in the current period is to a large extent constrained by actions taken in past periods, the effect of which on bank profitability is captured by the lagged value of the profitability measure.

Staikouras and Wood (2011) used the within effects transformation to estimate a fixed effects model of determinants of European bank profitability. The Time period covered in this study was 1994 to 1998 and the sample covered 685 European banks across 13 countries. Return on assets was used as a measure of profitability. Explanatory variables used in this paper were loan to assets ratio, equity to assets ratio, provisions for loan losses to total loans ratio, concentration ratio, and inefficiency measured as the ratio of overhead expenses to total assets, the growth rate of GDP and growth rate of gross personal income. The authors found a negative impact of GDP growth rate on bank profitability. According to them, countries with higher GDP or GPI (gross personal income) have a banking system that operates in a mature environment resulting in more competitive interest and profit margins. Therefore, a negative relationship between the two was to be expected and results were in line with these expectations. Market structure variables were insignificant. All other variables were significant and with expected signs.

Capraru and Ihnatov (2015) in their paper analyzed the determinants of bank profitability in the EU15 banking system for the period 2001-11. The European Union was formed initially with 15 countries. Then there were three successive waves of enlargement in 2004, 2007 and 2013 and now currently there are 28 members. The authors measured the impact of the first and the largest wave of enlargement (10 new members in 2004) on EU15 bank profitability, introducing a dummy variable. The return on average equity, the return on average assets and the net interest margin were used as measures of bank profitability. Three categories of independent variables were considered: Bank-specific variables (bank size, financial structure, credit risk, liquidity risk, business mix, income-expenditure structure and capital adequacy); industry specific variables (market concentration, financial intermediation etc.) and macroeconomic variables (economic growth and inflation). After estimating the influences of variables mentioned, they introduced a dummy variable for "first wave of

enlargement" for the period from 2004 to 2011. Growth in GDP per capita and inflation (measured by GDP deflator) were found to have a positive and significant influence on ROAA and ROAE, but an insignificant effect on NIM. They found, in addition, that the process of European Union enlargement from 2004 did not have a significant impact on EU15 banking systems' profitability. It had a weak and negative effect only in the case of net interest margin.

One common problem with papers discussed in this section is that they have ignored the fact that some of the variables used in these studies could be predetermined or endogenous in nature. For example, capital adequacy ratio at the end of the previous year will influence decisions of management of banks this year. If there is adequate capital in the beginning of the period, banks can afford to take risks and invest in those assets which are risky in nature but highly profitable. Therefore, the composition of loans will change accordingly. Also, more profitable banks might have higher levels of capital, which in turn leads to the problem of endogeneity. In some cases lagged values of other variables such as loan to total assets ratio, deposit to total assets ratio and bank size can be used in place of their current values to determine the profitability of banks. However, these variables will be predetermined[11] (or sequentially endogenous) in the model. Fixed effect estimation cannot be used with endogenous and predetermined variables. If these variables are estimated using fixed effects model, results will be biased.

A specific and relevant illustration of a predetermined explanatory variable in the context of models of bank profitability is a lagged dependent variable. We have already discussed why because of the nature of the business of banking, bank actions in the current period are constrained by decisions taken in the past with the implication that bank profitability in the current period is closely related to bank profitability in previous periods. With a lagged value of the dependent variable as one of the explanatory variables, even after

[11]Predetermined variables are those variables whose current and lagged values are uncorrelated with the disturbance of the current period but whose future values may be correlated with the disturbance. In econometric models this implies that the error term of current period is uncorrelated with current and lagged values of the predetermined variable but may be correlated with future values. For example, if there is change in NPA ratio it will be uncorrelated with past and potentially current profitability but might be correlated with future profitability of banks.

the within transformation, there is a violation of the assumption of strict exogeneity because the demeaned lagged dependent variable is necessarily correlated with the demeaned idiosyncratic error. This will result in biased and inconsistent estimates. Hence, GMM estimation technique was proposed that exploits all the linear moment restrictions that follow from the assumption of no serial correlation in the errors and no strictly exogenous variables. It has emerged as the commonly accepted estimator for estimation of dynamic panel data models.

2.3.3 Studies which have used generalized method of moments (GMM) for estimation

In analyzing the determinants of bank profitability, dynamic panel models might be a better option than fixed effects model as they capture a very important characteristic of bank profits, that is its persistence. Anderson and Hsiao (1981) first proposed a technique to estimate dynamic panel models using instrumental variables (IV) approach. However, later it was found that the Anderson–Hsiao estimator has a higher asymptotic variance than estimators proposed by Arellano and Bond (1991). The latter used the similar instruments, but adopted the generalized method of moments estimation approach. GMM estimators are of two types – Difference GMM and System GMM. The system GMM is assumed to be better than difference GMM if the underlying data generating process can most accurately be modelled as an autoregressive (AR) process with highly persistent AR explanatory variable and the dependent variable. (Grohmann, 2015) It also uses additional moment conditions which allow for the inclusion of time invariant variables which get omitted in estimation by difference GMM.

Some of the papers which have used GMM estimation technique to solve dynamic panel models in their studies are discussed here.

Trujillo and Ponce (2013) used system GMM estimators to analyse the determinants of profitability of Spanish banks for the period 1999-2009. Return on assets and return on equity were the dependent variables used in this study. Independent variables considered along with the first lag of the dependent variable were the loans to total assets ratio, the ratio of non-performing loans to gross loans, the ratio of loan loss provisions to net loans, equity to total assets ratio, deposits to total liabilities, annual growth rate of customer deposits, cost to

income ratio, logarithm of bank assets, Herfindahl–Hirschman index, annual growth rate of the real gross domestic product, consumer price index and interest rate on the main refinancing operations. For estimation purposes, system GMM is used. In the first difference equation, the system-GMM estimator uses lagged levels of the dependent and endogenous variables as instruments. The Arellano-Bond test for second-order serial correlation and the Sargan/Hansen test for over-identifying restrictions were also performed in this study. High significant values of both lagged dependent variables (i.e. return on assets and return on equity) confirms the dynamic nature of the model. The coefficient of lagged dependent variable is close to 0.4 in both cases which indicate moderate persistence of profits. A positive and significant impact of asset structure, asset quality, deposit to asset ratio, HHI and GDP growth on the profitability of banks were found. The impact of bank capital was found to be positive when the dependent variable is return on assets and negative when the dependent variable is return on equity. Inflation had a positive influence on return on assets but insignificant for return on equity. The cost to income ratio had a negative impact as per expectations. Whereas, against expectations, correlation with the interest rate on the MRO was found to be negative. This inverse relationship was defended by giving the argument that interest rate changes more rapidly on funding side compared to lending side. As a result when the interest rate falls, net interest margin increases and vice versa.

Author has also done some robustness check, first by employing different methodology such as OLS and within estimators. Other than bank size which shows a negative relation with profitability while estimated by OLS, all other variables had same signs and significance when estimated by other methods. Second robustness test was done by changing some variables such as the ratio of liquid assets to total assets in place of the ratio of loans to total assets, squared logarithm of bank assets for bank size and the ratio of non-interest income as a percentage of total operating revenue instead of Herfindahl-Hirschman index. The results did not differ from previous results.

Athanasoglou et al. (2008), used one-step[12] GMM estimators in their study. Authors have not explicitly mentioned whether it is difference GMM or system GMM. But the inclusion of dummy variable nature of ownership suggests the use of system GMM as time-

[12] In one-step estimation, the standard errors are not robust to heteroskedasticity or serial correlation in the errors.

invariant variables get omitted in difference GMM. Their study is based on an unbalanced panel of Greek banks and covers the period 1985-2001.The dependent variable used in the study was the return on assets. The study found a significant coefficient of the lagged profitability variable. The value of the coefficient was 0.35 which showed the moderate persistence of profits. There was a positive and significant coefficient of the capital variable. Credit risk measured by loan-loss provisions to loans ratio was negatively and significantly related to profits. The study found a positive and significant effect of productivity growth on profitability and a negative effect of operating expenses. The effect of bank size was insignificant. A negative and insignificant impact of concentration was found. However, authors found a strong correlation between the cyclical component of output and bank profits. It was found that coefficient of cyclical output is much higher when output exceeds its trend value but, the coefficient of cyclical output becomes insignificant when it is below its trend. This shows that banks are able to insulate their performance during economic downturns. Also, actual inflation in the previous year was taken as a proxy for expected inflation and it was found that it positively and significantly affects the profitability of Greek banks. This was attributed to Greek banks' management satisfactory anticipation of inflation which in turn helped them in adjusting interest rates appropriately to achieve higher profits.

Islam and Nishiyama (2016) also used system GMM estimators to study the impact of bank-specific, industry-specific and macroeconomic factors on the profitability of 259 commercial banks over the period 1997-2012. Countries covered in this study are Bangladesh, India, Nepal and Pakistan. However, they found the value of the coefficient for the one year lagged dependent variable statistically significant, which justifies the use of one-step GMM. However, they found a low degree of profit persistence as the value of the coefficient was 0.1076. It was found that whereas the equity level of a bank positively affects its profitability, liquidity position of a bank, funding gap, cost of funds and productivity ratio negatively and significantly affects bank returns. This study also found that deposit growth rate and bank size did not affect bank profitability. The authors found no evidence to support the traditional SCP (Structure Conduct Performance) hypothesis that market concentration had a positive impact on returns as the proxy variable HHI was insignificant. Macroeconomic determinants viz. GDP growth rate and term structure of interest rates had a significant negative impact on the profitability of banks. The results showed a significant positive influence of inflation on profitability which was explained by the authors as due to the existence of asymmetric information in South Asian banking. An important finding was the

considerable reduction of bank profits in the South Asian countries due to what the authors term as the late hit of the global recession in the region. Their results show that banks lose approximately26 basis points of ROA in the year 2009.

Goddard, Molyneux & Wilson (2004) used the dynamic panel and cross-section analysis to estimate growth and profit equations of five major European Union countries during the mid-1990s. The dependent variable for the profit equation was return on equity and for growth equation was change in logarithm of total assets of bank i between time period t and t-1. In this paper, they presented univariate, bivariate and multivariate versions of both models. In univariate version, current growth is modelled using lagged size and lagged growth covariates; and current profit is modelled using lagged profit. Bivariate version incorporates lagged profits in growth equation and lagged growth in the profit equation. Finally, variables included in multivariate version are nominal value of OBS business/(total assets -nominal value of OBS business) for bank in year t, where OBS is off balance sheet business, capital to assets ratio, liquid assets to total assets), share of bank i in its country's total banking sector assets, banking sector Herfindahl index and annual growth rate of real GDP.

The Authors tried to capture two-way causality between growth and profit and found current profit to be an important pre-requisite for future growth. But excessive current growth was found to have damaging implications for future profit. Capital assets ratio and liquidity ratio had a modest effect on profitability. Market concentration and profitability ratio were found to be positively related in this study. But there was little indication of a relationship between bank level export inefficiency and profitability.

In another paper Goddard, Molyneux and Wilson (2004a) used three models to evaluate determinants of bank profitability. These are a cross-sectional, a pooled cross-sectional time-series and a dynamic panel model. This study used data for six major European countries namely, Denmark, France, Germany, Italy, Spain and the UK for the period 1992-98. Return on equity was used as the only measure of profitability. Independent variables incorporated in these models include size, diversification, risk and ownership type, as well as dynamic effects. It was found that coefficient for profit persistence was higher when estimated with pooled model than dynamic panel model. The degree of profit persistence was found to be the highest in France as per both the pooled and the dynamic

panel models. The authors argued that this is because of the historically high level of government regulation which has protected banks in France from the full rigours of competition. Spain showed the lowest degree of profit persistence, as low as 0.0896. However other remaining countries show the moderate persistence of profits. If we look at the relationship between bank size and profitability in this paper, no evidence was found in the pooled estimations. However, the cross-sectional and dynamic panel estimations show some significant size–profit relationships within the data set. A positive relationship was found between CAR and profitability. Evidence of systematic variation in profitability by nature of ownership in countries other than Germany is little. No systematic relationship was found between nature of ownership and profitability in pooled estimations.

The Authors could have done some robustness checks in their study by allowing for the possibility that some of them are endogenous or predetermined variables. For example, CAR could be used as a predetermined variable as the capital position at the beginning of period will influence decisions of banks regarding their portfolios throughout the year and therefore measures of profitability at the end of the year. Results could also be checked at different lag levels for robustness.

2.3 Review of literature based on studies done in India

Literature available in India on impact of various factors on profitability of banks include contributions by Sinha and Sharma (2016), Badola and Verma (2006), Rao (2006), Thota (2013), Vyas et al. (2008), Karimzadeh et al. (2013), Verma (2015), Bhatia et al. (2012), and Pandia and Vellingiri (2014).

As in the previous section, this section will also have subsections discussing contributions based on the methodologies used viz. ordinary least squares method, within transformation estimation technique and GMM estimation technique.

2.3.1 Studies which have used OLS technique for estimation

Karimzadeh et al. (2013) used a linear regression model to study the determinants of bank profitability using data for 8 Indian banks, viz. State Bank of India, Bank of India, Central Bank of India, Punjab National Bank, Union Bank of India, ICICI Bank, HDFC Bank

and Axis Bank, over the period 2003-11. The dependent variable in this study was return on assets and independent variables were the size of a bank, the average lending rate charged by the bank, loans to total assets ratio, deposits to total assets ratio, market concentration, GDP and inflation. Simple ordinary least squares method was used to estimate the regression equation. Bank size, deposits to total assets, loans to total assets, market concentration and GDP, all were found to be positively related to return on assets. However, inflation and lending rate were found to be negatively related with ROA but the relation for both was statistically insignificant.

Bhatia, Mahajan and Chander (2012), in their paper, consider 23 private sector banks of India and the four-year period 2006-07 to 2009-10. The time period is chosen to cover the period of financial crisis and bank failures in developed countries like the USA. The methodology used in this study is Backward Stepwise Regression Analysis. Return on assets is used as a measure of profitability. It was found that the bank-specific variables viz. spread ratio, provisions and contingencies, non-interest income, operating expense ratio, profit per employee, investment-deposit ratio and non-performing assets had a significant effect on the profitability of banks in the private sector of the Indian economy. A puzzling feature of the study is the inclusion of profit per employee, which is calculated as net profits divided by a total number of employees, among the regressors. As banks will come to know about net profits at the end of the financial year, profit per employee will also be determined at the end of the year. Therefore, it is not clear how something, which is getting simultaneously determined with the profitability of banks, can impact it unless it is a lagged value of profit per employee.

In contrast to the previous paper in which only Indian private banks were studied, Badola and Verma (2006) confined their study to only public sector banks in India. The methodology used in their study is step-wise multivariate regression model used on temporal data. The time period covered in this study is 1991-92 to 2003-04. The study found non-interest income, operating expenses, provision and contingencies and Spread to have a significant effect on profitability. Net profit (profit after tax) is used as measure of profitability. Provision and contingencies and operating expenses displayed a negative relationship with profits while others had a positive relationship. However, some variables, namely, the credit deposit ratio, non-performing assets as percentage of net advances and business per employee were found to have relatively low explanatory power. A peculiar thing

with this study is that some of the explanatory variables used are absolute and some are relative in nature.

Rao (2006) focussed on the impact of monetary policy on the profitability of banks in India. Firstly, regression analysis was done to analyze all the independent variables independently. For that ROA was regressed on each monetary policy variable separately and all were found statistically significant. Ordinary least squares method was used for estimation. The independent variables considered were bank rate, lending rates of the banks, cash reserve ratio and statutory liquidity ratio. After that multiple regression was conducted and the results showed, surprisingly, that there was no significant relationship between monetary policy and profitability of public sector banks.

Verma (2015), analyze the impact of macroeconomic factors on an index of returns on bank stocks. The index was calculated by taking the average returns of banks listed on National Stock Exchange of India for the period of April 2005 to January 2015. Time series data is used in this study. The macroeconomic variables included a change in the wholesale price index, change in exchange rate, change in industrial production, change in total credit and change in Nifty. Stationarity of various time series was tested using Augmented Dickey Fuller (ADF) test and all series were found to be stationary. Ordinary least squares estimation was done and it was found that wholesale price index and industrial production had an insignificant impact on the index. However, the other remaining independent variables that is, exchange rate, total credit and Nifty had a significant impact on the index.

2.3.2 Studies which have used fixed effects model for estimation

Another study which has tried to analyze bank specific and macroeconomic determinants of profitability for Indian banks is that by Thota(2013). He studied 108 commercial banks of India and covered the time period 1999 to 2011. Banks covered in the study were grouped according to their ownership. The study considered 28 public sector banks (SBI and its associates (08) and Nationalized banks (20)), 35 private sector banks (of these 35 private banks, 24 banks were classified as old and 11 banks as new based on age) and 45 banks operating under foreign ownership. A fixed effects regression method was used to estimate the model. The results indicated that profitability of commercial banks in India, irrespective of the nature of ownership is affected by both internal and external variables and

changes in the overall banking environment. However, it was also found that the impact is not uniform across bank types.

The loans to assets ratio do not have any impact on profitability according to this study. The impact of credit risk measured by the ratio of loan loss provisions to total loans is positively related to profitability levels of foreign and private banks and in the rest of the cases, it is not significant. The estimated results give conflicting signs for the effect of diversification measured by the ratio of non-interest income to total assets. Significant positive coefficients were found for SBI and its associate banks and public banks as a group and negative coefficient was found in the case of new private banks for both measures of profitability viz. ROE and ROA. Also, the impact of overhead costs on ROE was positively significant in the case of all banks and foreign banks as a group, while negatively significant in the case of public banks as a group. In the rest of regressions, it was not significant. The impact of overhead costs on ROA was positively significant in the case of all banks and negatively significant for private banks. The level of capital strength and ROE were negatively related and it holds with ROA in the case of all banks, foreign and private banks but it does not hold for public sector banks. For public sector banks, it was positive and significant. Size had an insignificant relationship with bank profitability. It was found that GDP growth rate negatively impacted profitability in the case of all banks and private banks as a group. Thota argues that economic growth improves the business environment and lowers entry barriers which in turn increase competition. This increased competition consequently lowers bank profitability. Money Supply (M2) growth and inflation impact ROA positively which, according to the author, indicates that Indian banks anticipated money supply and inflation correctly. One of the problems with this study is that the author has ignored the fact that profits can persist over time, recognition of which could have changed the entire study by affecting the methodology used and results obtained.

Vyas, Singh and Yadav (2008) investigated the effect of CRAR, noninterest income and net interest margin on ROA of Indian scheduled commercial banks (excluding regional rural banks) in a panel data study for the period 1997-2007. They found a positive and significant result for all the factors in their study. It was also found that ownership of banks i.e. whether a bank is public or private has no effect on bank profitability.

2.3.3 Studies which have used generalized method of moments (GMM) for estimation

Sinha and Sharma (2016) used a dynamic panel data framework to study determinants of bank profits for Indian banks. Indian commercial banks covered in the study over the period 2000-2013 are 42 in number. The same model was also estimated separately for the crisis period from 2006 to 2009. Because of the persistence in the time series for bank profits and the endogeneity of determining factors, estimation by difference generalized method of moments (GMM) was used in this study. A problem of endogeneity is created due to the presence of lagged dependent variable in the model, as it gets correlated with error terms. The authors also modelled capital to assets ratio as an endogenous variable. Moreover, banks generally decide provisions which they kept aside for bad debts in advance and accordingly adjust at the beginning of financial year. Hence, the ratio of provision for loan losses to total loans, which depicts credit risk of the bank, was modelled as a predetermined variable in the model used.

Only return on assets was used as a measure of bank profitability in this study. Six bank specific variables were studied to see their impact on bank profitability. These were the ratio of provisions for non-performing assets to total loans, capital to assets ratio, annual growth of deposits, bank size, non-interest income and operating expenses to total assets.

The Herfindahl - Hirschman Index (HHI) is used as a measure of market concentration, which is an industry specific variable. The macroeconomic variables which were considered included GDP growth and inflation rate.

A major problem for the reader of this study is that, because the methodology has not been reported properly, it is not possible to gauge the correctness or significance of the exercise. For example, an important consideration in GMM estimation of dynamic panel data models is the number of instruments used in the model. Instrument proliferation can over fit endogenous variables and therefore might not be able to get rid of problem of endogeniety (Roodman, 2009). Sinha and Sharma do not report the number of instruments. However, the value of the Hansen test statistic is reported. Also, the authors could have used different lag

levels to check the consistency of results. Also, as we discuss later, variables like GDP growth rate are potentially endogenous variables.

Sinha and Sharma found a significant value of the lagged dependent variable justifying the use of the dynamic model and indicate the moderate persistence of profits. The positive significant relationship was found between banks' profits and GDP growth rate. The authors explain this relationship by arguing that with growth in GDP, credit demand increases leading to higher bank profits. The effect of inflation on profits was found to be negative and was attributed to the wrong anticipation of expected rise in inflation. The authors have also observed a positive impact of size on banks' profitability. The effect of the ratio of provisions for loans losses to total loans was found to be statistically significant and negative across all time periods. Other variables which had a significant positive effect on bank returns included the ratio of capital to assets, the share of non-interest income, the value of the HHI, the ratio of operating expenses to total assets and deposit growth. The effect of the last two variables was, however, weak or insignificant during the crisis period.

2.4 Some general comments on the existing literature

In our view, existing studies on the determinants of bank returns especially in the case of India suffer from any one or both of two major shortcomings.

Firstly, in a large number of contributions to the literature, the notion of a determining variable used is misleading. In our view, x is a determinant of y if and only if it can be said to decisively affect the level of y not if it is simultaneously determined with the level of y. However, in the above studies, variables like the ratio of non-interest income to total assets, the growth rate of deposits, investment-deposit ratio, the ratio of deposits to total assets, the share of loans in total assets and the ratio of operating expenses to total assets are not something which determines the profitability of commercial banks. They are simultaneously determined along with bank profits by the decisions of the bank management and the macroeconomic and policy environment.

Not only this, some of these ratios like the operating expenses to total assets ratio are by definition negatively related to the return on total assets. We do not need an empirical

investigation to tell us that *ceteris paribus* a bank with a higher value of the ratio will have a lower return on assets. Thus, including this variable hardly adds to an understanding of the determinants of profitability.

Also, if we take non-interest income to total assets into account, first of all it is something which gets determined at the end of the year. Secondly, it depicts how diversified revenues of a bank are, which depends on specific characteristics of banks such as nature of ownership. Private banks may prefer to have more diversified sources of revenue in its portfolio than public sector banks as they generally don't get any financial support from the government like public banks do in case of financial emergency. The size of a bank also influences portfolios of banks as larger banks are generally more diversified than smaller banks as they have the expertise to extend credit in different lines. The attitude of banks towards risk also impacts diversification. As more risk-averse banks will have more diversified portfolios. Therefore considering these specific bank characteristics, different banks will have different decisions regarding choice of assets in portfolios. These portfolios will change throughout the year and at the end of the year various outcomes including return on assets, return on equity, the ratio of non-interest income to total income etc. will get determined on the basis of this portfolio. Therefore even if they are considered as one of the explanatory variables, their values in the previous year should be taken into account. Otherwise, endogeneity problem can arise.

Other than lagged values of variables endogeneity of variables is another issue which is not considered in most of the studies. However, Wang and Wang (2015) in their paper did mention that it is a shortcoming of their paper that they ignored endogeneity of variables. Even some non-bank-specific variables like GDP growth can possibly be endogenous in nature. As higher their flow of profits banks have, the more funds they can lend with the same degree of leverage. Not only this but factors also which affects the willingness and efficiency with which banks lend credit would affect both measures of profitability as well as the growth in economic activity and prices such as interest rates. Therefore, credit creation in the economy will increase, which in turn increases economic activity and annual growth in GDP.

Among the papers reviewed above, Sinha and Sharma (2016) is the only paper which has paid some attention to modelling explanatory variables as predetermined and endogenous.

Moreover, in a major part of existing research, the econometric model does not consider some features of bank profits such as persistence of bank profits, which might arise because of stickiness in asset portfolio of banks and in interest rates. This may result in biased and inconsistent findings. For example, papers like Gul et al. (2011), Staikouras and Wood (2011), Capraru and Ihnatov (2015) and Thota(2013) which have studied determinants of profitability of banks, in general, could have captured persistence of profits in their models. Studies, which have captured the possible persistence of profitability through the inclusion of a lagged dependent variable among the regressors and used GMM estimators, have paid little attention to the important issue of instrument proliferation. Simply by being numerous, instruments can overfit instrumented variable and therefore might get fail in removing their endogenous components. As a result, we cannot gauge the credibility of results as this can bias coefficient estimates towards those from non-instrumenting estimators. Unfortunately, with an increase in the number of instruments the power of the Hansen test to detect this problem of invalidity of the instruments set itself weakens. Its value can be increased by simply increasing the number of instruments. Roodman (2009), therefore, cautions that "researchers should report the number of instruments and reviewers should question regressions where it is not reported." This injunction is often not followed. Sinha and Sharma (2016), for example, use system GMM estimators in their study but, do not report the number of instruments. According to (Roodman, 2009), as formally there are no tests and rules of thumb to tell the optimal number of instruments, it is important for researchers to test GMM results for robustness by reducing the number of instruments. Papers like those by Trujillo and Ponce (2013) include some robustness checks by using different methodologies and by changing the set of explanatory variables such as such as ratio of liquid assets to total assets in place of ratio of loans to total assets, squared logarithm of bank assets for bank size and ratio of non-interest income as a percentage of total operating revenue instead of Herfindahl-Hirschman index. But, none of the reviewed papers tested for robustness to reductions in the instrument set.

Chapter-III
Data and Methodology

3.1 Introduction

The key intention of the present chapter is to present an empirical model suitable to analyze the factors determining the profitability of Indian commercial banks. Therefore, keeping in mind this objective, this chapter is divided into five sections which talk about data and methodology used in this study in detail. In section 2 of this chapter i.e. section 3.2, description of data is provided. In section 3.3, the specification of the econometric model used in this study is explained. Section 3.4 of this chapter discusses the methodology used for estimation purposes in detail. Finally, in last section, the sources of the data and other issues related to the data are discussed.

3.2 Description of Variables

In this section, we have defined the various variables used in this study. We have restricted the number of explanatory variables used in the study in order to restrict a number of instruments in our model. Too many instruments can lead to instrument proliferation, which can fail to remove the endogeneity of variables as explained in section 3.4 of this chapter on methodology.

3.2.1 Dependent Variables

Return on assets defined as the ratio of net income (net profits) to average total assets and return on equity defined as the ratio of net income (net profits) to average shareholders' equity are the two dependent variables of our study. ROA reflects the ability of the management of a bank to generate profits from its assets and therefore, indicates how effective a bank is in managing its assets. ROE is the return which shareholders get on their equity. Even though in the literature return on equity is commonly used as a measure of profitability, ROE disregards the higher risk that is associated with a high leverage and the

effect of regulation on leverage. Banks with a lower leverage ratio (higher equity) usually report a higher ROA but a lower ROE. Therefore, in this study return on assets is considered as the primary measure of profitability. However, we have also reported results for return on equity in this study.

3.2.2 Independent Variables

The independent variables used in this study can be divided into two groups, viz. bank specific variables and aggregate or macroeconomic variables. Data on these variables are obtained from annual data published by RBI as mentioned earlier in this study.

Bank specific variables used in this study include the lagged value of the NPA ratio, which is calculated as net NPAs divided by net advances and the lagged value of the relative size of a bank, which is calculated as total assets of a bank divided by combined assets of all banks considered in this study. Both of these variables are treated as predetermined variables in the context of the models estimated in this study.

Aggregate or macroeconomic variables used in this study include real GDP growth rate and inflation rate[13]. Real GDP values at market prices are used in this study to calculate GDP growth with new base index 2011-12. Splicing was used to convert the data based on the base year 2004-05.

In Table 2 of the appendix all the variables used in this study are reported and summarized. In Table 3 of the appendix variables considered in this study with expected signs are summarized.

3.3 Econometric Model

The final empirical models used in this study after taking into consideration variables discussed in the previous section are the following:

$$ROA_{i,t}=\alpha_0+\alpha_1 RoA_{i,t-1}+\alpha_2 NPA_{i,t-1}+\alpha_3 RSB_{i,t}+\alpha_4 GDP_{i,t}+\alpha_5 INF_{i,t}+\alpha_6 PubD_i+\varepsilon_{i,t} \quad (1)$$

[13] For calculating inflation rate, the wholesale price index is used.

$$ROE_{i,t}=\beta_0+\beta_1 RoE_{i,t-1}+\beta_2 NPA_{i,t-1}+\beta_3 RSB_{i,t-1}+\beta_4 GDP_{i,t}+\beta_5 INF_{i,t}+\beta_6 PubD_i+\theta_{i,t} \quad (2)$$

In this model subscripts *'i'* stands for i^{th} bank and 't'stands for t^{th} year. α_0 andβ_0 are intercept terms and $\alpha j's$ and $\beta_j's$ for j=1,2,...,6 are partial slope coefficients of equation 1 and equation 2 respectively. $\varepsilon_{i,t}$ and $\theta_{i,t}$ are stochastic disturbance terms which can be written as follows:

$$\varepsilon_{i,t} = \tau_i + \mu_{i,t} \quad (3)$$

$$\theta_{i,t} = \omega_i + \psi_{i,t} \quad (4)$$

where τ_i and ω_i denote unobserved bank specific effects[14] which are time invariant and $\mu_{i,t}$ and $\psi_{i,t}$ are idiosyncratic error terms which are assumed to vary over time and across banks. Bank-specific patterns of heteroskedasticity and serial correlation might be exhibited by idiosyncratic errors other than fixed effects. It is also assumed that idiosyncratic disturbances are uncorrelated across banks.

The variables used in the above equations are defined below.

$ROA_{i,t}$: The return on assets for the i^{th} bank in the t^{th} period.

$ROE_{i,t}$: The return on equity for the i^{th} bank in the t^{th} period.

$NPA_{i,t-1}$: The ratio of non-performing assets to total advances for the i^{th} bank in the $(t-1)^{th}$ period.

$RSB_{i,t-1}$: The relative size[15] of the i^{th} bank in the $(t-1)^{th}$ period.

$GDP_{i,t}$: The rate of growth of real GDP in the t^{th} period.

$INF_{i,t}$: The inflation rate in the t^{th}period.

$PubD_i$: A dummy variable for public bank

[14]Bank specific effects are unobservable, time invariant effects specific to a particular bank. For example, quality of bank management etc.

[15] Relative size of a bank is calculated by dividing the total assets of that bank by total assets of all banks considered in the study.

3.4 Methodology for Model Estimation

In order to estimate the model discussed in previous section dynamic panel data methods are used. A typical case warranting the use of dynamic panel data techniques is the presence of individual (bank) fixed effects, a lagged dependent variable among the regressors and 'large N, small T', which is fulfilled in this study as N, the number of banks, is 45 and T, the number of years is 12. (Roodman, 2009)

As can be seen in both equations (1) and (2), the lagged value of the dependent variable, Return on Assets and Return on Equity, appears on the right-hand side of the equation among the regressors.

Also, some of the explanatory variables used in this study can be assumed to be predetermined such as $NPA_{i,t-1}$ and $RSB_{i,t-1}$. Non-performing assets of the previous year will determine profitability in the current year by influencing the decisions of banks. The relative size of a bank at the end of the previous year will impact the constraints facing the bank in the current year and thereby influence bank decisions and strategies, and, therefore, the profitability of banks in the current year. However, idiosyncratic factors affecting bank profitability captured in the disturbance term for the current year may also affect the relative size of a bank and the NPA ratio in the current year, which are regressors for bank profitability measures in the next period.

There are some specific characteristics of a bank which differs from one bank to another and are difficult to measure or quantify. These characteristics affect bank profitability and therefore if not taken into account, there could be correlations between some of the explanatory variables and the error term. This will give us bias coefficients for those variables. As the lagged dependent variable, $RoA_{i,t-1}$ is correlated the with unobserved bank specific effects τ_i and other explanatory variables are highly likely to be so, a problem of endogeneity arises. Due to the presence of an endogenous variable in our estimation model, the assumption of exogeneity gets violated which makes the OLS estimator biased and inconsistent. Since the lagged dependent variable is positively related to error term the OLS coefficient estimate will be upward biased.

Therefore, in order to eliminate unobservable, time-invariant bank fixed effects, fixed effects OLS estimation is used. It is done by using the within transformation i.e. by time demeaning the original equation, as shown in the equation below:

$$(RoA_{i,t} - \overline{RoA_i}) = \alpha_1 (RoA_{i,t-1} - \overline{RoA_i}) + \alpha_2 (NPA_{i,t-1} - \overline{NPA_i}) + \alpha_3 (RSB_{i,t-1} - \overline{RSB_i}) + \alpha_4 (GDP_{i,t} - \overline{GDP_i}) + \alpha_5 (INF_{i,t} - \overline{INF_i}) + (\tau_i - \tau_i) + (\mu_{i,t} - \bar{\mu}_i) \quad (3)$$

However, while the within transformation eliminates some of the inconsistency of the OLS it does not eliminate all of the inconsistency. As on the right hand side now we have $(RoA_{i,t-1} - \overline{RoA_i})$ and $(\mu_{i,t} - \bar{\mu}_i)$ which are correlated with each other as by construction $\bar{\mu}_i$ contains $\mu_{i,t-1}$which is correlated with $RoA_{i,t-1}$. So, inconsistency does not vanish. This is the problem of dynamic panel bias. (Nickell, 1981) Note that, in contrast to simple OLS estimation, the FE OLS estimation is downward-biased. "In fact, the OLS and FE OLS estimates can be considered as the upper and lower bounds for the autoregressive coefficient"(Grohmann, 2015), which in our case is α_1. The assumption of strict exogeneity of the explanatory variables conditional on the unobservable effects is also violated in the presence of predetermined variables.

As both OLS and fixed effects estimators cannot remove the inconsistency a different transformation of the data is needed to directly remove the dynamic panel bias.

Such a transformation was proposed by Manuel Arellano and Stephen Bond in 1991. The Arellano–Bond estimator is a generalized method of moments (GMM) estimator[16]used to estimate dynamic panel data models. Before Arellano and Bond, a solution is proposed by Anderson and Hsiao (1981) which uses instrumental variables (IV) estimation. However, the asymptotic variance of Anderson-Hsiao estimators was found higher than the asymptotic variance of Arellano–Bond estimator, which uses generalized method of moments for estimation rather than instrumental variables estimation. The use of second or higher lags of the dependent variable as instruments is proposed by Anderson and Hsiao (1981) for the transformed lagged dependent variable so that problem of endogeneity can be solved in

[16]Refer Roodman (2009) for detailed discussion on GMM estimators.

dynamic panel models. Such instruments could be either in the form of differences of higher lags or in the form of lagged levels. The GMM estimation technique considers all such possible instruments and exploits all the linear moment restrictions that follow from the assumption of no autocorrelation in the errors and the presence of predetermined/endogenous variables to emerge as a best estimator in estimation of dynamic panel data model. Also, even if there is problem of heteroskedasticity, estimators we get, are efficient and unbiased as all the potential orthogonality conditions are considered (Baum, 2003).

'Difference GMM' has got its name because estimation proceeds after first-differencing[17] the data in order to eliminate the fixed effects. It was proposed by Arellano and Bond (1991). System GMM was proposed by both Arellano and Bover (1995) as well as Blundell and Bond (1998).

System GMM uses an additional set of moment conditions for estimation purposes. It augments difference GMM by estimating simultaneously in differences and levels, the two equations being distinctly instrumented (Roodman, 2009). For the equation in differences System GMM adopts the same technique of estimation as the Difference GMM. For example in this case lagged levels of the dependent variable with lags greater than 2 are used as instruments for the first difference of lagged dependent variable. However, for the equation in levels, differences in current and lagged values of the explanatory variable are used as instruments for the levels. The use of System GMM, therefore, assumes that there is no correlation between the first differences of instruments and the fixed effects.

Due to its technique of using a system of equations, System GMM allows for the inclusion of time invariant regressors like a dummy for ownership of banks in our model. In contrast, in Difference GMM, time-invariant regressors get omitted because when a variable is a time invariant across all the cross sections (like *PubDi*) then the value of such variables in their first difference form will be zero across all individuals. If the data generating process for the dependent variable can most accurately be modelled as an autoregressive (AR) process with high persistence between the AR explanatory variable and the dependent variable, then it is advisable to choose System GMM over Difference GMM. Persistence in the variables can incur bias and imprecision if estimated by difference GMM (Grohmann,

[17]First differencing means differencing the model by the value of the variables of the previous period.

2015). The system-GMM estimator can decrease finite sample bias and asymptotic variance compared to difference estimator.

We use the system GMM estimator in this study as most of the variables used in this study are persistent in nature as shown in Table 4 of the appendix using alternative estimates. This is also helpful because it permits the use of a time invariant variable, a bank ownership dummy, as a regressor to distinguish between public and private sector banks. There is no specific reason to suppose that the additional assumption required for the use of system GMM that the differences in the explanatory variables are uncorrelated with the fixed effects, is violated in the case of our model.

Two important tests are associated with GMM estimation of dynamic panel data models. The first one is Arellano and Bond's test for no serial correlation in the disturbances; and the second is the Hansen J test, which tests whether the model is over identified or not.

Autocorrelation in the idiosyncratic disturbance term $(\mu_{i,t})$ would render some lags invalid as instruments. Therefore, a test for autocorrelation was developed by Arellano and Bond (1991). This test is applied to the residuals in differences. Since $\Delta\mu_{i,t}$ is mathematically related to $\Delta\mu_{i,t-1}$ via the shared $\mu_{i,t-1}$ term, negative first-order serial correlation is expected in differences. Thus to check for first-order serial correlation in levels, we look for second-order correlation in differences, because second-order correlation in differences means $\Delta\mu_{i,t}$ and $\Delta\mu_{i,t-2}$ are correlated. This is possible only if $\mu_{i,t-1}$ and $\mu_{i,t-2}$ are correlated. Because of presence of fixed effects, full disturbance term $(\varepsilon_{i,t})$ is presumed to be auto-correlated and estimates are designed to remove these fixed effects. "But, if the idiosyncratic error terms $\mu_{i,t}$ are themselves serially correlated of order 1 then, for instance, $y_{i,t-2}$ is endogenous to the $\mu_{i,t-1}$ in the error term in differences, $\Delta\varepsilon_{i,t}= \mu_{i,t}-\mu_{i,t-1}$, making it a potentially invalid instrument after all" (Roodman, 2009). In such a scenario, the second lag term of the dependent variable and first lag term of all predetermined variables as instruments will be invalid. Hence, if we reject the null hypothesis of this test (no serial correlation) then it implies the invalidity of the instruments used.

An important assumption for the instruments set to be valid is the exogeneity of instruments. The Hansen J test has a null hypothesis of "the instruments as a group are

exogenous". All the empirical moments have zero expectation under the null hypothesis of this test (Roodman, 2009a). Therefore, the higher the p-value of the Hansen J statistic the better it is (Mileva, 2007). But we should also keep in mind the instrument count because instrument proliferation can weaken the power of the Hansen test. Roodman (2009a) argues that too many instruments can lead to the problem of instrument proliferation which can overfit[18] endogenous variables. This will ultimately fail to wipe out their endogenous components. Too many instruments can deteriorate the Hansen test to the point where it generates questionably good p values equal to 1.

Unfortunately, there is no test or rule of thumb to check how many instruments are too many. However, xtabond2 gives a warning when a number of instruments is more than the number of individual units in the panel, as a minimally arbitrary rule of thumb. Therefore, it is a good exercise if instrument count is reported and tests for robustness of results by reducing the number of instruments are done. Options for reducing the instrument count includes limiting the lags used in GMM-style instruments and, in xtabond2, collapsing instruments. The difference in Hansen test which is used to check the validity of a subset of instruments is also reported in this study. According to Roodman (2009a)[19], when a subset is added to the estimation model, there will be increase in *J*, the validity of subsets is checked by that increase in *J*. A high instrument count not only weakens the overall Hansen test but also this difference in Hansen test.

When doing one-step estimation, the standard error estimates would not be robust to heteroskedasticity or serial correlation in the errors. Therefore, when errors are heteroskedastic, a customized tool is needed which is two step GMM estimators. Two step estimators are robust under heteroscedasticity, but their standard errors are downward biased. Windmeijer has solved this problem by proposing a finite sample correction for two-step GMM estimators.

We have also controlled for time effects in this study. To quote Roodman (2009), "The test for autocorrelation and the robust estimates of the coefficient standard errors

[18]Overfitting occurs when a model is extremely complex, such as having too many parameters relative to number of observations. Predictive power of an overfit model is poor as it overreacts to minor fluctuations in the data.

[19] Refer to p-142 of Roodman (2009a).

assume no correlation across individuals in the idiosyncratic disturbances. Time dummies make this assumption more likely to hold."

3.5 Data Collection and Issues

This study covers a time period from 2004-05 to 2015-16. The number of banks covered in the study is 45. These 45 banks include 26 banks in the public sector and 19 banks in the private sector. Out of the 26 public sector banks, 20 are nationalized banks and 6 are SBI and its associate banks. In my study, I have used only public sector and private sector banks because the majority of banking activity in India is carried out by them. Foreign banks and regional rural banks are excluded. Data used in this study is secondary and has been taken from 'Statistical Tables Related to Banks in India', 'Basic Statistical Returns of Scheduled Commercial Banks in India' and 'Handbook of Statistics on the Indian Economy'. These are annually published by Reserve Bank of India.

As there were many mergers and acquisitions[20] during the time period covered in the study, a weighted average has been calculated for the merged banks. The weights[21] are given by the relative size of a particular bank in the merged group. For example, in 2006, IDBI Bank Ltd. acquired United Western Bank. Therefore, for the year 2005, a weighted average for all the variables was calculated. In 2005 total assets of IDBI Bank Ltd. were 813602 million and total assets of United Western Bank were 70836 million. Therefore, total assets of the both banks are 88438 million (= (813602 + 70836) million). Now, for calculating relative size of IDBI Bank Ltd. total assets of IDBI Bank Ltd. is divided by combined assets of both banks. Therefore weights given to IDBI Bank Ltd. and United Western Bank in 2005 were 0.92 and 0.08 respectively. Similarly in 2006 weights were 0.93 and 0.07 for IDBI Bank Ltd. and United Western Bank respectively. Splicing of data has also been done wherever needed for converting two time series of observations for the same variable with different base years into a single series with a common base year.

[20]Refer to Consolidation in the Indian Financial Sector (Leeldhar, 2008).

[21] Relative size of a particular bank is calculated by dividing the assets of that bank by combined assets of merged banks.

Chapter-IV
Results and Analysis

4.1 Introduction

The dynamic panel model which we have discussed in the previous chapter is estimated using GMM estimation method and analysed in this chapter. The GMM estimators as discussed before solve the problem of dynamic panel bias. Among the two GMM estimators – Difference GMM and System GMM – System GMM is appropriate for this study for two reasons.

1. A time-invariant variable viz. dummy for nature of ownership is included in our model as one of the independent variables. If estimated through difference GMM the time-invariant variable will get omitted.

2. Most of the variables, especially the dependent variable, used in this study are persistent in nature as shown in Table 4 of appendix where alternative estimates such as ordinary least squares, within transformation, difference GMM and system GMM are used to check persistence of series. In this table we can see that all the variables (including the dependent variable) except the macroeconomic variables are persistent in nature.

Hence, due to the above-mentioned reasons, System GMM is employed as estimation technique and results obtained from estimation of regression equations 1 and 2 are discussed in this chapter. The results obtained from regression equation 1, where the dependent variable is return on assets are provided in Table 4.2.1, and results obtained from regression equation 2, where the dependent variable is return on equity are provided in Table 4.3.1. As explanatory variables in this regression equation include predetermined variables such as $NPA_{i,t-1}$and $RSB_{i,t-1,}$ instruments are created for these variables at suitable lags of their level variables. Other than this lagged level of dependent variables i.e. $RoA_{i,t-1}$ and $RoE_{i,t-1}$ are also instrumented with their different lag levels. Results obtained from the same model at different

lag levels are provided in different columns of each table and information regarding different lag levels used has been mentioned in footnotes of each table. All other variables including $GDP_{i,t}$ and $Inf_{i,t}$ are modelled as exogenous variables in Table 4.2.1 and Table 4.3.1. However, they are treated as endogenous variables later to check for robustness of the results. The p-value of Hansen J test which is a test of over-identification of restrictions is also reported in notes to each table. Difference in Hansen statistic which is use to check the validity of instrument subsets is also reported. Other than this, the number of observations, the number of instruments and the result of the Arellano- Bond test for auto-correlation are also reported in notes given below each table. These two tests together allow us to gauge the validity of instruments used.

This chapter is divided as follows. In section 4.2 results obtained from regression equation 1 are reported and analyzed. In section 4.3 results obtained from regression equation 2 are reported and analyzed. Finally in the last section i.e. Section 4.4 the robustness of these results is checked by carrying out some additional exercises.

4.2 Results for return on assets

Results obtained from regression equation 1 for return on assets using estimation method two-step System GMM are provided in Table 4.2.1 below.

Table 4.2.1: Estimation results for Return on Assets

$RoA_{i,t}$	(1)	(2)	(3)	(4)	(5)
$RoA_{i,t-1}$	.4711***	.4617**	.3558**	.3221*	.5081****
	(.1753)	(.1653)	(.1802)	(.1861)	(.1277)
$NPA_{i,t-1}$	-.2420****	-.2381****	-.2664****	-.2809****	-.2442****
	(.0468)	(.0450)	(.0558)	(.0582)	(.0448)
$RSB_{i,t-1}$	.0363*	.0307	.0366*	.0279	.0315*
	(.0224)	(.0223)	(.0225)	(.0191)	(.0183)
GDP_t	-.0113	-.0126	-.0135	-.0115	-.0093
	(.0099)	(.0092)	(.0088)	(.0088)	(.0079)
Inf_t	-.0505****	-.0508****	-.0523****	-.0540****	-.0543****
	(.0125)	(.0123)	(.0108)	(.0116)	(.0112)
Pubdummy	-.1864**	-.1864**	-.2003*	-.1686**	-.1726**

	(.0751)	(.0732)	(.0860)	(.0814)	(.0722)
Constant	1.1306****	1.1587****	1.3023****	1.3404****	1.1060****
	(.2324)	(.2021)	(.2341)	(.2343)	(.1865)
G	44	44	44	44	44
J	38	40	42	44	44
Hansen_df	31	33	35	37	37
Hansen (p)	0.219	0.267	0.354	0.315	0.378
GMM instruments for levels					
Hansen test excluding group	0.239	0.327	0.316	0.217	0.266
Difference (null H = exogenous)	0.314	0.281	0.462	0.597	0.622
gmm(lroa, lag(x y))					
Hansen test excluding group	0.083	0.151	0.172	0.135	0.051
Difference (null H = exogenous)	0.575	0.522	0.649	0.678	0.819
gmm(lrsb lnpa, collapse lag(x y))					
Hansen test excluding group	0.131	0.129	0.134	0.137	0.240
Difference (null H = exogenous)	0.709	0.808	0.913	0.799	0.951
iv(i.year gdp wpi pubdummy)					
Hansen test excluding group	0.069	0.062	0.147	0.097	0.117
Difference (null H = exogenous)	0.755	0.873	0.801	0.888	0.921
AR(1) P	0.026	0.025	0.025	0.025	0.019
AR(2) p	0.978	0.971	0.868	0.804	0.971
Wald (p)	0.000	0.000	0.000	0.000	0.000

Notes: **p-value<0.11; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*

- Results provided in this table are obtained by employing two–step System GMM estimators.
- Asymptotic standard errors which are robust in nature are presented in brackets below the estimated value of coefficient of each variable. These errors have been subjected to Windmeijer finite sample correction.
- The results in the different columns relate to the following specifications of the instrument set.
  - In Column (1) only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; and for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag3 are chosen and then collapsed for instruments.
  - In Column (2), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag4 are chosen and then collapsed for instruments.
  - In Column (3), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag5 are are chosen and then collapsed for instruments.
  - In Column (4), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag6 are are chosen and then collapsed for instruments.
  - In Column (5), only lag 2 to lag 3 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ *only* lag 2 is chosen and then collapsed for instruments.
- G denotes total number of groups.

- Number of instruments used in estimation is denoted by J.
- Hansen_df gives degrees of freedom for Hansen J test which tests for the number of over-identified restrictions used for each specification of lags.
- P value for Hansen J test is denoted by Hansen (p) in table.
- Serial correlation of first order in the first difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(1)p in the table.
- Serial correlation of second order in the second difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(2)p in the table.
- Wald (p) represents the p value for wald test of overall fit of the model. Significant p value suggests the estimated model to be good.
- Time dummies are controlled via use of i.year in syntax of STATA.

The Wald test is a way to test whether explanatory variables used in model are significant or not. Its p-value is 0 which implies overall fitness of the model is good. P-value of AR(1) at different lag levels is less than 0.05 which means significant at five percent level of significance and AR(2) values are insignificant at all instrument sets used in Table 4.2.1. Inconsistency in results is implied when there is second order correlation. The presence of first order correlation is not a problem. Hence, our results are consistent.

We have estimated the regression equation with different instrument sets which are mentioned in notes to Table 4.2.1. Results shows that sign of coefficients are unchanged at different lag levels of variables. Value and significance of coefficients has also not changed much. This confirms the consistency of results and therefore while interpreting the results we will use the results in column 1 as reference.

The Positive and significant coefficient of the lagged dependent variable confirms the dynamic nature of the model specification. As the value of the coefficient is in the range of 0.3 to 0.5 at different lag levels, it shows moderate persistence of return on assets. Similar results are found by Sinha and Sharma (2016), Trujillo and Ponce (2013) and Athanasoglou et al. (2008).

The Impact of the ratio of non-performing assets to total advances on return on assets is negative and highly significant. Therefore, it confirms the theory that if the value of bad debts is higher in bank balance sheet of the previous year, profits could be lower this year. This is not only because a greater share of existing loan assets is not generating income, but also because banks are more careful in their present lending, accepting assets which have less risk associated with them even if returns are lower. Further, a higher fraction of NPAs at the

beginning of a year signals a higher chance of capital loss during the year. The coefficient of the NPA ratio is around -0.25 which means one percentage point increase in NPA ratio will decrease return on assets by 0.25 percentage points. Most of the studies which included ratio of non-performing assets to total advances as one of the explanatory variables in their study such as Wang and Wang (2015), Capraru and Ihnatov (2015), Trujillo-Ponce (2013) and Bhatia, Mahajan and Chander (2012) confirm this negative relationship in their studies.

The relative size of a bank at the end of the previous year has minimal or no impact on return on assets of the bank. As can be seen from Table 4.2.1, its coefficient value is insignificant for two instrument sets out of five and for the remaining three, the coefficient is weakly significant. However, the coefficients are positive which implies larger the size of a bank relative to other banks in the industry, larger will be its profits because of internal economies of scale or greater market power. Although Sinha and Sharma (2016) found a significant impact of bank size on return on assets, Islam and Nishiyama (2016), Goddard, Molyneux and Wilson (2004) and Thota (2013) found no evidence of such an impact.

However, we shall see later in section 4.2.1, that if we allow for the possibility that growth rate of GDP and rate of inflation are endogenous variables in the model then the estimates suggest that RSB has a significant positive effect on current bank profitability.

The Coefficient of GDP growth is negative but insignificant. The negative coefficient implies that whereas an increase in GDP growth of a nation has an adverse partial impact on the return of assets of banks within this particular sample, this result has no statistical significance even at 10% level of significance. But like RSB, GDP growth also gained significance when GDP growth and inflation are treated as endogenous variables in section 4.2.1. However, an interesting question thrown up by the estimate is why do not find evidence of positive association in the data. Thota (2013), Wood (2011), Nishiyama (2016) and Gul et al. (2011) have argued that with growth in any economy, business environment of that country also improves and hence barriers to entry are lower. As a result of this, competition increases and lowers profit margins. However, the argument lacks substance when related to the context of the present exercise. The main reason for this is that the argument would appear to be true for the relation of bank profitability with changes in the trend level of GDP or GDP per capita rather than for the relation of bank profitability with changes in the annual growth rate of GDP. It is hard to believe that annual fluctuations in the

growth rate of GDP lead to significant annual fluctuations in the market structure especially in an industry like banking where entry is strictly regulated. Combey and Togbenou (2017), Kanwal and Nadeem (2013), Liu and Wilson (2010) and Francis (2013) also found a negative relation between GDP growth and bank profits.

Reason for the lack of a positive association between bank profitability and current GDP growth may actually be simpler. An increase in GDP growth affects both the assets and the liabilities side of bank balance sheets. As an increase in GDP means an increased demand for credit, therefore, the first and foremost impact will be on the assets side. Increased demand for credit means an increase in deployment of credit by banks, hence an increase in the total assets of banks. As we know that return on assets is calculated as net income divided by total assets, increase in assets would imply an increase in the denominator of the ratio. Therefore, it will tend to pull down the value of the return on assets. On the other hand, as these loans granted must be funded by either deposits or borrowings, therefore there will be an increase in liabilities. On these liabilities whether deposits or borrowings, banks have to pay interest which is a deduction from income. Therefore there is another effect which, by decreasing the numerator, will pull down the value of the ratio. However, the numerator will also tend to increase because of the interest income which banks will earn on these loans but, it might be the case that most of this increased inflow of interest from loans will begin from the next year (this might be true for increases in the interest outflow as well). In such a case, there is a possibility that the increase in the denominator is more than the increase in numerator because of which increase in GDP growth may fail to lead to a rise in current bank profitability.

Empirical data on Indian commercial banks for the study period also supports this argument. In Table 4.2.2 below we have arranged the annual data on various variables for all scheduled commercial banks in India according to annual GDP growth rates. Rates of GDP growth are arranged here in ascending order. This table gives us a rough idea of the argument given above.

We know that with increase in GDP growth, demand for credit also increases which would imply increase in assets of banks. It can be seen in Table 4.2.2 below that average percentage growth in assets in four years in the lowest growth rates was 16.66 and in four

years with highest growth rates was 21.68. This confirms the idea that growth in GDP is associated with growth in assets which tends to lower the return on assets of banks.

Now if we have a look at interest earnings it can be seen that the average percentage growth in interest earned in the years with the lowest growth rates was 21.95 and average percentage growth in interest earned in the years with the highest GDP growth rates was 23.86. What this shows is that the difference in average rates of growth of interest earnings between high growth years and low growth years is not much and is, in fact, much less than in the case of average rates of growth of assets.

In fact, confirming our hypothesis that the increases in bank interest earnings from increased GDP growth and credit growth start may begin flowing to a large extent from the following year, we can observe from Table 4.2.2 that growth in interest earnings seems to significantly influence by growth in credit and growth in GDP in the preceding year. In 2012, which is a relatively low growth year, and in 2008, which is a relatively high growth year, growth in interest earnings was almost same, i.e. around 33 percent. The reason for this high growth of interest earnings in a year with a relatively low rate of growth can be found in its previous year. We can see that 2011 was a year with high rate of growth and therefore high growth in assets. These increased assets of year 2011 lead to increased interest income flows in year 2012. Therefore, despite having low growth in year 2012, interest earnings experienced high growth. What is interesting is that in 2011 itself, the year with the highest rate of growth, the growth in interest earnings was much lower at 18.34 per cent. As this increased demand for credit will get funded either by borrowings or deposits, growth in bank liabilities also increases with an increase in GDP growth. Similar to interest earnings on the new assets, a part of the increased flows of interest payments by banks on the new liabilities begin from the next year. Therefore growth in interest payments shows almost a similar pattern as growth in interest earnings. But it can be noted that growth in interest payments is usually higher than growth in interest income. Trujillo and Ponce (2013) also note that changes in interest rate take place more quickly on the funding side than on the lending side. Therefore we can see that at least one major component of the return on assets, the ratio of net interest income to total assets tends to decrease faster on average in high growth years than in low growth years. Moreover, if we compare the ratio of the average growth rate of net interest income to average growth rate of total assets, it was 0.95 in the 4 years with the

lowest growth rates and 0.90 in the 4 years with the highest growth rates. Hence, there is a possibility of negative impact of GDP growth on the profitability of banks.

Given our hypothesis that a major part of the increased flow of interest earned on loans given in current year will be fetched by banks in next year, it is a possibility that the lagged value of the GDP growth rate will have a positive impact on return on assets. To check this we introduced the lagged value of GDP growth rate in our model and found the coefficient to be positive but insignificant, as reported in Table 5 of the Appendix.

Table 4.2.2: Growth rates of GDP and growth rates of various financial variables of Indian scheduled commercial banks for period 2005-16

Year	Growth Rate	Interest Earned	Interest Expended	Net Interest Income	Assets
2009	3.89	25.93	26.55	24.66	21.09
2013	4.74	16.53	19.39	11.06	15.25
2014	5.02	11.99	12.33	11.27	14.45
2012	6.64	33.37	43.97	16.90	15.84
2016	8.01	5.26	4.49	6.87	7.70
2010	8.48	6.87	3.37	14.24	15.01
2015	8.58	10.02	10.38	9.26	9.64
2007	9.26	24.97	32.90	14.10	24.20
2006	9.28	18.99	20.30	17.24	18.27
2008	9.80	33.15	46.05	12.58	25.04
2011	10.26	18.34	9.87	34.47	19.22

Note: All values are annual growth rates expressed in percent

Source: Author calculations from various publications of RBI.

The value of the coefficient of inflation is highly significant and negative. The value of the coefficient is around -0.05 which means an increase in inflation by one percentage point will lead to decrease in return on assets by 0.05 percentage point. This result implies that Indian commercial banks failed to anticipate inflation because of which inflation had an

adverse impact on the profitability of banks. As interest rates are sticky in nature, banks will earn interest in current year based on interest rates fixed in previous year. Therefore if inflation is not correctly anticipated banks might fail to adjust their interest rates accordingly.

Sinha and Sharma (2016) and Karimzadeh et al. (2013) also agree with this view. However, Kunt and Huizinga (1999) argued that inflation negatively impacts the profitability of banks in developing countries because their costs tend to increase faster than revenues during inflationary environments.

Moreover, in Table 4.2.3 below, ratio of average growth rate of net interest income (which is a major portion of net income) to average growth rate of total assets in the 5 years with the lowest inflation rates was 1.09 and the value of this ratio in the 5 years with the highest inflation rates was 0.99. In fact, an inspection of the following table suggests that net interest income grew at a much faster pace in years with low inflation than in years with high inflation. Therefore this gives a fair idea of the possible reason for the negative impact of the current inflation rate on current profitability of banks.

Table 4.2.3: Inflation rates and growth rates of various financial variables of Indian scheduled commercial banks for period 2005-16.

Year	Inflation Rate	Interest Earned	Interest Expended	Net Interest Income	Assets
2011	2.2	18.34	9.87	34.47	19.22
2006	2.4	18.99	20.30	17.24	18.27
2015	2.4	10.02	10.38	9.26	9.64
2007	3	24.97	32.90	14.10	24.20
2013	4.8	16.53	19.39	11.06	15.25
2008	5.4	33.15	46.05	12.58	25.04
2010	5.7	6.87	3.37	14.24	15.01
2014	5.7	11.99	12.33	11.27	14.45
2012	6.2	33.37	43.97	16.90	15.84
2016	6.3	5.26	4.49	6.87	7.70
2009	7.3	25.93	26.55	24.66	21.09

Note: All values are annual growth rates expressed in percent

Source: Author calculations from various publications of RBI.

The Dummy variable for nature of bank ownership i.e. whether a bank is in the public sector or in the private sector, is negative and significant. The value of the dummy if the bank is a public sector bank is 1, otherwise 0. Therefore, the results imply that the return on assets for public sector banks is lower by around 0.18 percentage points than that of private sector banks. The result is in line with expectations that private banks are driven more by the commercial motive of earning profits than public sector banks, which must also take social objectives into account.

4.3 Results for return on equity

Table 4.3.1 below presents the results for the return on equity model estimated by two-step system GMM estimators.

Table 4.3.1: Estimation results for Return on Equity

$RoE_{i,t}$	(1)	(2)	(3)	(4)	(5)
$RoE_{i,t-1}$	.4974**	.4943*	.4155*	.3939	.4413*
	(.2901)	(.2756)	(.2580)	(.2520)	(.2529)
$NPA_{i,t-1}$	-3.8695****	-3.862****	-4.2357****	-4.2427****	-4.1819****
	(1.0795)	(1.0183)	(1.041)	(1.1079)	(1.1604)
$RSB_{i,t-1}$	.6480*	.4631*	.4237	.4216*	.5006**
	(.3410)	(.2746)	(.2776)	(.2274)	(.2143)
GDP_t	-.1249	-.1464	-.1612	-.1659	-.1271
	(.1688)	(.1645)	(.1631)	(.1560)	(.1266)
Inf_t	-.8878****	-.8897****	-.8838****	-.9044****	-.9074****
	(.1740)	(.1749)	(.1782)	(.1822)	(.1766)
Pubdummy	-.1403	-.1644	.6762	.7261	-.3299
	(1.3477)	(1.2121)	(1.2089)	(1.1670)	(1.1904)
Constant	15.2495*	15.6377***	17.1585****	17.5153****	16.5200****
	(5.4427)	(5.0411)	(4.7815)	(4.4460)	(4.5197)
G	44	44	44	44	44
J	38	40	42	44	44
Hansen_df	31	33	35	37	37
Hansen (p)	0.175	0.215	0.274	0.293	0.340

GMM instruments for levels					
Hansen test excluding group	0.336	0.061	0.078	0.101	0.084
Difference (null H = exogenous)	0.547	0.873	0.922	0.897	0.982
gmm(lroe, lag(x y))					
Hansen test excluding group	0.094	0.036	0.055	0.062	0.009
Difference (null H = exogenous)	0.775	0.799	0.830	0.852	0.956
gmm(lrsb lnpa, collapse lag(x y))					
Hansen test excluding group	0.233	0.109	0.109	0.108	0.255
Difference (null H = exogenous)	0.935	0.741	0.846	0.846	0.730
iv(i.year gdp wpi pubdummy)					
Hansen test excluding group	0.149	0.117	0.132	0.137	0.075
Difference (null H = exogenous)	0.906	0.577	0.685	0.731	0.949
AR(1) P	0.026	0.024	0.021	0.021	0.019
AR(2) p	0.988	0.988	0.961	0.934	0.960
Wald (p)	0.000	0.000	0.000	0.000	0.000

Notes: **p-value<0.11; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*

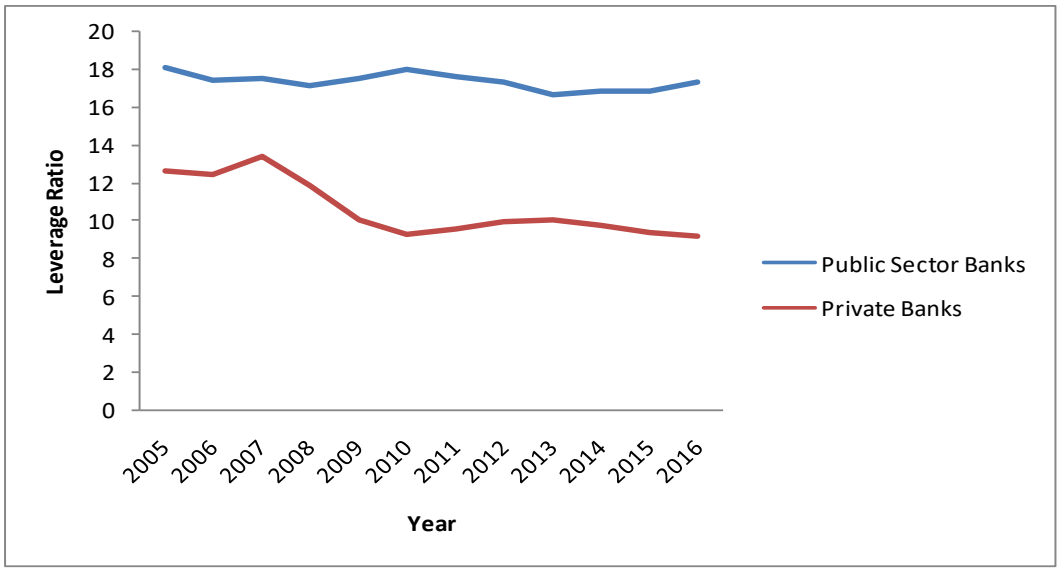
- Results provided in this table are obtained by employing two–step System GMM estimators.
- Asymptotic standard errors which are robust in nature are presented in brackets below the estimated value of coefficient of each variable. These errors have been subjected to Windmeijer finite sample correction.
- The results in the different columns relate to the following specifications of the instrument set.
  - In Column (1) only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; and for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag3 are chosen and then collapsed for instruments.
  - In Column (2), only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag4 are are chosen and then collapsed for instruments.
  - In Column (3), only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag5 are chosen and then collapsed for instruments.
  - In Column (4), only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag6 are are chosen and then collapsed for instruments.
  - In Column (5), only lag 2 to lag 3 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ *only* lag 2 is chosen and then collapsed for instruments.
- G denotes a total number of groups.
- Number of instruments used in estimation is denoted by J.
- Hansen_df gives degrees of freedom for Hansen J test which tests for the number of over-identified restrictions used for each specification of lags.
- P value for Hansen J test is denoted by Hansen (p) in table.
- Serial correlation of first order in the first difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(1)p in the table.
- Serial correlation of second order in the second difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(2)p in the table.

- Wald (p) represents the p-value for Wald test of overall fit of the model. Significant p-value suggests the estimated model to be good.
- Time dummies are controlled via use of i.year in syntax of STATA.

Like in the case of the return on assets, results for the return on equity also shows predictive power of model is good as shown by the Wald test. The validity of the instruments is exhibited by the results of the Hansen test and the Arellano-Bond test for autocorrelation at different lag levels.

The signs of coefficients also remain changed when the dependent variable is change from return on assets to return on equity. However, the levels of significance at which variables are significant have changed for some variables. For example, the dummy for ownership of banks was highly significant when the return on assets was used as dependent variable, but now it shows no evidence of a relation between ownership and return on equity. This result can be explained with Figure 4.3.1 below. In this figure the leverage ratio measured by the ratio of return on equity to return on assets is plotted against year for both public sector banks and private banks. It is evident from this graph that the leverage ratio has been higher for public sector banks than for private banks.

Figure 4.3.1: Leverage Ratio of public sector banks and private banks for the period 2005-16



Source: Author calculations from Statistical Tables Relating to Banks in India, RBI.

Persistence of profits measured by the coefficient of the lagged dependent variable is around 0.4 i.e. moderate when profitability is measured by return on equity. The size of this coefficient is similar to that in case of return on assets. It also confirms dynamic nature of our model. However, the size of the coefficient is only weakly significant for some of the instrument sets.

The results also indicate that a one percentage point increase in the ratio of non-performing assets will lead to a decline of around 3.8 to 4.2 percentage points in return on equity. This result is highly significant the coefficient of NPA ratio is statistically significant at 0.1 percent level in case of all of the different sets of instruments.

Like in the case of return on assets, the relative size of a bank has a positive but weakly significant impact on its return on equity. The value of the coefficient for relative bank size lies in the range of 0.42 to 0.64.

The coefficient of the GDP growth rate continues to be negative but, is again statistically insignificant, implying that we cannot reject the hypothesis that GDP growth has no impact on the return on equity. Kanwal and Nadeem (2013) also found a negative impact of GDP growth on return on equity. The possible reasons for the absence of a positive association between GDP growth and current bank profitability have been discussed at length in the case of bank return on assets. The results suggest that there is no significant increase in the leverage ratio in high growth years compared with low growth years.

Almost mirroring the results in the case of return on assets, inflation is again found to have a negative and highly significant impact on return on equity. The coefficient value shows that an increase of one percentage point in inflation will reduce the return on equity by 0.88 to 0.90 percentage points.

4.4 Robustness Check

To further validate the results found, a number of robustness checks are done. Firstly, we checked for robustness by treating as endogenous variables the GDP growth rate and the

inflation rate, both of which had been considered as exogenous variables earlier in the model. Secondly, robustness regarding methodology is done by applying OLS and within groups estimation methods to the same models. These methods are employed here to check the robustness of results because most of the studies have employed them for estimation purposes rather than GMM estimators.

4.4.1 Results assuming endogeneity of macroeconomic variables

GDP growth and inflation can be thought of as an endogenous variable if the factors whose impact is captured by the error term can affect both profitability and GDP growth. For example, suppose any particular bank does most of his business in some particular sector, state or country. Then if there is any negative/positive shock to production in that sector or state or country, this might affect the credit deployment by that bank in general. If this is a large bank it will affect both aggregate demand in general as well as bank profitability. Negative or positive shocks can happen due to changes in policy, due to climatic factors and natural disasters, due to discoveries of resources, due to political unrest etc. A particular bank might also be affected, for example, by labour unrest or may be subject to a failure of its computer system due to a hacking attack. In such a case level of credit and aggregate demand in the economy will be affected and thereby can influence GDP growth, inflation and bank profits simultaneously.

Another possible example could be of demonetisation. Recently on 8 November 2016, the Government of India announced demonetisation of ₹500 and ₹1000 notes which not only had an impact on aggregate demand in the economy and therefore on GDP growth and inflation but also on bank profits. It is to be noted that demonetisation in India of 2016 is not covered in this study, here it is used as a general example to explain the endogeneity of macroeconomic variables. A demonetisation like that carried out recently in India can have an adverse impact on the growth of a nation via two channels. First, as due to demonetisation access to currency as a medium of exchange is limited, there is a decline in demand due to shortage of cash to make payments. Second, there is a disruption in production activity especially in unorganised sectors where wages are paid in cash. Hence it can be said that due to an adverse impact on both demand and output demonetisation may affect GDP growth adversely at least in initial periods. Also, as aggregate demand and output change, the rate of inflation will also change accordingly. On the other hand, the decline in currency circulation

is reflected in a sharp increase in aggregate deposits of banks. In the short term, the banks have to bear the increased interest costs of these deposits without being able to invest them in income earning assets. Subsequently, scheduled commercial banks would either invest these increased deposits in government securities or extend their loans and advances both of which lead to increase in interest income for banks. Also, subsequently, with the surge in the deposits of banks, the cost of aggregate deposits may also be reduced as banks might be able to reduce interest rates on deposits for short term/medium term. (RBI, 2017) As a result, net interest income might increase which will have a positive impact on bank profits. However, this expected increase in net interest income also needs to be adjusted for the cost of managing injection of new bank notes such as calibration of ATM machines, staff overtime, security arrangements etc. Therefore, a monetary policy shock like demonetisation can impact the profitability of banks, aggregate demand and output simultaneously and therefore GDP growth and inflation.

The rate of GDP growth and inflation can be considered as potentially endogenous in the context of our model. Adekola (2016) studied five banks of Nigeria over a period of 10 years from 2005 to 2014 and analyzed impact of profitability of banks on economic growth measured by GDP growth rate. A negative and significant impact was found between the return on equity and GDP. Therefore the existing literature also provides us a reason to treat GDP growth as an endogenous variable.

Results obtained after considering GDP growth and inflation as endogenous variables are presented in Tables 4.4.1 and 4.4.2 for return on assets and return on equity respectively.

The validity of instruments and consistency of the estimator is intact in both models even after taking GDP growth and inflation as endogenous variables as shown by the results of the Hansen test and the Arellano and Bond test for autocorrelation.

The results obtained, do not differ much from the previous results when macroeconomic variables were considered exogenous as signs of the coefficients for the different explanatory variables remain unchanged. Also, most of the variables retain their statistical significance except the relative size of bank and GDP growth. GDP growth which was earlier insignificant for both the models has gained significance in a model where the

return on assets is used as dependent variable. However, the relative size of a bank is now significant in both models.

Table 4.4.1: Estimation results for Return on Assets with GDP and inflation as endogenous variables

$RoA_{i,t}$	(1)	(2)	(3)	(4)	(5)
$RoA_{i,t-1}$	.4826***	.5225***	.5226****	.4912***	.5170***
	(.1760)	(.1689)	(.1361)	(.1795)	(.1680)
$NPA_{i,t-1}$	-.2454****	-.2266****	-.2303****	-.2323****	-.2346****
	(.0431)	(.0439)	(.0503)	(.0439)	(.0436)
$RSB_{i,t-1}$	.0398**	.0354*	.0268*	.0376*	.0372**
	(.0196)	(.0183)	(.0156)	(.2115)	(.0186)
GDP_t	-.0764**	-.0519*	-.0902*	-.0745**	-.0576*
	(.0297)	(.0317)	(.0322)	(.0317)	(.0302)
Inf_t	-.0528****	-.0538****	-.0584****	-.0513****	-.0556****
	(.0106)	(.0115)	(.0130)	(.0113)	(.0107)
Pubdummy	-.1936**	-.1886**	-.1718**	-.2003**	-.1899**
	(.0785)	(.0802)	(.0716)	(.0839)	(.0766)
Constant	1.6297****	1.3894****	1.7197****	1.5923****	1.4515****
	(.3958)	(.4130)	(.3395)	(.4070)	(.4050)
G	44	44	44	44	44
J	38	42	46	40	40
Hansen_df	31	35	39	33	33
Hansen (p)	0.450	0.376	0.389	0.418	0.375
GMM instruments for levels					
Hansen test excluding group	0.164	0.160	0.293	0.131	0.197
Difference (null H = exogenous)	0.870	0.807	0.573	0.909	0.706
gmm(lroa, lag(x y))					
Hansen test excluding group	0.072	0.210	0.075	0.127	0.128
Difference (null H = exogenous)	0.923	0.618	0.793	0.810	0.749
gmm(lrsb lnpa, collapse lag(x y))					
Hansen test excluding group	0.323	0.278	0.285	0.358	0.236
Difference (null H = exogenous)	0.823	0.675	0.807	0.581	0.802
gmm(gdp wpi, collapse lag(x y))					
Hansen test excluding group	0.470	0.298	0.306	0.455	0.320
Difference (null H = exogenous)	0.351	0.607	0.709	0.335	0.563
iv(i.year pubdummy)					

Hansen test excluding group	0.255	0.162	0.339	0.189	0.200
Difference (null H = exogenous)	0.748	0.853	0.500	0.844	0.745
AR(1) P	0.012	0.016	0.007	0.013	0.013
AR(2) p	0.779	0.847	0.742	0.771	0.840
Wald (p)	0.000	0.000	0.000	0.000	0.000

Notes: **p-value<0.11; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*

- Results provided in this table are obtained by employing two–step System GMM estimators.
- Asymptotic standard errors which are robust in nature are presented in brackets below the estimated value of coefficient of each variable. These errors have been subjected to Windmeijer finite sample correction.
- The results in the different columns relate to the following specifications of the instrument set.
  - In Column (1) only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$, for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 is chosen and then collapsed for instruments.
  - In Column (2), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 to lag3 is chosen and then collapsed for instruments.
  - In Column (3), lag 2 to lag 3 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 is chosen and then collapsed for instruments.
  - In Column (4), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ *only* lag 2 is taken as instruments with collapse sub-option; for GDP_t and Inf_t *only* lag 2 to lag 3 is chosen and then collapsed for instruments.
  - In Column (5), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag 3 is taken as instruments with collapse sub-option; for GDP_t and Inf_t *only* lag 2 is chosen and then collapsed for instruments.
- G denotes total number of groups.
- Number of instruments used in estimation is denoted by J.
- Hansen_df gives degrees of freedom for Hansen J test which tests for the number of over-identified restrictions used for each specification of lags.
- P value for Hansen J test is denoted by Hansen (p) in table.
- AR(1)p gives p value for Arellano Bond autocorrelation test for absence of first order serial correlation in the first difference residuals; F(p)
- AR(2)p gives p value for Arellano Bond autocorrelation test for absence of second order serial correlation in the first difference residuals.
- Wald (p) represents the p value for wald test of overall fit of the model. Significant p value suggests the estimated model to be good.
- Time dummies are controlled via use of i.year in syntax of STATA.

Table 4.4.2: Estimation results for Return on Equity with GDP and inflation as endogenous variables

$RoE_{i,t}$	(1)	(2)	(3)	(4)	(5)
$RoE_{i,t-1}$	.5020*	.5955***	.5003***	.5597**	.5913**
	(.2708)	(.2635)	(.2321)	(.2667)	(.2622)
$NPA_{i,t-1}$	-3.903****	-3.4078***	-3.7691***	-3.6124***	-3.4215***
	(1.1017)	(.9823)	(1.1061)	(1.0704)	(.9994)
$RSB_{i,t-1}$	.7333**	.6068**	.4990***	.6111*	.6297**
	(.3463)	(.2777)	(.2139)	(.2912)	(.2977)
GDP_t	-.7828	-.4212	-.9218**	-.6955	-.4431
	(.5145)	(.4495)	(.4120)	(.4668)	(.4545)
Inf_t	-.8411****	-.8510****	-.9147****	-.8563****	-.8487****
	(.1706)	(.1723)	(.1823)	(.1846)	(.1729)
Pubdummy	-.1086	-.4018	.0198	-.3246	-.4038
	(1.1568)	(1.2217)	(1.1519)	(1.2316)	(1.1802)
Constant	19.8246**	15.5306**	21.5013****	18.4970**	15.7106**
	(7.9546)	(.7339)	(6.0984)	(7.5367)	(7.4886)
G	44	44	44	44	44
J	38	42	46	40	40
Hansen_df	31	35	39	33	33
Hansen (p)	0.311	0.362	0.415	0.310	0.279
GMM instruments for levels					
Hansen test excluding group	0.087	0.054	0.094	0.065	0.045
Difference (null H = exogenous)	0.859	0.994	0.987	0.939	0.963
gmm(lroe, lag(x y))					
Hansen test excluding group	0.022	0.073	0.021	0.041	0.045
Difference (null H = exogenous)	0.955	0.883	0.958	0.905	0.854
gmm(lrsb lnpa, collapse lag(x y))					
Hansen test excluding group	0.169	0.224	0.259	0.207	0.159
Difference (null H = exogenous)	0.980	0.820	0.992	0.818	0.803
gmm(gdp wpi, collapse lag(x y))					
Hansen test excluding group	0.199	0.222	0.277	0.196	0.223
Difference (null H = exogenous)	0.845	0.826	0.944	0.752	0.588
iv(i.year pubdummy)					
Hansen test excluding group	0.172	0.208	0.185	0.234	0.159
Difference (null H = exogenous)	0.665	0.713	0.889	0.526	0.645
AR(1) P	0.015	0.013	0.009	0.013	0.012

AR(2) p	0.787	0.831	0.788	0.786	0.827
Wald (p)	0.000	0.000	0.000	0.000	0.000

Notes: **p-value<0.11; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*

- Results provided in this table are obtained by employing two–step System GMM estimators.
- Asymptotic standard errors which are robust in nature are presented in brackets below the estimated value of coefficient of each variable. These errors have been subjected to Windmeijer finite sample correction.
- The results in the different columns relate to the following specifications of the instrument set.
  - In Column (1) only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$, for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 is chosen and then collapsed for instruments.
  - In Column (2), only lag 2 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 to lag3 is chosen and then collapsed for instruments.
  - In Column (3), lag 2 to lag 3 of $RoE_{i,t}$ is taken as instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$, $RSB_{i,t-1}$, GDP_t and Inf_t lag 2 is chosen and then collapsed for instruments.
  - In Column (4), only lag 2 of $RoE_{i,t}$ is taken as an instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1}$, *only* lag 2 is taken as instruments with collapse sub-option; for GDP_t and Inf_t *only* lag 2 to lag 3 is chosen and then collapsed for instruments.
  - In Column (5), only lag 2 of $RoE_{i,t}$ is taken as an instrument for $RoE_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1}$, lag 2 to lag 3 is taken as instruments with collapse sub-option; for GDP_t and Inf_t *only* lag 2 is chosen and then collapsed for instruments.
- G denotes total number of groups.
- Number of instruments used in estimation is denoted by J.
- Hansen_df gives degrees of freedom for Hansen J test which tests for the number of over-identified restrictions used for each specification of lags.
- P value for Hansen J test is denoted by Hansen (p) in table.
- Serial correlation of first order in the first difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(1)p in the table.
- Serial correlation of second order in the second difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(2)p in the table.
- Wald (p) represents the p-value for Wald test of overall fit of the model. Significant p-value suggests the estimated model to be good.
- Time dummies are controlled via the use of i.year in the syntax of STATA.

In Table 4.4.3 below, results from OLS method are provided. Results show that all of the explanatory variables retain their signs and significance in both models which confirm the consistency of our results. The value of R^2 is about 0.63in model 1, where the dependent variable is return on assets, implying that about 63% of the variation in thedependent variable is explained by explanatory variables used in the study. However, in model 2 where return on equity is used as a measure of profitability, about 57% of the variation in return on equity is explained by explanatory variables.

Table 4.4.3: Results from Pooled OLS method

Variables	Ordinary Least Squares Method	
	$RoA_{i,t}$	$RoE_{i,t}$
$Dependent\ Variable_{i,t-1}$	0.6249****	0.5750****
	(0.0954)	(0.0842)
$NPA_{i,t-1}$	-0.1235***	-2.1129***
	(0.0405)	(0.6407)
$RSB_{i,t-1}$	0.0086	0.0293
	(0.0054)	(0.1091)
GDP_t	-0.0097	-0.1934
	(0.0078)	(0.1377)
Inf_t	-0.0469****	-0.7697****
	(0.0104)	(0.1625)
Pubdummy	-0.1615****	-0.0836
	(0.0451)	(0.5587)
Constant	0.8364****	12.9141****
	(0.1616)	(2.0617)
R^2	0.6304	0.5693

Notes:

- *p-value<0.1; **p-value<0.05; ***p-value<0.01; ****p-value<0.001
- Robust standard errors clustered by bank are reported in parentheses.

We have also used the within groups transformation to estimate these models. Results are presented in Table 4.4.4 below. With the within groups estimation method, the coefficient of all variables are found to be significant including GDP growth and relative size of a bank for both models, which were insignificant and weakly significant respectively in case of System GMM estimation. What is interesting is that, while the sign of the coefficient of the GDP growth rate continues to be negative, the within groups estimator applied to the model suggests a significant negative effect of bank size on profitability. This can be explained by invoking possible diseconomies of scale. However, the positive relationship found in most existing studies suggests that the absence of a statistically significant relationship, as found in system GMM estimation, is probably a more reasonable conclusion regarding the impact of

bank size on profitability. The value of R^2 equals to 0.40 in model 1, where the dependent variable is return on assets, implies that about 40% of the variation in the dependent variable is explained by explanatory variables used in the study. However, in model 2 where return on equity is used as a dependent variable, about 37% of the variation in return on equity is explained by explanatory variables.

Table 4.4.4: Results from Within Groups method

Variables	Within Groups Method	
	$RoA_{i,t}$	$RoE_{i,t}$
$Dependent\ Variable_{i,t-1}$	0.3955****	0.4165****
	(0.0780)	(0.0832)
$NPA_{i,t-1}$	-0.1716****	-2.6989****
	(0.0409)	(0.6927)
$RSB_{i,t-1}$	-0.0786**	-1.2683**
	(0.0387)	(0.7079)
GDP_t	-0.0173**	-0.3279**
	(0.0081)	(0.1417)
Inf_t	-0.0445****	-0.7601****
	(0.0101)	(0.1523)
Constant	1.2662****	19.8237****
	(0.1611)	(2.5406)
R^2	0.4060	0.3746

Notes:

- **p-value<0.1; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*
- Robust standard errors clustered by bank are reported in parentheses.

We have noted in the previous chapter that the OLS and within groups estimates serve as upper and lower bounds for the autoregressive coefficient estimated by GMM. Our results confirm this as coefficient for $ROA_{i,t-1}$ and $ROE_{i,t-1}$ are 0.4711 and 0.4974 respectively when claculated by GMM. These values are 0.6249 and 0.5750 when estimation method is OLS and 0.3955 and 0.4165 when within groups estimation is used.

Chapter-V

Conclusion

This study was done with a view to assessing the impact of various factors, especially macroeconomic factors, on the profitability of Indian commercial banks over the period 2004-05 to 2015-16. The banking sector plays a crucial role in the economic growth and development of a nation by intermediating between savers and investors. To ensure a sound and stable capital position for banks in the economy, it is important to have an adequate and steady flow of profits in the banking industry. Therefore, it becomes important to understand the impact of various factors on the profitability of banks. As the recent 2008 financial crisis is followed by a global economic downturn, it attracted the attention of economists and academicians. Economists largely focused on analyzing how financial factors can affect the real economy. However, the state of the real economy is also supposed to affect financial conditions of banks over time. Hence, the main focus of this dissertation was on how would macroeconomic conditions like growth and inflation will affect current bank profitability.

This study has been carried out in the context of a dynamic panel data model. The GMM technique suggested by Arellano and Bond (1991) and then developed further by both Arellano and Bover (1995) as well as Blundell and Bond (1998) into the system GMM estimator which was considered appropriate for a dynamic model which is characterized by the presence of predetermined and potentially endogenous explanatory variables as well as by a high degree of persistence in the time series for some variables.

We have used profitability ratios viz. return on assets and return on equity as dependent variables in our study.

The two major macroeconomic variables which have been included in the analysis are the GDP growth rate and the inflation rate. GDP growth is found to have an insignificant impact on both ROA and ROE in our study. In fact, all the estimated coefficients of the GDP growth rate have a negative sign. Absence of a positive association between the current growth of GDP and bank profitability is not surprising once we recognize that increases in

GDP increase the demand for credit which not only has an effect on net income but also increases the net assets of a bank. Therefore, both the numerator and the denominator in the case of the return on assets can increase as a result of GDP growth. One should also recognize that the growth rate of net income for banks can be less than the growth rate of earnings because, with an unchanged or higher degree of leverage, a part of the credit deployed by banks would be funded by either deposits or borrowings and the interest payments of banks will also therefore increase. Therefore there are two important effects – increase in assets and increase in interest outflows – which tend to pull down the return on assets and there is one effect – increase in income inflows – which tends to push it up. The final impact can go either way.

Inflation measured by WPI was another macroeconomic variable used in this study. It was found to have a negative and highly significant effect in the case of both ROA and ROE. The impact of inflation on bank profitability depends on extent at which inflation is anticipated. If inflation is fully anticipated, then management of banks can adjust interest rates accordingly to increase revenues faster than costs which would have a positive impact on bank profitability. Otherwise, as in this case, the wrong anticipation of inflation can lead to a negative impact of inflation on profitability.

Other than macroeconomic variables two bank specific variables were also included in our model to capture the impact of bank specificity. These are the relative size of a bank and the ratio of non-performing assets to total advances. The estimated signs of the coefficients for both of these variables are as expected, being respectively positive and negative. But the result for the relative size of banks is either weakly significant or insignificant in most specifications which means that, given the time period and the banks considered in our study, it is difficult to claim that the relative size of a bank matters much when it comes to determination of profitability. However, ratio of NPA to total advances has a highly significant effect in the case of both ROA and ROE. Therefore, this study concludes that in order to increase their profitability banks should try to reduce their non-performing assets by granting loans to credit-worthy creditors.

This paper also concludes that private sector banks enjoy higher ROA than public sector banks. The reasons could be first, private banks are more cautious in giving loans and

therefore usually have lower bad debts than public sector banks. Second, because public sector banks are often viewed by governments as instruments to achieve various socio-political objectives, they are subject to additional restrictions in their operations. Public sector banks, for example, have a greater responsibility in terms of providing loans to weaker sections of the society at lower rates or with little collateral. The needs of financial inclusion might require them to operate loss-making branches. Therefore profitability ratios of public sector banks are lower when compared to private sector banks. However, the impact of private ownership on profitability was found to be insignificant in case of ROE.

From these results several policy implications are evident. One is, as inflation had a significant negative impact on the profitability of banks, policy makers while designing macroeconomic policies and targets regarding inflation need to take account of this effect on bank profitability. Two, the negative impact of GDP growth on bank profits (and the estimated positive coefficient of lagged GDP growth in one of the regression equations) probably indicates that financial health of the banking system benefits from economic growth only over the long term. Therefore, a stable macroeconomic environment with steady growth may be more desirable than a volatile macroeconomic environment with higher growth rates. Three, as the ratio of net NPA to net advances, had highly significant and negative impact on bank profits, it is needless to reiterate that the government and the central bank should take necessary steps to reduce the extent of NPAs in the banking system in order to maintain financial stability. Moreover, lower profitability of public sector banks suggests that there is a trade-off between financial stability and achievement of socio-political objectives with public sector banks. For example, if public sector banks provide more credit to borrowers with high credit risk simply in order to achieve socio-political objectives it might increase the extent of bad debts in their balance sheets. Government policy, which seeks to use public sector banks as policy instruments for the achievement of these objectives, therefore needs to take into account the possible long term consequences on the profitability and financial health of the banking system. Finally, the positive effect of relative bank size on profitability also suggests that smaller banks may be financially more vulnerable. their financial health, therefore, needs to be more closely monitored and one needs to study whether the government needs to ensure some minimum size for banks.

This study was an attempt to complement the existing literature on the determinants of profitability in case of Indian commercial banks. However it also leaves scope for further

research. For example, the number of variables used in this study was restricted due to the methodology used and the fact that the main focus of the study was on macroeconomic factors. We could have incorporated more control variables in this study such as the capital adequacy ratio or policy variables like the repo rate, CRR and SLR but these could not be included because we wanted to restrict the number of instruments in our model so that our results are valid and consistent. Therefore we included only two bank-specific variables which we considered the most relevant from a theoretical point of view, viz. the relative size of a bank and the ratio of net NPAs to net advances. An alternative model was also considered with the capital adequacy ratio replacing the share of NPAs in total advances as a measure of the capital risk facing banks but, not surprisingly gave weaker results. The NPA ratio clearly has a more direct impact on bank profitability separate from its implications for a bank's exposure to capital risk.

A more detailed study of the lags in the relation between macroeconomic variables and profitability can also be considered. We have seen in one of our results that, although statistically insignificant, lagged GDP growth had a positive impact on the profitability of banks in estimated regressions whereas current GDP growth had a negative impact, which is in contrary to findings of many papers. We attributed this to the differences in the time pattern of effects following from GDP and credit growth on various components of the profitability measures – on credit and assets, on interest inflows and outflows. A complete story of the impact of macroeconomic variables like growth and inflation is possible only when we know the effect of this not simply on current profitability but, on the entire time path of profitability.

The time period covered in this study is 2004-05 to 2015-16. One reason for considering this period is that before 2005 there were many mergers and acquisitions in the banking industry, and the industry stabilizes only after 2005. However, although additional assumptions will need to be made in carrying out a similar analysis, it might be interesting to take account of these mergers and acquisitions and see whether the results of this study continue to hold over an extended time period.

Moreover, because a major portion of banking activity in India is carried out by public and private sector banks with majority Indian ownership, we have focused on these two categories of banks only. Further studies can also incorporate foreign banks and their

subsidiaries. By considering a greater number of banks and longer time period, it becomes possible to incorporate a larger number of explanatory variables within dynamic panel data models without running into problems of instrument proliferation. This is a major advantage of increasing *'T'* and '*N'* in dynamic panel model.

Appendix

Table 1: Banks used in this study

Public Sector Banks	Private Sector Banks
Allahabad Bank	Axis Bank
Andhra Bank	Catholic Syrian Bank Ltd.
Bank Of Baroda	City Union Bank Ltd.
Bank Of India	DCB Bank Limited
Bank Of Maharashtra	Dhanlaxmi Bank
Canara Bank	Federal Bank
Central Bank Of India	HDFC Bank
Corporation Bank	ICICI Bank
Dena Bank	Indusind Bank
IDBI Bank Ltd.	Jammu Kashmir Bank Ltd.
Indian Bank	Karnataka Bank Ltd.
Indian Overseas Bank	Karur Vysya Bank
Oriental Bank Of Commerce	Kotak Mahindra Bank
Punjab And Sind Bank	Lakshmi Vilas Bank
Punjab National Bank	Nainital Bank
Syndicate Bank	RBL
UCO Bank	South Indian Bank
Union Bank Of India	Tamilnad Mercantile Bank Ltd.
United Bank Of India	Yes Bank Ltd.
Vijaya Bank	
State Bank Of Bikaner And Jaipur	
State Bank Of Hyderabad	
State Bank Of India	
State Bank Of Mysore	
State Bank Of Patiala	
State Bank Of Travancore	

Table 2: Summary statistics of the variables used in study

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
$RoA_{i,t}$	0.86	0.65	-3.38	3.44
$NPA_{i,t-1}$	1.42	1.15	0.01	8.11
$RSB_{i,t-1}$	2.22	3.10	0.04	22.44
GDP_t	8.78	2.09	4.79	11.42
Inf_t	4.19	2.31	-1.1	7.3

Table 3: Variables and Expected Signs

Variables	Description	Expected Sign
Dependent Variables		
Return on Assets	$\frac{\text{Annual Net Income}}{\text{Total Assets}}$	
Return on Equity	$\frac{\text{Annual Net Income}}{\text{Average Shareholders' Equity}}$	
Independent Variables		
Lagged NPA ratio	$\left(\frac{\text{Net NPA}_{(t-1)}}{\text{Net Advances}_{(t-1)}}\right)$	Negative
Lagged value of relative size of bank	$\left(\frac{\text{Total assets of bank i}_{(t-1)}}{\text{Total assets of all banks}_{(t-1)}}\right)$	Positive/Negative
GDP growth	It is calculated from real GDP values at market price with base year 2011-12	Positive/Negative
Inflation	Wholesale Price Index	Positive/Negative

Table 4: Alternative Estimates of the AR(1) Specification

VARIABLES	OLS	Within Transformation	Difference GMM	System GMM
$RoA_{i,t}$	**0.7428******	**0.5324******	**0.5220******	**0.7485******
	(0.0307)	(0.0388)	(0.0705)	(0.0698)
$NPA_{i,t}$	**0.8602******	**0.7997******	**0.8830******	**0.9904******
	(0.0398)	(0.0443)	(0.1352)	(0.1236)
$RSB_{i,t}$	**0.9811******	**0.7662******	**0.7355******	**0.9805******
	(0.0040)	(0.0266)	(0.1413)	(0.0030)
GDP_t	**0.0923****	**-0.0386**	**0.0626**	**0.1121****
	(0.0456)	(0.0475)	(0.0475)	(0.4422)
Inf_t	**5.73e-12**	**-0.1**	**-0.0566**	**-0.0566**
	(0.0455)	(0.0474)	(0.1132)	(0.1132)

Sample: 45 Banks; 2005-2016

- *p-value<0.1; **p-value<0.05; ***p-value<0.01; ****p-value<0.001Year dummies included in all models.
- Asymptotic standard errors in parentheses.
- GMM results are two – step robust estimates with heteroskedasticity consistent standard errors.
- All available lags are used while using GMM estimations.
- All computations are done using STATA 12.0.

Table 5: Estimation results for Return on Assets with lagged value of GDP

$RoA_{i,t}$	(1)	(2)	(3)	(4)	(5)
$RoA_{i,t-1}$	.4688***	.4561**	.3467**	.3340*	.5080****
	(.1692)	(.1609)	(.1743)	(.1788)	(.1217)
$NPA_{i,t-1}$	-.2435****	-.2414****	-.2690****	-.2721****	-.2491****
	(.0473)	(.0444)	(.0561)	(.0568)	(.0480)
$RSB_{i,t-1}$	.0359	.0304	.0357*	.0271	.0320*
	(.0225)	(.0215)	(.0215)	(.0207)	(.0173)
GDP_t	-.0091	-.0096	-.0113	-.0097	-.0069
	(.0092)	(.0089)	(.0085)	(.0082)	(.0080)
$LGDP_t$	.0078	.0055	.0050	.0044	.0083
	(.0114)	(0.1277)	(.0107)	(.0109)	(.0121)
Inf_t	-.0504****	-.0511****	-.0522****	-.0527****	-.0558****
	(.0130)	(.0128)	(.0115)	(.0109)	(.0120)
Pubdummy	-.1776**	-.1763***	-.1920**	-.1762**	-.1628**
	(.0763)	(.0737)	(.0787)	(.0774)	(.0690)
Constant	1.0494****	1.0950****	1.2516****	1.2771****	1.023****
	(.2192)	(.1882)	(.2471)	(.2325)	(.1654)
G	44	44	44	44	44
J	39	41	43	45	45
Hansen_df	31	33	35	37	37
Hansen (p)	0.181	0.223	0.306	0.407	0.301
GMM instruments for levels					
Hansen test excluding group	0.212	0.287	0.272	0.196	0.246
Difference (null H = exogenous)	0.278	0.253	0.445	0.841	0.493
gmm(lroa, lag(x y))					
Hansen test excluding group	0.084	0.152	0.173	0.139	0.051
Difference (null H = exogenous)	0.490	0.436	0.566	0.810	0.724
gmm(lrsb lnpa, collapse lag(x y))					
Hansen test excluding group	0.086	0.091	0.106	0.116	0.182
Difference (null H = exogenous)	0.826	0.856	0.915	0.967	0.945
iv(i.year gdp lgdp wpi pubdummy)					
Hansen test excluding group	0.099	0.120	0.179	0.091	0.095
Difference (null H = exogenous)	0.514	0.569	0.612	0.968	0.851
AR(1) P	0.025	0.024	0.024	0.025	0.018
AR(2) p	0.999	0.974	0.868	0.835	0.982
Wald (p)	0.000	0.000	0.000	0.000	0.000

Notes: **p-value<0.11; **p-value<0.05; ***p-value<0.01; ****p-value<0.001*

- Results provided in this table are obtained by employing two–step System GMM estimators.
- Asymptotic standard errors which are robust in nature are presented in brackets below the estimated value of coefficient of each variable. These errors have been subjected to Windmeijer finite sample correction.
- The results in the different columns relate to the following specifications of the instrument set.
  - In Column (1) only lag 2 of *RoAi,t* is taken as instrument for $RoA_{i,t-1}$; and for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag3 are chosen and then collapsed for instruments.
  - In Column (2), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag4 are are chosen and then collapsed for instruments.
  - In Column (3), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag5 are are chosen and then collapsed for instruments.
  - In Column (4), only lag 2 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ lag 2 to lag6 are are chosen and then collapsed for instruments.
  - In Column (5), only lag 2 to lag 3 of $RoA_{i,t}$ is taken as instrument for $RoA_{i,t-1}$; for $NPA_{i,t-1}$ and $RSB_{i,t-1,}$ *only* lag 2 is chosen and then collapsed for instruments.
- G denotes total number of groups.
- Number of instruments used in estimation is denoted by J.
- Hansen_df gives degrees of freedom for Hansen J test which tests for the number of over-identified restrictions used for each specification of lags.
- P value for Hansen J test is denoted by Hansen (p) in table.
- Serial correlation of first order in the first difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(1)p in the table.
- Serial correlation of second order in the second difference residuals is checked by p-value of Arellano Bond autocorrelation test and is denoted as AR(2)p in the table.
- Wald (p) represents the p value for wald test of overall fit of the model. Significant p value suggests the estimated model to be good.
- Time dummies are controlled via use of i.year in syntax of STATA.

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