# DETERMINANTS OF LIQUIDITY IN INDIAN COMMERCIAL BANKS: AN EMPIRICAL EVALUATION

**Ph.D. THESIS**

*by*

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**ROORKEE – 247 667 (INDIA)**
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**A THESIS**

***Submitted in partial fulfilment of the requirements for the award of the degree***

*of*

**DOCTOR OF PHILOSOPHY**

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# INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
# ROORKEE

## CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled **"DETERMINANTS OF LIQUIDITY IN INDIAN COMMERCIAL BANKS: AN EMPIRICAL EVALUATION"** in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy and submitted in the Department of Management Studies, Indian Institute of Technology Roorkee, Roorkee is an authentic record of my own work carried out during a period from July, 2012 to October, 2018 under the supervision of Dr. Anil K. Sharma, Associate Professor, Department of Management Studies, Indian Institute of Technology Roorkee, Roorkee.

The matter presented in this thesis has not been submitted by me for the award of any other degree of this or any other Institute.

**(ANAMIKA SINGH)**

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

(A. K. Sharma)
Supervisor

The Ph.D. Viva-Voce examination of **Anamika Singh**, Research Scholar, has been held on ……

**Chairman, SRC** **Signature of External Examiner**

This is to certify that the student has made all the corrections in the thesis.

**Signature of Supervisor (s)** **Head of the Department**

**Dated:**

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## ABSTRACT

Banks are significant financial intermediary of the economy. It circulates the surplus cash to the economically deficient economy. Thus, a bank performs the function of liquidity management. During the process of liquidity management banks encounter with various types of risks which may further result into banking crisis. Hence, liquidity management is very important task of banks. It has been observed that during the crisis period (2007-2009), liquidity of developed banks was affected. As the Indian economy is the significant emerging economy, in this study it has been analysed that how financial crisis affected the liquidity of Indian banks and what are the factors which influences liquidity of Indian banks.

Thus, this study aims to address following objectives in Indian banking sector, namely:

1. To analyze the impact of bank-specific and macroeconomic factors on liquidity of banks operating in India.
2. To study the change in the influence of determinants on liquidity of banks operating in India with change in bank ownership.
3. To examine the effect of determinants on bank liquidity with change in bank size.
4. To study the behaviour of determinants of bank liquidity in pre, crisis and post crisis periods.

The primary objective of the study is to find the determinants, which affects the liquidity of Indian banking system. The sample size selected for the study consists of 63 banks, it consist of nationalised banks, private banks, State banks of associates and foreign banks. This study employs panel data regression technique to attain the desired objectives.

Our analysis is divided into four stages. First stage of analysis includes all banks from 2000 to 2015. From the application of panel data estimations it was found that It was found that among bank-specific variables, NPA, NIM, ROA, cost of funding, and CAR are key determinants of bank liquidity. Macroeconomic variables - crisis, inflation and GDP - have a significant effect on liquidity.

Second stage of analysis forms three samples based on ownership structure of banks, i.e. public banks, private banks and foreign banks. Regression analysis concludes that crisis had a similar effect on all banks (private, public and foreign). Bank size had a significant negative effect on public banks' liquidity (LATA, CATA and LATD) and private banks' liquidity (CATA, LATA and LATD) while it showed mixed effect (negative and positive) on foreign banks' liquidity.

Other liquidity determinants - CAR, inflation, NIM, NPA, COF, GDP, deposits – showed mixed effect on liquidity of public, private and foreign banks.

Third stage analysis assesses the existence of association between independent variables and liquidity for small banks, medium banks, large banks and largest banks. Results reveal that NPA has a significant negative effect on medium banks and largest banks. COF has a significant negative impact on small banks, large banks and largest banks. Inflation has a negative effect on small banks, medium banks and large banks. GDP has a negative effect on medium banks, large banks and largest banks. While, crisis found to have a significant positive effect on all banks.

Fourth stage analysis also illustrates effect of various liquidity determinants on liquidity measures in different time periods. 2000 to 2006 period analysis finds that GDP, Inflation, capital, NIM, Profitability, deposits and size have a significant effect on liquidity. Examination of 2007 to 2009 period highlights that size, inflation, NIM, profitability, COF, deposits, GDP and Capital have a significant effect on liquidity. 2010 to 2018 time period examination suggests that deposits, GDP, size, COF, NPA, inflation have a significant effect on liquidity. Post-crisis period (2010 to 2015) have a significant negative effect on liquidity.

The present study contributes to the existing literature and provides an insight of the liquidity of Indian banking system. It will aid the managers in making better financial policies for the development of the Indian banking sector. Also, it will help them in understanding the areas of weakness and strengths in financial management and what variables they should consider before deciding upon the liquidity of banks. Finally this study recommends that as the liquidity is significantly important for banks, it should consider the effect of various variables on banks while taking decisions.

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## ABBREVIATIONS

| | |
|---|---|
| ADF | Augmented Dickey- Fuller |
| BIS | Bank for International Settlements |
| CAR | Capital Adequacy Ratio |
| CATA | Cash over Total Assets |
| COF | Cost of Funds |
| CRR | Cash reserve ratio |
| GDP | Gross Domestic Product |
| HDFC | Housing Development Finance Corporation |
| ICICI | Industrial Credit and Investment Corporation of India |
| IDBI | Industrial Development Bank of India |
| LATA | Liquid Assets over Total Assets |
| LATD | Liquid Assets over Total Deposits |
| LLC | Levin-Lin-Chu |
| LoansTA | Loans over Total Assets |
| NIM | Net-Interest Margin |
| NPA | Non-Performing Assets |
| OMO | Open market operations |
| PCARDBs | Primary Co-operative Agriculture and Rural Development Banks |
| RBI | Reserve Bank of India |
| ROA | Return on Assets |
| ROE | Return on equity |
| RRBs | Regional Rural Banks |
| SBI | State Bank of India |
| SCARDBs | State Co-operative Agriculture and Rural Development Banks |
| SLI | Systematic Liquidity Index |
| SLR | Statutory Liquidity Ratio |
| UCBs | Urban Co-operative Banks |
| UK | United Kingdom |

# CHAPTER 1

# INTRODUCTION

## Section A: Background

### 1.1 Introduction

Banks are vital financial institutions in any country. They play the role of an intermediary in the economy by directing surplus economic units (excess cash) to the economically deficient (borrowers). Thus, banks encourage capital formation and saving in the economy (Tesfaye, 2012). Theory of financial intermediation states that an essential role that banks must perform is make available liquidity by way of investment in illiquid assets (long term) through liquid liabilities (short term) (Wang, 2002). Banks carry out the function of creating liquidity by holding illiquid assets and making available demand deposits and cash. Diamond and Dybvig (1983) stressed "preference for liquidity" keeping in view economic agent uncertainty to rationalize existence of banks; banks existed due to the fact that they provided superior liquidity insurance as compared to financial markets. It is noteworthy that because banks ensure flow of liquidity, they are exposed to transformation risk and danger of run on deposits. In general terms, it may be understood that as more liquidity is created to be made available to customers (to meet liquidity demands), the risk that banks face with respect to losses arising due to disposal of illiquid assets also increases.

In past many researchers have studied the topic of economy (Abdo and Aguiar, 2011; Adrian and Fleming, 2011; Shachar and Vogt, 2017; Ahmed et al. 2011; Anand et al., 2018; Lutz et al., 2017; Ly, 2015; Molyneux and Thornton, 1992; Liu and Wang, 2010; Ruan and Zhang, 2018; Ruan et al., 2016; Chen et al., 2016; Hao and Zhang, 2013; Harold and Thenmozhi, 2014; Diamond and Dybvig, 1983; Diamond and Rajan, 2001; Drehmann and Nikolaou, 2013; Du, 2017; Ejoh et al., 2014; Eloitri, 2017; FANG and LI, 2017; Dunkley, 2009; Ennis and Wolman, 2015; Re Farooq and Zaheer, 2015; Gallagher and Nadarajah,2004; Gilje et al., 2016; Krishnamurthy et al., 2016; Liping and Xuchao, 2014; de Carvalho, 1999) and found that concept of banks are inevitable topic. The concept of a bank is studied by many authors (Al-Tamimi and Hussein, 2010; Anderson et al, 2018; Andreou et al.,2016; Anjum Iqbal,2012). Ariffin,2012; Atkin and Cheung, 2017; Bai et al., 2018; Bancel and Salé, 2016; Bassey and Moses 2015; Bech and Keister, 2017; Benmelech et al., 2017; Berkman and Hayes, 2000; Berkman and Nguyen, 2010; Berkman and Eleswarapu, 1998). Berkman et al., 2005; Bianchi and Bigio, 2014; Bindseil et al., 2003; Bonner et al., 2014; Bordeleau and

Graham, 2010; Lo, 2014; Kashyap and Stein, 2000; Khan et al., 2015; Khan et al., 2015; Perez, 2015; Petria et al., 2015)

A bank's liquidity is indicative of its capability to efficiently fund its transactions. Inability to do so is referred to as liquidity risk. A higher degree of liquidity risk is seen as the bank's incapability to fulfil its obligations (e.g. debt maturity, deposits withdrawal, funds for investment and loan portfolio). Bank for International Settlements (BIS, 2008) views liquidity as a bank's capability to fund asset increases and fulfil its liabilities without incurring losses. Banks must be able to acquire desired levels of liquidity at reasonable cost when immediate needs arise.

Attaining optimum liquidity levels depends on several factors like bank characteristics, size, and level and nature of the intricacy of bank activity. According to Greuning and Bratonovic (2004), bank liquidity management includes: a strong decision-making structure for the management of liquidity risk; appropriate funding strategy; well-defined exposure limits; and an established set of rules in order to arrange liquidity when need arises. All banks should possess a well-structured liquidity management policy and ensure that it is conveyed to the entire organization. Banks must also have competent and experienced managers capable of assessing situations and reacting to them intelligently. Being able to do so would enhance investor trust.

Bank liquidity may be influenced by bank-specific and macroeconomic factors, and regulations of the government/central bank. Examples of bank-specific factors are: bank size, ownership structure, profitability, capital adequacy, loan growth, percentage of non-performing loan on the total volume of loans which measures loan quality, etc.. Macroeconomic factors may include: gross domestic product (GDP), inflation rate, interest rate, etc.

The relationship of various macroeconomic and bank-specific variables with bank liquidity has been discussed in detail in the various chapters of this thesis.

## 1.2 Why this Study in an Indian Context?

There are various research in Indian context (Tripathy, 2006; Singh et al., 2013 Aspal and Nazneen, 2014; Jayadev, 2013; Joshi and Joshi, 2009; Ketkar and Ketkar, 2008; Kumar and Singh, 2012; Das and Ghosh, 2006; Mishra et al., 2012; Mohamad,2016; Mohan, 2013; Mohan and Kapur, 2009; Mohapatra and Das, 2013; Mukherjee et al., 2002; Ramzan and Zafar, 2014; Rochet, 2008; Schertler, 2010; Shah et al., 2018; Shin, 2014; Pana et al., 2010; Raddatz et al., 2015; Prasad and Ghosh, 2007; Nachane and Ghosh, 2007; Indi Nazir, 2010;

Brunnermeier, 2009; Ghosh et al., 2008; Das et al., 2015; Gertler and Kiyotaki, 2015; Horváth et al., 2014; Ibe, 2013; Ghosh, 2009; Mittal and Garg, 2016; Mittal and Garg, 2018; Mittal and Garg, 2017; Makkar and Singh, 2013). The significance of liquidity management in banks and financial institutions has been established by research. Inadequate management of liquidity may result in dire outcomes and severe impact on the economy. Thus, the study of bank liquidity, its determinants, and the associations therein in relation with the external environment assumes great importance. It becomes necessary to understand how a change in any one of the variables would impact the others. The authors feel the need to examine the behaviour of determinants of bank liquidity in normal (non-crisis) and unusual circumstances (crisis) in order to gain insights into the mechanism by way of which situations and circumstances affect liquidity of banks. The considered duration of time for the study is 2000-2015 (this includes the crisis of 2007-2009). This duration is broken up into pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2015) periods in order to understand what difference exists in the influence that determinants exert on bank-liquidity in the aforementioned time periods. Also, it has been examined what relationship bank ownership shares with determinants, and what influence determinants exert on liquidity as a result of this association. Similarly, change in the influence of determinants on liquidity with change in bank size has been observed. Bank-specific and macroeconomic determinants of bank-liquidity have been included in the present study. Bank specific factors included are - profitability (ROA), capital adequacy ratio (CAR), cost of funds (COF), deposits (Deposits), bank size (Size), non-performing assets (NPAs), and net interest margin (NIM). Macroeconomic determinants are – gross domestic product (GDP), unemployment (Unemployment), inflation (Inflation), and crisis (Crisis). Both macroeconomic and bank specific factors have been selected on the basis of existing literature.

Several studies have been carried out in other countries considering the above-mentioned factors, especially after the financial crisis. Developed economies were the ones more affected by the financial crisis, and substantial research has been carried out to assess the impact of the crisis in such nations. While it is generally accepted that the Indian banking system remained relatively resilient during the crisis, there is not much literature to assess how determinants of liquidity behaved immediately before, during, and after the crisis in a developing country like India. It is important to understand the difference in the behaviour of determinants in normal and abnormal situations in different parts of the world so that the data may be studied comparatively, and important insights and conclusions drawn. The present study takes such a step by examining the influence (and change in influence) of determinants

on bank liquidity in three different time frames (pre, crisis and post-crisis) to determine the difference in the behaviour of determinants, and underlying associations, especially in an Indian context. Results of the study have been validated by a pilot survey (conducted after analysis) of banking professionals.

## 1.3 Indian Banking System: An Overview

### 1.3.1 Introduction

The Indian banking system began in 1921 when the Presidency Bank was set up. The erection of the Presidency Bank gave way to the establishment of the Imperial Bank of India for conducting central banking functions. The year 1934 witnessed the formation of the Reserve Bank of India (RBI) as a regulatory body; the RBI was nationalized in 1949 under the RBI act, 1932 (Das, 2013). After nationalization, RBI became an authoritative body, and assumed added responsibilities of controlling, regulating, and inspecting other banks. The Imperial Bank of India was acquired by RBI in 1955, and renamed State Bank of India (SBI). In 1959, seven SBI subsidiaries were nationalized. With a view to improve robustness and resilience of banks, the Government of India nationalized 14 more banks in 1969. Six more banks were nationalized in 1980 (Das & Ghosh, 2006). After nationalization, the confidence of people in banks increased.

The banking system of India is made up of cooperative and commercial banks. New reforms were introduced in the financial and economic sectors in the 1990s after which considerable improvement took place in the banking system of India, with the issue of NPAs reducing substantially (Pennathur, Subrahmanyam, & Vishwasrao, 2012).

The recommendations of the Narasimham Committee (1992) with respect to various reforms reinforced the banking structure and ascertained stability therein (Sathye, 2003). The Banking Regulation Act (1993) allowed private sector banks entry in Indian markets. Financial sector reforms were important because the reforms included: (1) monetary framework restructuring; (2) interest rate deregulation; (3) initiation of exchange rate system (market based); (4) fresh regulatory standards like capital adequacy; (5) novel norms pertaining to asset liability and asset classification; and (6) fresh provisions and standards pertaining to risk management (Das, 2013). The Reserve Bank of India actively played a role in enhancing the efficiency of, and adding depth to the financial market. Revisions in the monetary policy framework decreased reliance on direct instruments; de-emphasis of cash reserve ratio (CRR), and use of open market operations (OMOs) emerged as liquidity management instruments (Reddy, 1999). Deregulation in interest rates, greater flexibility in banks' licensing policy, capital structure

escalation, and functional independence in public sector banks were the measures adopted for stability (Das, 2013). As a result of these measures, the economy witnessed a boost in growth.

### 1.3.2 Structure of Indian Banking System

RBI, the central bank of the country, is the regulator and supervisor of the functions of the banking industry of India. The RBI handles money supply and dictates key banking and market rates. The banking system of India comprises cooperative and commercial banks. Commercial banks hold over 90% of all assets of the banking system of India, and are classified into two major categories:

(1) Scheduled Commercial Banks ( listed in the Scheduled II of RBI Act, 1934); and
(2) Non-scheduled Commercial Banks

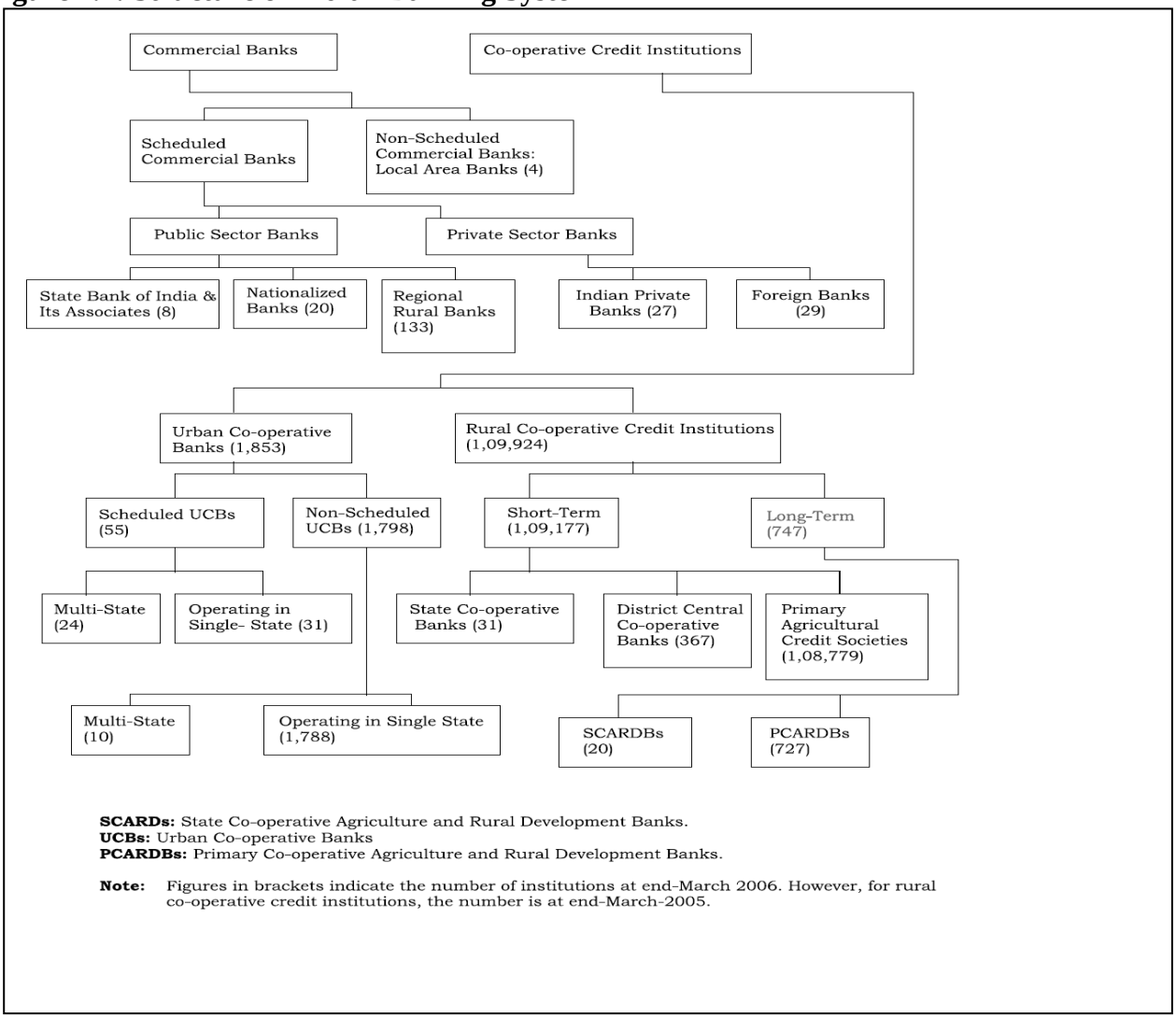
Based on ownership structure, scheduled commercial banks are categorized as:

(1) Public sector banks including:
    i. SBI and its associate banks,
    ii. Other nationalized banks,
    iii. Other public sector banks (e.g. IDBI).
(2) Private sector banks (Old private banks that began business before 1995, and new private banks that started operating after 1995).
(3) Foreign banks.
(4) Regional rural banks (RRBs) and other local banks.

Public sector banks have more branches across the country and hold over 70% of all banking industry assets. These banks command a higher market share and have a larger customer base in rural and urban sectors. Of Indian public sector banks, the SBI group is one of the largest banking groups. Private banks operating in India comprise old players and new. Private banks are more savvy in terms of technology and better meet the needs of urban customers. Foreign banks more often function as branches of parent organisations and have a relatively limited share in the Indian banking sector. Nevertheless, foreign banks have carved a niche for themselves and do possess a very profitable market share in metro cities. Foreign and private banks hold 25% to 30% of all assets of the Indian banking system. To empower weaker sections in rural areas and aid the Indian agricultural sector, public sector banks fund the activities of RRBs in these areas.

RRBs have a limited existence in the banking system of India with a mere 3% share. Figure 1.2 shows the share of private, public and foreign banks (in terms of total assets) in the banking sector of India.

**Figure 1.1: Structure of Indian Banking System**

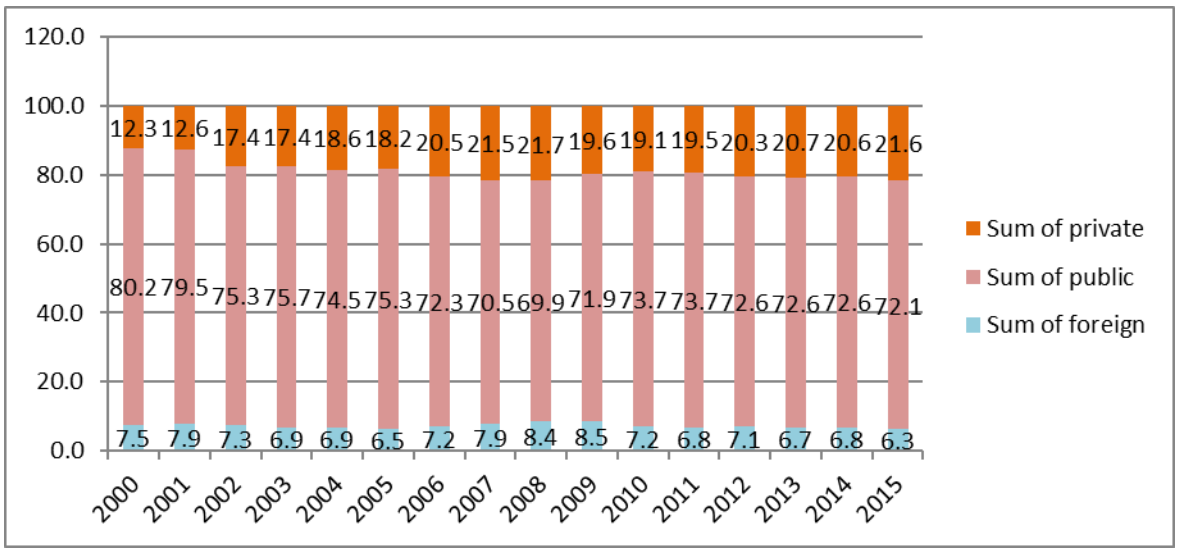



**SCARDs:** State Co-operative Agriculture and Rural Development Banks.
**UCBs:** Urban Co-operative Banks
**PCARDBs:** Primary Co-operative Agriculture and Rural Development Banks.

**Note:** Figures in brackets indicate the number of institutions at end-March 2006. However, for rural co-operative credit institutions, the number is at end-March-2005.

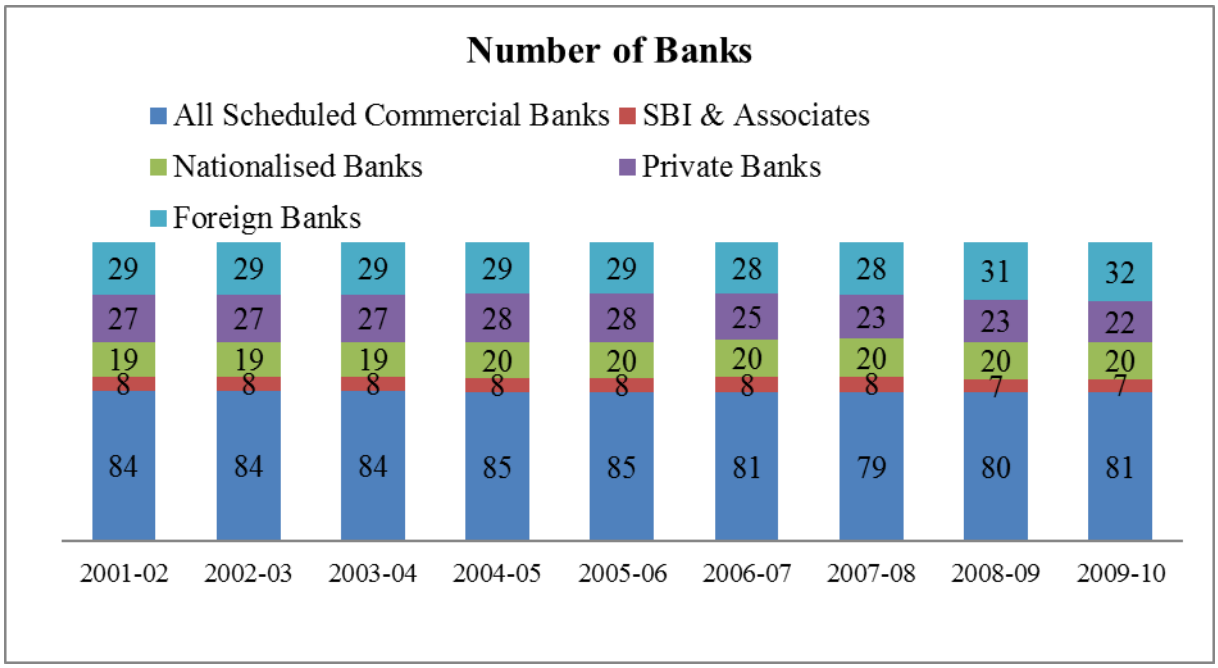
**[Source:** Report on Banking Statisitcs, RBI.]

**Figure 1.2: Percentage Share of Bank Groups in Total Assets of the Indian Banking Sector**




**[Source:** Report on Trend and Progress of Banking in India 2009-10, RBI.]

**Figure 1.3: Number of Scheduled Commercial Banks Over a Decade**




**[Source:** Profile of Banks, RBI, 2010.]
**[Note:** This data includes scheduled commercial banks only (excluding RRBs).]

Figure 1.3 exhibits the number of scheduled commercial banks operating in Indian banking sector after the first and second phase of financial reforms. In the year 2001-02, there were total 8 banks in SBI and associates group. However, in the year 2008-09 State Bank of Saurashtra merged with SBI and later on in the year 2010-11 State Bank of Indore merged with the SBI. Among the nationalised banks, IDBI included as public banks in the year 2004-05 in the banking business in India. Among the private banks, Yes bank joined the banking business in India in the year 2004-05 and now days it is one of the leading and fastest growing private bank in India. After the year 2005-06, a number of small private banks merged with the giant banking groups in leading private and public banks' such as Bank of Rajsthan and Sangli Bank merged with the ICICI Bank; Lord Krishna Bank and Centurian Bank of Punjab merged with the HDFC Bank; Bharat Overseas Bank merged with the Indian Overseas banks.

Foreign banks are increasing in number over a decade and enhancing their operations in India with the entry of a number of foreign banks in the Indian banking industry.

## 1.4 Bank Liquidity

In the recent past, several banks the world over were confronted by liquidity problems, chiefly due to liquidity mismanagement. Liquidity and its proper management assumed greater importance after the global financial crisis which led to several commercial banks going bankrupt due to liquidity issues.

Reserve Bank of India guidelines (2012) state: "Liquidity is a bank's capacity to fund increase in assets and meet both expected and unexpected cash and collateral obligations as they become due." The guidelines also mention liquidity risk as: "Inability of banks to meet such obligations as they become due without adversely affecting the bank's financial conditions." Mohan (2006) asserted that carrying out of monetary policy and management of liquidity have proved difficult in India post financial liberalisation (in 1991). Before that, monetary policy in India was not a significant problem because of controlled rate of exchange, administratively fixed (mostly) interest rates, restricted portfolio flows, and insignificant foreign direct investment in India.

The period post financial liberalisation in 1991 witnessed opening of economy, deregulation of interest rates, and foreign exchange rates to be allowed to be driven by the market. These changes led to liquidity management assuming more significance as a result of exchange rate fluctuations and interest rate volatility.

Several authors have examined the different facets of bank liquidity management in the context of various countries. Bank for International Settlement (BIS, 2010) provides a structure for management of liquidity risk by banks, and lays down reforms taken up by BIS to reinforce regulations with respect to global capital and liquidity. The proposed framework seeks to enhance the ability of the banking sector to withstand shocks emerging due to economic and financial stress. BIS puts forth two standards for liquidity funding: first, developing liquidity coverage ratios to improve banks' short term liquidity risk resilience by making sure that a bank holds high liquid assets to meet short term liabilities; and second, working out Net Stable Funding Ratio (NSFR) to help build long-term bank resilience (period of a year and more) and make available a maturity structure of liabilities and assets that can be maintained. Following the regulations laid down by BIS, the Reserve Bank of India (2012) delineated theoretical principles for sound liquidity management in Indian banks. RBI lays down that banks in India must form policies, practices and strategies to manage liquidity risk on the basis of a bank's risk tolerance. Banks must recognize, measure, oversee and control liquidity risk by cash flow projection from liabilities, assets, and off balance sheet items. Banks must consider that liquidity cannot be transferred easily across business units, and must manage funding needs and liquidity risk accordingly across currencies, legal entities, and business lines.

Aspachs et al. (2005) examined how central bank's Lender of Last Resort (LOLR) policy influenced bank liquidity. The study gives an analysis of the determinants of the liquidity policy of UK banks. The study found significant evidence showing presence of

liquidity moral hazard. The study further revealed that banks built liquidity buffers in times of weak economic growth and drew liquidity in times of robust economic growth.

Valla et al. (2007) presented a measure (asset based) of bank liquidity to capture and quantify the mechanics of liquidity flows in French banks for the period 1993 to 2005. They found that on average, positive liquidity flows were greater than negative liquidity flows; net nominal liquidity flows grew by 1% (quarterly) between 1993 and 2005. Liquidity expansion and contraction was 6% to 5% (quarterly) which suggested an active market trading beyond substantial growth in bank liquidity. Rauch et al. (2009) examined how macroeconomic factors and monetary policy of the central bank affected liquidity creation in German savings banks for the duration 1997 to 2006. The study found that from 1997 to 2006, total liquidity generated in savings banks of Germany increased by 51%. It was also revealed that liquidity generation in German savings banks negatively relied on indicators of monetary policy. Vodova (2011 & 2012), after examining liquidity determinants of commercial banks in Czech Republic and Slovakia, revealed that liquid asset share in total assets and liquid liabilities in deposits and short term funding reduced with bank profitability, higher capital adequacy and larger bank size.

Malik and Rafique (2013) observed macroeconomic and bank specific liquidity determinants of Pakistani commercial banks for the period 2007 to 2011. They concluded that bank specific factors like liquid assets were required with an increase in bank size. Also, regulations by the central bank significantly influenced commercial bank liquidity.

Chagwiza (2014) found a positive association between bank liquidity and capital adequacy, total assets, gross domestic product and bank rate when studying liquidity problems in banks in Zimbabwe. Adoption of multi-currency, business cycle and inflation rate negatively impacted liquidity. Bank size and liquidity were found to have a positive correlation.

Mohan (2006) recognized issues pertinent to management of liquidity in the Indian context.

Srinivasan and Gupta (2007) identified issues related to liquidity management in Indian banks. They opined that banks utilized excessive statutory liquidity ratio (SLR) to finance credit growth. Further, banks in India borrowed short term and lent long term which increased mismatch between liabilities and assets.

Mishra et al. (2012) developed a systemic liquidity index (SLI) for India to evaluate liquidity conditions in the country. The index is not bank specific and includes parameters of the corporate sector.

### 1.4.1 Determinants of Bank Liquidity

Several studies have been carried out on bank liquidity and related factors like bank size, profitability, capital, ownership, etc. (Dinger, 2009; Tesfaye, 2012; Delechat et al., 2012). (Alger and Alger, 1999; Aspachs et al., 2005; Bonner et al., 2013; Bunda and Desquilbet, 2008; De Haan and van den End, 2013; Hamadi and Awdeh, 2012; Kashyap et al., 2002; Lartey et al., 2013; Moussa, 2015; Tesfaye, 2012), and suggested that factors such as bank size, profitability, capital adequacy, non performing assets, net interest margin, cost of funding, ownership, deposits, etc. affect liquidity of banks.

Choon et al. (2013), in context of Malaysian banks for the period 2003-2012, found that profitability, gross domestic product and non performing loan positively affected liquidity of banks. Capital adequacy, financial crisis and bank size had a negative influence on bank liquidity. Interbank insignificantly influenced Malaysian bank liquidity.

Michael et al. (2006) observed the link between NPAs and liquidity in Indian cooperative banks from 1996 to 1997. The study discovered that a rise in NPAs resulted in decreased bank liquidity. Further, bank refinancing capability also reduced because of NPAs which impacted liquidity generation of banks (Chari and Narasimham, 2002). Rana (2016) asserted that when advances, loans and assets invested in discontinued creating expected income, they turned into Non Performing Assets (also known as non-performing loans).

Drakos (2003) and Hesse (2007) found a negative link between bank liquidity and net interest margin. On the other hand, Maudos and Solis (2009) revealed an insignificant relation between market liquidity and net interest margin.

Hamadi and Awdeh (2012) revealed that liquidity had a negative impact on net interest margin of Lebanese banks from 1996 to 2009. Further, foreign bank liquidity insignificantly influenced net interest margin. Shen et al. (2009) studied commercial bank liquidity risk in 12 developed countries for the period 1994-2006, and discovered that liquidity risk reduced profitability due to increased funding cost.

Horvath et al. (2014) assessed Czech banks from 2002 to 2010 and uncovered significant links between competition among banks and generation of liquidity; more

competition was found to decrease banks' liquidity generation. Also, decreased lending and deposit activities by banks appeared to be a result of greater competition among banks.
Distinguin et al. (2013) highlighted the link between bank capital and liquidity creation. They studied European and US commercial banks involved in trading practices during 2000-2006 and discovered that banks decreased their capital ratio when confronted by greater illiquidity or in times of higher liquidity generation. Higher illiquidity further made small banks to reinforce their standards of solvency.

Funding cost also has received significant research attention (Shen et al., 2009; Munteanu, 2012; Alger and Alger, 1999). Alger and Alger (1999) highlighted that an increase in funding cost led to a decrease in cash and increase in securities. This indicates that bank liquidity is influenced by higher cost of funding.

Acharya and Kulkarni (2012) opined that India's banking sector was relatively more robust. During 2008–2009, banks saw relocation in deposits; depositors exhibited greater faith in banks of the public sector and deposited more therein. Pennathur et al. (2012) examined Indian banks during 2000–2009 considering variables like profitability (return on assets) and bank size. They found that bank ownership was vital to establishment of bank profitability. Foreign banks exhibited higher return on assets whereas public sector banks showed higher return on equity. Delechat et al. (2012) examined how macroeconomic and bank- specific variables influenced liquidity of Central American banks. They found that foreign banks held lower liquid buffers in comparison to other banks. Earlier, Dinger (2009) had similar findings. Profitability has shown a positive impact on bank liquidity in some studies (Vodova, 2013; Choon et al., 2013). Contrarily, Delechat et al. (2012) and Rauch et al. (2009) asserted that profitability negatively impacted liquidity of banks. Aspachs et al. (2005) found profitability and size insignificantly impacted bank liquidity.

Bonner et al. (2013) established a nonlinear association between liquidity and bank size. Acharya and Mora (2015) examined bank competency in terms of maintaining adequate liquidity buffers for the period 2007–2009. Ratnovski (2013) stressed the significance of banking practice accuracy and sufficiency of liquid buffers. The study further asserted that transparency enabled banks to protect themselves from liquidity risk, and that adequate liquidity holding of banks met customer demands. High capital availability increased the risk absorbing capability of banks (Berger and Bouwman, 2009) and their capacity of liquidity generation (Vodova, 2013; Munteanu, 2012). Eichengreen and Gupta (2013) asserted that in times of a banking crisis, deposit withdrawal increased; hence, efficient liquidity management

during such times worked as buffer and highlighted the effect of deposit transfer from private banks to public sector banks in the banking system of India. Moussa (2015) revealed an insignificant influence of deposits on liquidity of banks.

This paper considers the following variables to ascertain their impact on bank liquidity:

#### 1.4.1.1 Bank-Specific Factors

Bank size (Size) - Bank size is calculated as natural log of total assets. Kashyap et al. (2002) and Delechat et al. (2012) examined factors affecting banks' liquid asset holdings and found that bank size significantly influenced liquidity levels. Several other studies have also observed bank size to be an important variable affecting bank liquidity (Bonfim and Kim, 2012; Bonner et al., 2013; Dinger, 2009; Tesfaye, 2012). Contrarily, Aspachs et al. (2005) showed an insignificant effect of bank size on liquidity. Choon et al. (2013) and Rauch et al. (2010) established a significant negative association between bank size and bank liquidity.

Cost of funds (COF) - Cost of funds is the interest rate paid by financial institutions for the funds that they deploy in their business. The cost of funds forms one of the significant input costs for any financial institution; lower cost of funds would give better returns in the event of funds being deployed as short and long term loans to borrowers. The difference between cost of funds and rate of interest charged from borrowers forms a key source of profit for majority of financial institutions. A few studies have examined the affect of cost of funds and funding sources on liquidity of banks (Bunda and Desquilbet, 2008; Munteanu, 2012 and Alger and Alger, 1999). According to Alger and Alger (1999) and Munteanu (2012), banks showed greater inclination to invest in liquid assets when cost of refinancing increased. This suggests that when cost of liability rises, banks depend more on liquid assets as liquidity sources instead of interbank markets.

Deposits (Deposits) –A bank deposit signifies placement of funds in a bank account or with any other financial institution. Deposits form the key source of funds for banks and financial institutions; majority of people prefer to deposit their money in banks, the banks, in turn, pay interest on such deposits. Banks use the deposits for their own revenue-creating activities. Moussa (2015) revealed an insignificant influence of deposits on liquidity of banks. Bonner et al. (2013) and Kashyap et al. (2002) asserted that with an increase in demand deposits, there was also an increase in liquidity asset holdings. Alger and Alger (1999) assumed that at a particular deposit level, if greater risk exists for borrowers (like in economic recession), banks must increase liquid assets. Dinger (2009) observed emerging economies from 1994 to 2004 and discovered that increase in deposit rate decreased bank liquidity.

Capital adequacy ratio (CAR) - The capital adequacy ratio (CAR) is a measure of a bank's capital. It may be expressed as percentage of risk weighted credit exposures of a bank. It is also understood as capital-to-risk weighted assets ratio (CRAR), and employed to safeguard depositors and increase efficiency and stability of financial systems worldwide. High capital availability enhances risk absorbing capability (Berger and Bouwman, 2009) and liquidity generation capacity of banks (Vodova (2013), Munteanu (2012) and Dore (2013). Distinguin et al. (2013) emphasized the association between capital of bank and liquidity creation. They studied European and US commercial banks engaged in trading practices from 2000-2006 and discovered that banks reduced their capital ratio when confronted by liquidity problems. Further, when small banks encountered liquidity issues, they reinforced their solvency standards. Capital adequacy and bank liquidity were also investigated by Choon et al. (2013), Berger and Bouwman (2010), Delechat et al. (2012), Chen and Phuong (2014), Moussa (2015), Bunda and Desquilbet (2008), Bhati and DeZoysa (2012) and Bhati et al. (2015), and significant negative influence of capital adequacy on bank liquidity was discovered.

Profitability [return on assets (ROA)] - Profitability ratios form class of financial metrics employed to evaluate the ability of businesses to create earnings relative to expenses and separate pertinent costs incurred in a particular time period. Examples of profitability ratios include: profit margin, return on assets (ROA), and return on equity (ROE).In this study, we use ROA as a profitability measure. Profitability is evaluated in relation with expenses and costs, and analyzed comparatively with assets to determine how effectively a company deploys assets to create sales, and finally, profit. The term 'return' in ROA suggests net income or net profit – total earnings from sales after deducting all expenses, taxes and costs. The greater the number of assets of a company, the greater the amount of sales (and possibly profit) it might generate.

Some studies have found that profitability positively influences bank liquidity (Choon et al., 2013; Vodova, 2013 and Lartey et al., 2013). On the other hand, Delechat et al. (2012), Rauch et al. (2010), Valla et al. (2006) and Rauch et al. (2010) asserted that profitability negatively influenced liquidity of banks. Aspachs et al. (2005), however, stated that profitability showed an insignificant association with liquidity of banks.

Bank ownership (Ownership) – In India, scheduled commercial banks are divided into three ownership categories – public, private and foreign. Some authors (Fungacova and Weill (2012); Fungáčová et al. (2010); Trinugroho et al. (2016); Al-Khouri (2012); Ogilo and Mugenyah (2015); Delechat et al. (2012)) have examined the effect of ownership structure on liquidity of banks. Al-Khouri (2012) revealed that government ownership seemingly did not

influence bank liquidity. Fungacova and Weill (2012) discovered that levels of liquidity creation varied across ownership types of banks. State-controlled banks generated greater liquidity as compared to foreign and domestic private banks. Also, state controlled banks were less impacted by financial crisis.Fungáčová et al. (2010) revealed that post deposit insurance implementation, the association between liquidity creation and capital was significant and negative for small and medium-sized banks. The relationship was not significant for larger banks, but was significant and negative for private domestic banks. The association was not significant for foreign and state-controlled banks. Delechat et al. (2012) indicated that foreign banks held lesser liquid buffer because they had access to parent banks in emergencies.

Net interest margin (NIM) - Net interest margin (NIM) represents the gap between interest income created by banks or other financial institutions and interest amounts paid to lenders (e.g.deposits), in relation with their (interest-earning) asset amounts. Several studies have examined the association between liquidity of banks and net interest margin. Drakos (2003) and Hesse (2007) revealed a negative link between bank liquidity and net interest margin. On the contrary, Maudos and Solis (2009) indicated an insignificant association between market liquidity and net interest margin. Hamadi and Awdeh (2012) observed Lebanese banks from 1996 to 2009 and found that liquidity had a negative effect on net interest margin. Further, liquidity of foreign banks was found to insignificantly influence net interest margin. According to Drakos (2003) and Hesse (2007), with an increase in net interest margin, there was a rise in bank income.

Non-performing assets (NPAs) A non-performing asset (NPA) may be understood as a credit facility in relation to which interest and/or instalment of bond finance principal has been 'past due' for a particular time period. NPA, as used by financial institutions, refers to loans that may result in a default. Simply, assets that neither provide returns in the present, nor may be expected to bring returns in the future, may be labelled NPAs. NPAs hamper cash flows of banks. If NPAs keeps building up, both banks and the economy may meet future crisis. Lower NPAs in a bank suggest a stable cash flow in the system, allowing the banks to hold lower liquidity. However, higher NPA levels would require banks to hold more liquidity. Rana (2016) asserted that when advances, loans and assets invested in discontinued creating expected income, they turned into Non Performing Assets (also known as non-performing loans).

#### 1.4.1.2 Macro-Economic Factors

Inflation (Inflation) – Inflation refers to the rate of increase of the general price level of goods, and resultant decrease in the currency's purchasing power. Central banks strive to keep inflation in limits, and prevent deflation for an economy's smooth functioning. Several

developing nations utilize change in the consumer price index (CPI) as a central measure of inflation. India previously employed WPI as an inflation measure, but the new CPI (combined) has been announced as the new inflation measuring standard. In India, change in Consumer Price Index (CPI) is considered to measure inflation rate. Moussa (2015) empirically examined Tunisian banks established negative impact of inflation rate change on bank liquidity. Bhati et al. (2015) observed Indian banks, and found negative influence of rate of inflation on liquidity of banks. Tesfay (2012) and Horvath et al. (2014) also studied liquidity and inflation. Tesfay (2012) revealed a positive impact of inflation on liquidity while Horvath et al. (2014) established insignificant effect of inflation on banks' liquid assets.

Gross domestic product (GDP) - Gross domestic product (GDP) represents the value (in monetary terms) of all finished services and goods produced within the borders of a country within a specific period of time.

GDP has generally been employed as indicator of the economic health of a nation, and measure of a nation's standard of living. GDP is also accepted as proxy for business cycle. Moussa (2015), Bunda and Desquilbet (2008) and Choon et al. (2013) discovered a positive influence of GDP on liquidity of banks. Valla et al. (2006), Dinger (2009), Vodova (2011) and Aspachs et al. (2005) highlighted negative links between the two. Aspachs et al. (2005), stated that from 1985-2003, UK banks apparently held lower levels of liquidity when GDP increased and vice versa.

Unemployment (Unemployment) - Unemployment rate is a gauge of the pervasiveness of unemployment and computed as percentage by dividing number of unemployed people by total number of people presently in the labor force. Rauch et al. (2010) and Horvath et al. (2014) asserted that unemployment significantly and negatively impacted liquidity. More unemployment decreased capital and hindered creation of liquidity. On the contrary, Munteanu (2012) indicated that higher rate of unemployment resulted in greater bank liquidity.

Crisis (Crisis) A financial crisis is a state wherein a rapid decline in the value of financial assets or institutions is observed. It is frequently linked with a run on the banks or panic; investors sell assets or extract money from savings accounts in the anticipation that these assets would also drop in value if left at the financial institution. Financial crisis may severely impact bank liquidity. According to (Choon et al., 2013), financial crisis refers to the situation where assets or institutions are left less than their nominal value, resulting in losses. Vodová (2013), Vodova (2011), Bunda and Desquilbet (2008) and Choon et al. (2013) revealed a negative correlation between financial crisis and bank liquidity. While financial crisis might be

a result of inadequate bank liquidity, the opposite may also occur. Interestingly, Chen and Phuong (2014) found that banks were more liquid in crisis. Eichengreen and Gupta (2013) examined the effect of movement of deposits from private to public sector banks in India from 2007-2009.

## 1.5 Rationale of the Study

The present study examines the influence of macroeconomic [gross domestic product (GDP), inflation (Inflation), and crisis (Crisis)] and bank-specific [return on assets (ROA), bank size (Size), deposits (Deposits), cost of funding (COF), capital adequacy ratio (CAR), net interest margin (NIM), non-performing assets (NPAs)] factors on liquidity of banks (public, private and foreign) in India. Further, the study examines how the influence of aforementioned determinants changes with change in bank size and ownership, and in normal (non-crisis) and abnormal (crisis) situations.

Research has highlighted the significance of proper liquidity management in banks and financial institutions. Improper or insufficient liquidity management may result in dire consequences and a very damaging impact on the nation's economy.

Thus, it is important to study the relationship among bank liquidity, determinants of liquidity, and the external environment to understand how a change in any one variable affects others. It is necessary to examine how determinants act in normal (non-crisis) and unusual (crisis) situations as this would shed light on the mechanism by way of which situations wield influence on liquidity of banks.

This study takes into account the time period 2000-2015 (including the crisis of 2007-2009) and divides it into pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2018) to ascertain the change in the effect of determinants on liquidity in the considered time frames. The contribution and originality value of the study lie in the fact that no effort has been made hitherto to study the influence of determinants on liquidity of banks in three distinct time periods (pre, crisis and post-crisis) to determine the difference in determinants' behaviour, especially in the context of India. This study provides deeper insights into how determinants affect bank liquidity in normal and abnormal situations.

### 1.5.1 The Objectives of this Study are as follows:

1. To analyze the impact of bank-specific and macroeconomic factors on liquidity of banks operating in India.

2. To study the change in the influence of determinants on liquidity of banks operating in India with change in bank ownership.
3. To examine the effect of determinants on bank liquidity with change in bank size.
4. To study the behaviour of determinants of bank liquidity in pre, crisis and post crisis periods.

### 1.5.2 Scope of the Study

The scope of a study delineates the boundaries of the study and helps maintain structure throughout. The scope of this study is defined below:

1. The study considers 63 scheduled commercial banks (public, private and foreign) operating in India during the period 2000-2018.
2. The period of study (2000-2015) is divided into three phases – pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2018).
3. The study observes change in influence of determinants on bank liquidity during the three periods, as well as during the entire period.
4. Balanced panel data have been employed, this means that equal number of banks have been considered in all time periods.
5. Panel regression model (fixed effect estimates and random effect estimates) has been used.
6. Results of the study have been validated by a pilot survey (conducted after analysis) of banking professionals.

## 1.6 Conclusion

This chapter gave an introduction to the present study. It explained the macro-economic and bank-specific variables, and time period (2000-2018) considered. The chapter provided an overview of existing literature on the study variables and associations established between them. Further, the rationale, scope, objectives and hypotheses of the study were laid down, and organization of the present thesis explained. The next chapter (Chapter 2) will provide a detailed review of relevant literature on the study variables and their underlying associations.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

Existing literature suggests that bank liquidity is a function of micro and macro factors. Micro factors include bank specific determinants of liquidity whereas macro factors are external factors that influence bank liquidity but are not under the control of bank management. Bank liquidity has been investigated by studies in the past (Al-Harbi, 2017; Al-Khouri, 2012; Allen and Gale, 2014; Alshatti, 2014; Cetina and Gleason,2015; Cetorelli and Goldberg, 2012; Buch and Goldberg, 2015; Carletti et al., 2007; Cecchetti, 2015; Diamond, 1997; Muriithi and Waweru, 2017; Nguyen and Leander, 2014; Odunayo and Oluwafeyisayo, 2015; Olagunju et al., 2012; Panetti and Deidda, 2017; Molla, 2017; Molyneux and Thornton, 1992; Hart and Zingales, 2014; Lakštutienė and Krušinskas, 2010; Marozva, 2015; Kregel, 1986; Fungáčová and Weill, 2012; Wong et al. 2018; Wang 2002; Waemustafa and Sukri, 2016; Waemustafa and Sukri, 2015; Uremedu, 2009; Triepels and Daniels, 2016; Trenca et al., 2012; Trenca et al., 2015; Sopan and Dutta, 2018; Sathye, 2003; Rao and Jijo, 2001; Reddy, 1999), while taking into account bank specific and macroeconomic variables ( Bonfim and Kim, 2012; Bonner et al., 2013; Delechat et al., 2012; Eichengreen and Gupta, 2013). In literature is has been found that ownership (Das et al., 2005; Trinugroho et al., 2016), associated risk (Imbierowicz and Rauch, 2014; Jedidia and Hamza, 2015; Kochubey and Kowalczyk, 2014) and crisis (Berger and Bouwman,2008;Bourke et al., 2014; Correa et al., 2016; Carlson et al., 2015; Cukierman, 2014; Ioan and Dragoş, 2009; Tripathy and Asija,2017; Subbarao, 2009; Mohsni and Otchere,2015; Naimy, 2009) is a critical factor which influences bank activities. It The various paper on bank liquidity describes the factors influencing banks' liquidity which are explained as follows:

**Al-Khouri (2012)** examined annual GCC data for the period 1998-2008.Panel data model was used on 43 banks in 6 nations (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates).Regression analysis showed that government ownership insignificantly impacted liquidity. Capital ratio showed a positive significant influence on creation of liquidity. Profitability (ROA) negatively and significantly influenced creation of liquidity. Further, bank size and previous liquidity levels proved significant for determining liquidity generated by banks. Larger bank size and greater liquidity generated by banks in previous time periods caused greater liquidity generation. Macroeconomic factors (inflation, economic growth and

GDP per capita, and stock market capitalization) showed insignificant influence on creation of liquidity.

**Belete (2015*)*** observed bank-specific and macro-economic factors influencing liquidity of banks. Eight Ethiopian banks were considered for the period 2002-2013. Mixed methods research approach was employed with a combination of documentary analysis and in-depth interviews. Employing balanced fixed effect panel regression, it was found that capital strength, interest rate margin and inflation showed significant and positive association (statistically) with liquidity of banks. Loan growth, on the other hand, displayed a negative and statistically significant link with liquidity of banks. The associations for profitability, non-performing loans, bank size and gross domestic product emerged statistically insignificant.

**Berger and Bouwman (2010)** investigatedquarterly U.S. bank data for the duration 1984 to 2008. Vector autoregression (VAR) model and a single-equation approach were employed. Key findings were: In normal situations, monetary policy loosening (tightening) linked with statistically significant increase (decrease) in generation of liquidity by smaller banks. This was substantially driven by the effect on balance sheet liquidity generation, albeit the effect was small economically. Monetary policy did not show significant influence on total liquidity generation by large and medium sized banks which generated nearly 90% of total bank liquidity; the effect on- and off-balance sheet liquidity generation by such banks was at times significant. Stronger results pertaining to smaller banks were in consistency with literature using bank lending instead of creation of liquidity(e.g., Kashyap and Stein 2000). In times of financial crisis, efficacy of monetary policy falls. The influence of monetary policy was found significantly weaker (statistically) with respect to banks of all sizes, comparative to its intent in times of financial crises than in normal situations, and this was significant (economically) for large sized banks. These results were determined by on- and off-balance sheet liquidity generation response to monetary policy. Higher liquidity generation (relative to a given time trend) precedes financial crises, indicating that unusually high creation of liquidity may be a sign of a crisis. Detrended liquidity generation levels were found to possess incremental explanatory power when predicting crises even when macroeconomic factors like GDP growth, monetary policy, and stock market returns were controlled. The results were fundamentally driven by off-balance sheet liquidity generation.

**Cornett** *et al.* **(2011)** examined quarterly US commercial bank data from 2006 to 2009. The study investigated banks' behaviour in times of financial crisis, and the way cash, liquid assets and credit availability were managed by banks. It was discovered that crisis led to crisis of liquidity, and increase and reduction in liquid assets and credits (respectively) by banks.

Banks with higher levels of illiquid assets raised liquidity and decreased lending levels. Smaller banks were found to depend on core deposits and capital, and lent more than other banks. Larger banks contained greater number of illiquid assets over total assets in comparison to smaller banks. Larger banks had a greater number of unused commitments. Larger banks showed greater susceptibility to liquidity risk in comparison to smaller banks. Larger banks had more undrawn commitments, showed less reliance on core deposits, held lesser capital and lower levels of liquid assets of balance sheet assets. Off-balance sheet liquidity risk realized as borrowers, in great numbers, withdrew from pre existing promises.

**Cucinelli (2013)** analyzed the link between liquidity risk (assessed with liquidity coverage ratio and net stable funding ratio) and a few particular bank structure variables (size, capitalization, assets quality and specialization). The sample comprised 1080 listed and non-listed Eurozone banks. OLS regression based on panel data was applied. Results highlighted that larger banks had greater exposure to liquidity risk. Banks having greater capitalization offered better liquidity in the long run. Asset quality impacted only short term liquidity risk measure. Banks specializing more in lending activities displayed greater vulnerability in funding structure. In times of crisis, liquidity risk management changed only in the short run. It was particularly observed that larger banks showing greater specialization in lending activities were more probable to hold lower levels of liquidity; this could be because banks could reach out to the lender of last resort if confronted by problems. Banks that were more capitalized showed better liquidity in the long run. Banks with greater asset quality were more probable to manage liquidity in the short run. Financial crisis seemed to have an impact only on liquidity coverage ratio, hence, on short term management of liquidity. This could be because banks, in times of financial crisis, show greater inclination to manage liquidity in the short run.

**Dinger (2009)** examined 378 banks in ten Central and Eastern European emerging economies, including Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia for the duration 1994 to 2004. GMM and OLS were employed. It was discovered that Capital (equit/total assets) significantly and positively influenced liquid assets of banks. Deposits rate significantly and negatively impacted liquid assets. Banks showed a tendency to invest less in low-return liquid assets when deposits were costly. Size showed a nonlinear association with liquidity. Interbank rate displayed a positive (significant in 3 out of 5 regression) influence on liquidity. GDP growth significantly and negatively impacted liquidity. Liquidity was measured as ratio of liquid assets to customer and short term funding. Results concerning interbank assets showed that on an average, foreign

banks held less interbank assets as compared to domestic banks, but displayed the tendency to augment interbank lending in relation to domestic banks when faced by liquidity distress. With respect to interbank liabilities, foreign banks were found to usually have greater amounts of interbank liabilities as compared to domestic banks. However, when faced by aggregate liquidity shortage, foreign banks relatively reduced their interbank borrowing. Thus, in times of crisis, domestic banks showed the tendency to augment their interbank liabilities as compared to foreign banks.

**Ferrouhi and Lahadiri (2013)** analyzed annual data pertaining to Moroccan banks' liquidity for the duration 2001 – 2012. Results showed that liquidity reduced in the last decade. The decline intensified after the 2007 financial crisis. Larger banks held greater liquidity as compared to smaller banks. Results revealed that in Morocco, eleven determinants chiefly determined liquidity: size of banks, share of own bank's capital of the bank's total assets, external funding to total liabilities, return on assets, foreign direct investment, monetary aggregate M3, foreign assets, growth rate of gross domestic product, public deficit, inflation ratio and the effects of financial crisis. Hence, liquidity of Moroccan banks positively correlates with bank size, share of own bank's capital of the bank's total assets, external funding to total liabilities, monetary aggregate M3, foreign assets, foreign direct investment and negatively correlated with return on assets, inflation rate, growth rate of gross domestic product, public deficit and financial crisis. Conversely, bank's return on equity, equity to total assets and unemployment rate showed no influence on liquidity of foreign banks.

**Subedi and Neupane (2011)** investigated factors affecting liquidity and financial performance of six banks in Napal for the duration 2002/03 to 2011/12. Results of balanced fixed effect panel regression regression analysis revealed that capital adequacy, share of non-performing loans in the total volume of loans negatively and significantly (statistically) impacted bank liquidity. Loan growth, growth rate of gross domestic product on the basis price level, liquidity premium paid by borrowers and short term interest rate displayed negative and insignificant (statistically) effect on liquidity of banks. Bank size positively and significantly impacted bank liquidity while inflation rate showed a positive and insignificant influence on liquidity of banks. Liquidity was measured as liquid assets over total assets, and loans over sum of deposits and short term financing.

**Vodova (2013)** observed Czech and Slovak commercial banks from 2001 to 2010. Panel data regression analysis was used. Liquid asset ratio of Czech banks was found to increase with increase in capital adequacy, in the presence of Czech koruna depreciation (which drives banks to emphasize international transactions in interbank market) and

declining credit portfolio quality (banks offset higher credit risk by careful management of liquidity risk). Slovak bank liquidity was determined by bank size(smaller banks were more liquid); bank capital adequacy (banks having lower capital adequacy held greater liquid asset buffers), bank profitability (negatively correlated with liquidity), growth rate of gross domestic product in the previous year ( positively associated with bank liquidity) and realization of financial crisis (where realization of financial crisis worsened liquidity of banks).

**Vodova (2012)** investigated factors affecting Polish commercial bank liquidity. The period under study was 2001 to 2010. Panel data regression analysis indicated that bank liquidity was greatly established by economic conditions (overall), and declined due to financial crisis, increased unemployment and economic downturn Bank liquidity also decreased with greater profitability of banks, greater interest rate margin and larger bank size. Contrarily, bank liquidity rose with greater capital adequacy, inflation, share of nonperforming loans, loan interest rates, and interbank transactions. Results showed capital adequacy and inflation to positively influence L1 (percentage of liquid assets over total assets). Size, GDP, unemployment, interest rate on loans and interest ratio on deposits, inflation and financial crisis showed negative influence on L1. Capital adequacy, GDP of last year, interest rate on loans displayed a positive influence on L2 (percentage of liquid assets over deposits). Contrarily, profitability exerted a negative influence on L2. Non-performing loans pertaining to previous years and inflation showed a positive impact on L3 (percentage of loans over total assets). Interest rate on loans and interest rate on deposits displayed negative influence on L3. GDP and interest rate on interbank transactions showed negative impact on L4 (percentage of loans over deposits).

**Fadare (2011)** investigated liquidity of Nigerian banks. Liquidity was estimated as natural log of total loan over deposits. Linear least square model was used and time series data for the duration 1980 to 2009 considered. Findings suggested that liquidity ratio, monetary policy rate and lagged loan over deposit ratio were significant for prediction of liquidity of the banking sector. Further, decline in monetary policy rates, liquidity ratios, volatility of output relative to trend output, and cash demand led to a rise in existing loan-to-deposit ratios. On the other hand, reduction in circulation of currency proportionate to deposits of the banking sector, and lagged loan-to-deposit ratios led to a fall in existing loan-to-deposit ratios. In times of non-financial crisis, banks accepting deposits either held excess liquidity, or maintained liquidity according to policy benchmarks. In times of financial crises however, banks accepting deposits were found significantly illiquid in relation to benchmarks, thereby substantially raising their susceptibility to distress.

**Diaz and Huang (2017)** examined the influence of governance on creation of liquidity of banks in the US. Quarterly data pertaining to the period 2003 to 2013 were considered. The considered time duration was divided in three phases - pre crisis, crisis and post crisis. Univariate and multivariate analysis was used. Larger banks that were governed better were found to generate greater liquidity. In crisis, ownership, compensation structure, progressive practices and CEO education significantly and positively influenced liquidity.

**Chalermchatvichien** *et al.* **(2014)** studied the link between ownership concentration and risk taking behaviour of banks in East Asian countries from 2005 to 2009. Current assets over current liabilities, loans over deposits, Basel III NSFR and Basel CAR were used as measures of liquidity. Regression analysis was employed. Concentrated ownership was found to enhance liquidity of banks. In case of lower ownership concentration, increased ownership concentration led to decreased capital stability. On the other hand, in case of higher ownership concentration, increased ownership concentration resulted in increased capital stability. Financial crisis showed insignificant influence on the association among liquidity, ownership concentration and capital adequacy.

**Muharam (2013)** comparatively analyzed conventional and Islamic banks' liquidity risk for a period of five years (2007 to 2011). Cash over total assets was used as measure of liquidity. Multiple linear regression and Chow test were employed. ROE and CAR were found to significantly and negatively impact conventional banks' liquidity risk. RLA and ROA, on the other hand, displayed insignificant positive influence on liquidity risk of conventional banks. NIM insignificantly and negatively impacted conventional banks' liquidity risk. NIM and ROE showed significant and positive impact on Islamic banks' liquidity risk. RLA and liquidity gaps exerted insignificant influence on liquidity risk of Islamic banks. Liquidity gaps displayed significant and positive impact on conventional banks' liquidity risk. CAR insignificantly and negatively impacted Islamic banks. ROA positively influenced liquidity risk of Islamic banks.

**Anjum Iqbal (2012)**observed Pakistani banks' liquidity risk (conventional banks and Islamic banks). Sum of cash and cash equivalents over total assets was used as measure of liquidity risk. Regression was applied on data pertaining to both types of banks for the period 2007 to 2010. Findings indicated that bank size, ROA, CAR and ROE significantly and positively associated with liquidity risk of conventional and Islamic banks. NPL significantly and negatively impacted liquidity risk of both conventional and Islamic banks.

**Mashamba (2014)** observed Zimbabwean banks' liquidity for the duration 2009 to 2014. Loans over total assets was used as measure of liquidity. OLS was employed, and it was found NPL significantly and negatively impacted liquidity. Size significantly and positively impacted liquidity of banks. Capital adequacy ratio and loan growth showed insignificant and positive impact on liquidity of banks.

**Abdillah** *et al.* **(2016)** analysed the factors influencing profitability and liquidity of Indonesian banks. Banks included were Muamalat Indonesia, Bank Syariah Mandiri, and Bank Mega Syariah. Profitability was measured as return on assets (ROA) while liquidity was measured as quick ratio. Independent variables influencing profitability were - capital adequacy ratio (CAR), quick ratio and return on assets (ROA). Variables influencing liquidity were - efficiency, non performing financing and capital adequacy ratio. Multiple regression analysis was applied on quarterly data for the years 2008 to 2015 and it was found that efficiency and quick ratio had a significant negative impact on profitability. Capital adequacy ratio (CAR) had a significant positive impact on profitability. While capital adequacy ratio (CAR) had a significant positive influence on liquidity, efficiency (OER) had a significant negative effect on liquidity. Non performing financing (NPF) showed insignificant effect on liquidity.

**Alger and Alger (1999)** assessed 32 Mexican banks for the period January 1997 to March 1999 and formed panel data set for 27 months. Data were retrieved from call reports, balance sheets and income statements. Banks were classified as small (32), medium(12) and large banks(3). Impact of size, deposits, capital and refinancing cost on liquidity was analyzed. Using applied fixed effect and random effect estimates, it was found that demand deposits and bank size had a negative effect on liquid assets. High funding cost decreased cash but increased securities. Capital had a positive effect on liquid assets. Three different measures of liquid assets were used - cash, securities and the sum of cash and securities.

**Aspachs** *et al.* **(2005)** evaluated quarterly data of 57 UK banks for the period 1985 to 2003and analyzed both bank-specific and macroeconomic factors influencing bank liquidity. Using General Methods of Moments (GMM), it was found that profit and size had an insignificant effect on liquidity. Liquidity had a negative relation with policy rate and GDP growth. Domestic banks' interest margin (opportunity cost for holding liquidity) had a negative effect on liquidity while foreign banks' interest margin had a positive effect on banks' liquid buffer. A liquid asset is calculated as the sum of securities invested in, reverse repos, bills, commercial papers and cash. Other liquidity ratios calculated were - liquid assets over total assets, and liquid assets over total deposits.

**Bonner** *et al.* **(2013)** studied yearly data of 7000 banks of 30 OECD countries for the years 1998 to 2007 and analyzed factors such as deposits, profitability, size and business model using pooled OLS. It was found that when liquidity regulation was absent, profit and deposits had a positive effect on liquidity. Capital ratio had an insignificant effect on the size of liquidity buffer. Size had a nonlinear relationship with bank liquidity. Two liquidity parameters were chosen to analyze the effect of independent factors on bank liquidity - sum of cash and due from banks over total assets, and total deposit over total assets.

**Bonner** *et al.* **(2015)** studied annual data of 7000 banks of 25 OECD countries and analyzed macro economic factors and bank-specific factors. Using OLS and Generalized Methods of Moments (GMM) estimation, it was found that while the presence of liquidity regulation decreased liquidity volatility, it was not associated with a high liquid buffer of banks. Liquidity was considered dependent variable and measured as percentage of sum of government bonds, cash, and due from banks over total assets. Independent variables were profit, deposits, capital ratio, concentration, disclosure, DGS, financial openness and government debt. Findings revealed that in the presence of liquidity regulation, concentration and disclosure were significant factors determining liquidity holdings.

**Bunda and Desquilbet (2008)** studied 36 emerging economies for the years 1995 to 2004. The study included 1308 banks and using panel data regression analysis (two-way random effect models), it was found that gross domestic product, inflation, and capital adequacy had a positive impact on banks. Bank size, lending interest rate and financial crisis had a negative effect on liquidity. Four liquidity ratios were used - liquid assets/ total assets, net loans / total assets, liquid asset/ customer and short term funding, and liquid assets / total deposits and borrowings

**Bhati** *et al.* **(2015)** studied nationalized Indian banks for the period 1996 to 2012. Liquidity was calculated as cash, balance with banks, balance with RBI, money at call and short notice and bills purchased. Using OLS regression, it was found that size had a positive influence on liquidity. Capital had a negative effect on liquidity. Studied variables were CRR, call rate, capital, SLR, bank size, and gross domestic product. Four liquidity ratios were calculated where two ratios were asset based while the other two ratios were liabilities based.

**Choon** *et al.* **(2013)** evaluated 15 banks of Malaysia for the period 2003 to 2012. Using fixed effect model, it was found that non performing loans, profitability and gross domestic product had a positive effect on liquidity. Size, capital adequacy and financial crisis had a negative effect on liquidity. Interbank rate showed an insignificant impact on liquidity.

**Fielding and Shortland (2005)** studied bank liquidity in Egypt for the period 1983 to 1996. Liquidity was calculated as logarithm of reserve assets ratio. Using regression analysis on bank data, it was found that bank liquidity was positively influenced by discount rate, rate of depreciation (black market exchange rate) and violent political incidence. Liquidity was negatively correlated with economic reform.

**Fungacova and Weill (2012)** studied quarterly data of Russian banks for the period 1999 to 2009. The paper studied the role of liquidity in the economy and volatility in liquidity creation due to financial crisis world-wide. It was found that overall, the low level of financial development in Russia was the cause of low liquidity creation. When analyzing the ratios of liquidity creation to assets, major differences in liquidity creation across bank ownership types and size classes were observed. State-controlled banks created more liquidity than their foreign and domestic private counterparts, and were also less affected by the financial crisis. In terms of size, large banks contributed the most to liquidity creation. Conversely, the detrimental impacts of the financial crisis were felt more acutely by smaller banks rather than larger banks. To a certain extent, these results reflected that state-controlled banks were on average larger than other banks in Russia.

**Fungáčová** ***et al.*** **(2010)** observed the effect of deposit insurance on the association between liquidity creation and capital in Russian banks. An unbalanced panel containing over 41,000 bank-quarter observations for 1,593 credit institutions from the first quarter of 1999 to the first quarter of 2007 was analysed. Difference-in-difference approach was used to study the data. Fixed effects panel-data estimators and findings suggested that deposit insurance had a limited impact on the association between capital and liquidity creation which was negative (before and after the implementation of deposit insurance). Additional estimations confirmed that the relationship between bank capital and liquidity creation varied with size and type of ownership. After the implementation of deposit insurance, the relationship between liquidity creation and capital was significantly negative for small and medium-sized banks. The association was not significant for large banks, but was significantly negative for private domestic banks. The relationship was not significant for state controlled and foreign banks.

**Johannes P. S. Sheefeni (2016)** examined bank-specific determinants for commercial bank liquidity in Namibia. The study was based on quarterly data covering the period 2001:Q1 to 2014:Q2, and employed unit root and ordinary least squares. Results of the unit root test showed that all variables were stationary in levels and thus, the ordinary least squares technique was used to conduct the estimation. The results revealed a statistically insignificant negative relationship between commercial bank liquidity and return on equity as a measure of

commercial bank profitability. Furthermore, the results showed a positive (though statistically insignificant) relationship between commercial bank liquidity and capital adequacy, as well as between commercial bank liquidity and non-performing loans. Liquidity was measured as percentage of liquid assets over total assets.

**Kamran and Ali (2015)** studied liquidity of the Pakistani banking sector for the period 2003 to 2011. Liquidity was measured as total loans or borrowings over total assets. Fixed effect model, least square dummy variable, pooled regression and random effect model were applied on data of 17 banking firms. Results revealed that TIER I capital ratio had a negative effect on liquidity. On the other hand, growth rate of gross domestic product, cost to income ratio and funding cost had a positive effect on liquidity.

**Moussa (2015)** studied banks of Tunisia and using fixed and random effect estimates found that for the period of 2000 to 2010 ROA, NIM, inflation rate and GDP growth rate had a negative effect on bank liquidity. ROE showed a positive effect on liquidity. Bank size, deposits and financial expenses had an insignificant influence on bank liquidity.

**Moore (2010)** studied the banks of Latin America and the Caribbean. Liquidity was measured as loan to deposit ratio. Ordinary least square regression model was used. Findings suggested that fluctuation in cash to deposit and interest rate (money market) had a negative influence on liquidity. Liquidity trend had an inverse association with business cycle.

**Malik and Rafique (2013)** studied bank specific and macro-economic factors of 26 commercial banks of Pakistan for the period 2007 to 2011. It also included the Asian financial crisis of 2008. Liquidity was measured as cash and cash equivalents over total assets (L1) and advances net of provision over total assets (L2). Share of non-performing loan over total volume of loans, log of total assets, interest rate had a positive effect on liquidity (L1). Inflation had a negative effect on liquidity (L1). Financial crisis negatively affected liquidity (L1). Bank size, interest rate and financial crisis showed a positive effect on bank liquidity (L2).

**Michael** *et al.* **(2006)** studied cooperative banks of India for the years 1996 to 1997. The objective of this study was to analyze the impact of nonperforming assets on operational efficiency of banks. Using theoretical analysis, it was found that NPA had a negative impact on liquidity. This suggests that NPA influences the Indian economy on both levels - micro and macro. It affects the bank capital level which may further result in a banking crisis. It also highlights that increasing NPA levels affect bank profitability. High levels of NPA affect borrowers and creditors and also worsen the refinancing capacity of cooperative banks. High levels of NPA affect the profitability and liquidity of banks which affects bank solvency.

**Munteanu (2012**) investigated 27 Romanian banks for the period 2002 to 2010. The crisis brought substantial changes to the structure of bank liquidity determinants. Multivariate regression model was employed. In order to empirically investigate the relationship between the selected variables and liquidity ratio, the time period under study was divided into pre-crisis (2002-2007) and crisis (2008-2010) periods. The variables considered included internal factors (Capital Adequacy, Assets Quality, Interbank Funding, Funding Cost and Cost to income ratio) and external factors (Interest rate ROBOR, Credit risk rate, Inflation rate, GDP real growth rate and Unemployment). To investigate the relationship between related variables and liquidity, the study considered two liquidity ratios - net loans over total assets(L1) and liquid assets over deposits and short term Funding(L2).For 2002 to 2010, Z-score, cost to income ratio credit risk had a positive impact on liquidity(L1). Impaired loans, Tier 1 capital and interbank funding showed a negative impact on liquidity (L1). Loan loss provision, unemployment, and funding cost showed a positive impact on liquidity(L2); interest rate ROBOR 3M had a negative impact on liquidity (L2).For 2002-2007, Tier 1 capital, interbank funding and impaired loans showed a negative impact on liquidity (L1), loan loss provision had a positive impact on liquidity (L1). Tier 1 capital showed a positive impact on liquidity (L2), inflation rate and credit risk rate had a negative impact on liquidity (L2). 2008-2010 Z-score showed a positive impact on liquidity (L1). Impaired loans had a negative impact on liquidity (L1). Loan loss provision, interest rate ROBOR 3M and inflation rate had a positive impact on bank liquidity (L2).

**Nigist Melese (2015)** studied 10 Ethiopian commercial banks[Commercial Bank of Ethiopia (CBE), Construction and Business Bank (CBB), Awash International Bank S.C (AIB), Dashen Bank S.C (DB), Bank of Abyssinia S.C (BOA), Wogagen Bank S.C (WB), United Bank S.C (UB), Nib International Bank S.C (NIB), Cooperative Bank of Oromia (CBO) and Lion International Bank (LIB)] from 2007 to 2013 and analyzed both bank specific and macroeconomic factors. Using panel fixed effect, it was revealed that real GDP, capital adequacy and profitability had a negative influence on liquidity. Bank size had a positive effect on liquidity. Non-performing loan, loan growth, inflation rate, and interest rate margin had an insignificant effect on liquidity. Bank size was measured as LnTA, profitability as ROA, GDP growth rate was measured as annual real GDP rate and capital adequacyas equity over total assets. Liquidity was measured as average loan-average deposits/ total assets.

**Patora (2013)** assessed annual financial statements of 21 banks functioning in CEE countries, including Hungary, Poland, Slovenia, Slovakia and Czech Republic. Duration of study was 2004 to 2012. Using pooled OLS regression on unbalanced sample, it was found that

capitalization had a negative effect on liquidity. On the other hand, unemployment rate, opportunity cost, profitability ROA and market power had a positive effect on liquidity.

**Rauch** *et al.* **(2010)** evaluated liquidity creation by 457 German banks and also analyzed the factors influencing liquidity creation by banks (state-owned savings) for the period 1997 to 2006. Multivariate dynamic panel regression was used. The study suggested that liquidity was influenced by macroeconomic factors. It highlighted that interest rate (monetary policy) had a significant negative effect on liquidity (i.e. tightening monetary policy decreases liquidity). Level of unemployment signifies health of the economy. Unemployment level is associated with demand of loans. In the study, unemployment level had a negative influence on liquidity. In other words, the lower the unemployment rate, the more liquidity was created by banks. They found that no bank specific factors [profitability, bank size (total number of customers of bank)] had any effect on liquidity creation. Saving quota indicated that deposit behaviour of clients (private) was statistically insignificant.

**Rim El Khoury (2015)** studied Lebanese commercial banks for the period 2005 to 2013. Analysis included interbank rate, financial crisis, capital, unemployment, loan growth rate, bank size, inflation, interest rate, unemployment and inflation. It was found that interbank rate and size had a positive effect on liquidity. Liquidity had a negative relationship with financial crisis, loan growth rate and inflation.

**Sudirman, I. (2014)** examined a sample of 20 banks in Indonesia for the period 2004-2011. The effect of bank liquidity determinants was analyzed with GMM difference and GMM system. Based on test results using the GMM difference with that lag (2.2), it became known that liquidity in the previous year (LIQt-1) had a positive significant effect on bank liquidity. Profitability in this study was measured through net interest margin which showed significant positive effect on liquidity.

Based on the test results using the GMM system with lag (2.2), it was discovered that both tier 1 capital (CAP) and total capital (CAL) had a significant effect on bank liquidity, asset quality (ASE) had a significant positive effect on liquidity, profitability (PRF) had a positive significant effect on liquidity, funding (FND) was significantly negative against liquidity, interest rate (BIR) had a significant negative effect on liquidity, inflation (INF) (Consumer Price Index (%))had a significant effect on liquidity, and capital market development (CDP) had a significant positive effect on liquidity

**Sheefeni and Nyambe (2016)** studied quarterly macro economic data of Namibian banks for 2001 to 2014, and using cointegration model, found that monetary policy rate

insignificantly affected Namibian banks' liquidity while gross domestic product significantly affected the liquidity of Namibian banks. There was negative effect of inflation on liquidity. In analysing determinants of commercial banks' liquidity, the measure of liquidity indicator [loans/total assets (LTA)] was used as regressand. The regressors were real GDP, inflation rate (INF) and monetary policy rate (repo rate) (RR). Ordinary least squares and cointegration test were applied. Results revealed that real gross domestic product was the main determinant of commercial bank liquidity in Namibia and this relationship waspositive as well as statistically significant. The relationship between monetary policy rate and commercial bank liquidity was found to be positive but statistically insignificant. On the contrary, inflation showed a negative impact on commercial bank liquidity in Namibia, though it was statistically insignificant. The study recommended that real gross domestic product be used as an indicator or to signal the direction of commercial banks' liquidity in Namibia.

**Tesfaye (2012)** analyzed the factors influencing the liquidity of Ethiopian banks and studied the effect of significant factors affecting liquidity on the financial performance of banks. Eight commercial banks of Ethiopia were assessed for the period 2000 to 2011. Using panel regression estimates and balanced fixed effect model, it was found that bank size, capital adequacy, non-performing loans, interest rate, interest rate margin and inflation rate had a statistically significant and positive influence on liquidity. GDP and increased loan had an insignificant effect on liquidity. While analyzing the impact of statistically significant factors on financial performance, it was found that bank size and capital adequacy had a positive effect while short term interest rate and non-performing loans had a negative effect on financial performance. Inflation and interest rate margin had a statistically insignificant effect on financial performance. Effects of liquidity on financial performance were inconclusive.

**Trenca** *et al.* **(2015)** assessed quarterly data of 40 commercial banks of countries like Croatia, Spain, Cyprus, Italy, Greece, and Portugal from 2005 to 2011. Using GMM regression model, liquidity was measured as net loans to total deposits. Increase in GDP, inflation, unemployment and public deficit lowered bank liquidity. The study suggested that as GDP increased, it increased credit default activity and economic activity which led to a decrease in liquidity of banks. Further, increased inflation decreased purchasing power; it increased the demand for money, led to increased bank lending and low liquidity. Also, high unemployment rate in a country led to increased non-performing loans which lowered bank liquidity. High public deficit encouraged increased bank loans which resulted in low liquidity. The study also suggested that liquidity of the previous year influenced liquidity of the present year.

**Trinugroho** *et al.* **(2016)** analyzed quarterly data of Indonesian banks from 2002 to 2008. The study used liquid assets over total assets, liquid assets over deposits, cash over total assets and loans over total assets as measures of bank liquidity. The objective of the study was to examine the effect of deposit insurance coverage on bank liquidity and how bank liquidity changed on the basis of change in ownership structure. Based on OLS estimates, it was found that deposit insurance coverage had a negative influence on liquidity and ownership structure didn't have a significant influence on bank liquidity and deposit insurance.

**Vodova (2011)** examined annual data of Slovak banks for 2001-2010. Using panel data model, it was found that financial crisis had a negative effect on liquidity. Bank specific and macroeconomic data were considered. Bank liquidity dropped mainly as a result of the financial crisis. Bank liquid assets, or more precisely the share of liquid assets in total assets and deposits and short term funding, also decreased with higher bank profitability, higher capital adequacy and bigger bank size. Big banks relied more on the interbank market or on a liquidity assistance of the Lender of Last Resort. Liquidity measured by the share of loans in total assets and deposits and short term borrowing increased with the growth of gross domestic product. It was also found that interest rates (on loans, on interbank transaction and monetary policy interest rates), interest rate margin, share of non-performing loans and rate of inflation had no statistically significant effect on the liquidity of Slovak commercial banks.

**Vodova (2013)** assessed Hungarian banks for the period 2001 to 2010. Panel data regression was applied and it was found that profitability, capital adequacy and interest rate had a positive impact on liquidity. Interest margin, bank size, interbank interest rate, and monetary policy had a negative effect on liquidity. Gross domestic product growth rate had an ambiguous relation with liquidity.

**Vodova (2011)** assesed Czech banks for the period 2001 to 2009 and using panel data regression method, found a positive relation between capital adequacy, non-performing loans, interest rates on interbank transaction and loans. Size showed an ambiguous relation with liquidity. Inflation, financial crisis and business cycle had a negative impact on liquidity. Profitability, interest margin, monetary policy and unemployment had an insignificant effect on liquidity. In the study, four liquidity measures were used - liquid assets/ total assets(L1), liquid assets/ deposits+ short term borrowings(L2), loans/ total assets (L3) and loans/ deposits+ short term financing(L4).

**Vtyurina** *et al.* **(2012)** studied determinants of bank liquidity in Central America. Used panel of 100 banks and applied regression analysis. Financial development, capital adequacy

and size showed a positive association with liquidity holding. GDP, loan loss reserve, profitability and net interest margin had a negative effect on liquidity. It was revealed that the demand for precautionary liquidity buffers was associated with measures of bank size, profitability, capitalization, and financial development. Deposit dollarization was also associated with higher liquidity, reinforcing the monetary policy and market development challenges in highly dollarized economies.

**Chagwiza (2014**) analyzed Zimbabwean banks' liquidity and studied data from 2010 (January) to 2011(December). Multi regression analysis was applied and a positive association was found between liquidity, bank size, capital adequacy, bank rate and gross domestic product. Implementation of multi-currency, business cycle and inflation rate had a negative influence on bank liquidity.

**Gautam, R (2016)** sought to identify the determinants of liquidity of Nepalese commercial banks. In order to achieve the research objectives, data were collected from a sample of ten commercial banks in Nepal over the period 2005 to 2014. Bank specific and macroeconomic variables were analyzed using the least square regression model. Findings of the study revealed that bank size, capital adequacy and inflation rate had a positive impact on liquidity while non-performing loans, profitability and GDP growth rate showed anegative impact on liquidity of Nepalese commercial banks. Capital adequacy, non-performing loan and profitability had statistically significant effects on the liquidly of Nepalese commercial banks whereas bank size, GDP growth rate and inflation rate had statistically insignificant impact on the liquidity of Nepalese commercial banks. Capital adequacy, non-performing loan, bank size, profitability, growth rate of GDP and inflation rate were the major determinants of liquidity of this industry.

**Muritala and Taiwo (2014)** critically examined the impact of capitalization on bank liquidity creation in selected banks of Nigeria using annual data of 10 banks for the period 2006 to 2010. Using panel least square regression, it was found that bank size was significantly positively associated with capital. Liquidity and non-performing assets had insignificant effect on capital. Results implied that banks having better capitalization created less liquidity.

**Aikaeli (2006)** studied monthly data of Tanzanian commercial banks and analysed surplus liquidity from 1999 (June) to 2004 (December). Autoregressive distributed lag model was used and excess liquidity was regressed against five explanatory variables comprising rate of required reserves, depositors' cash preferences, lagged values of excess liquidity, loans return variations and bank borrowing rate. In the short run, increase in credit risk, cost of funds

and rate of required reserves positively influenced excess liquidity accumulation. High levels of excess reserves in the previous year led to less accumulation of liquid assets in the subsequent period. When the central bank limits reserves, commercial banks increase liquid asset accumulation. In the long run, an increase in the rate of required reserves lowered excess liquidity in commercial banks. Other factors which affected excess liquidity positively in the long-term included: volatility of cash preference; borrowing rate; and credit risk.

**Horvath** *et al.* **(2014)** studied the association of liquidity creation and bank capital and performed Granger-causality tests on the dynamic GMM panel framework on Czech banks and analyzed for the duration of 2000 to 2010. Analyses suggested that liquidity creation kept on increasing until the financial crisis in the case of large banks. Analyses were carried out on overall sample, as well as after classifying data on the basis of bank size. Using Granger-causality test, it was found that capital had a negative Granger effect on liquidity (small banks). Also, financial crisis slowed down liquidity creation. Liquidity creation had a negative Granger-cause effect on capital. Findings also suggested that Basel III might result in low liquidity creation by banks due to higher capital requirements.

**Pana** *et al.* **(2010)** used annual data of US commercial banks for the period 1997 to 2004. The studied sample included 189 mergers and using ordinary least squares regression analysis, it was found that merger had a positive impact on liquidity creation by banks having more deposit insurance. Similarly, merger showed positive impact on liquidity creation for an acquirer having large deposit insurance. Negative association of economic growth level and liquidity creation was found in the case of a small acquirer during the mergers. Equity capital of acquirer (large) had significant effect on liquidity creation during the merger.

**Nikbakht** *et al.* **(2016)** studied 18 banks listed on the Tehran stock exchange. The period under study was 2010 to 2014. Using fixed effects and random effect estimates, it was found that total capital ratio had a significant positive effect on liquidity of banks listed on the Tehran stock exchange.

**Berger and Bouwman (2008)** studied U.S. banks from 1993 to 2003 using time effect and bank fixed effects and found an increase in liquidity creation until 2003. Most of the liquidity was created by large banks, retail banks, multibank holding company members and recently merged banks. Bank value and liquidity creation had a positive association. For large banks, the association between liquidity creation and bank capital was positive whereas in the case of small banks, it was negative.

**Alemayehu (2016)** sought to discover significant factors explaining Ethiopian banks' liquidity. Considered independent factors could be categorized into bank- specific factors and macroeconomic factors. Bank Size, Profitability, Capital Adequacy, Loan Growth and Non-Performing Loans were included in bank-specific factors whereas general inflation, national bank bill and gross domestic product were considered macroeconomic factors. Fixed Effect Model (FEM) was used for eight commercial banks from 2002 to 2013, and it was found that profitability and capital adequacy had a significant positive association with banks' liquidity. National bank bill and loan growth had a significantly negative effect on banks' liquidity. Bank size, gross domestic product, non-performing loans and inflation had insignificant association with liquidity.

**Qin and Pastory (2012)** presented the liquidity position of banks in Tanzania from 2000 to 2009. Casual research design was adopted to analyze the position of banks' liquidity. CRDB, National microfinance bank and national bank of commerce data were used using ANOVA test; it was found that banks had high levels of liquidity throughout the studied time period but they varied over the years. National microfinance bank had the highest level of liquidity as compared to CRDB and national bank of commerce.

**Yaacob** *et al.* **(2016)** examined 17 Islamic banks in Malaysia and considered secondary data for the period 2000-2013. The study used liquidity coverage ratio (LCR) and Net Stable Funding Ratio (NSFR) as liquidity measures. Variables were categorized as microeconomic (size, profitability, capital adequacy ratio, bank specialization and asset quality) and macroeconomic (inflation rate and GDP). Two models were adopted for model - fixed effect and random effect. Based on Hausman test, fixed effect estimates were chosen. LCR and NSER were liquidity measurements so as to obtain the objective of liquidity risk analysis. Obtained coefficient signs were studied with respect to opposite coefficient signs. Capital adequacy, financing, GDP and inflation emerged as significant determinants of LCR. Capital adequacy and inflation showed significant positive effect on LCR while GDP and financing showed significant negative effect on LCR. This meant that capital adequacy and inflation had a negative impact on liquidity risk while GDP and financing had a positive influence on liquidity risk. GDP and inflation had negative significant and positive significant effects on NSFR respectively. This meant that GDP had a positive impact on liquidity risk and inflation had a negative effect on liquidity risk.

**Kamau** *et al.* **(2013)** examined the influence of variables on the liquidity of Kisumu city banks. 27 banks operating in the city were chosen. An exploratory survey was adopted and questionnaires were distributed to heads of finance. Using multiple regression analysis, it was

found that profitability, management policies, monetary policies, balance of payment, contingency planning, banks obligations, government expenditure and credit rating influenced bank liquidity.

**Ogilo and Mugenyah (2015)** studied 43 commercial banks of Kenya from 2010 to 2014 and to determine the factors influencing liquidity risk, multiple regression analysis was used. Liquidity risk was calculated as loans to deposit ratio and it was found that when independent variables were analyzed individually, capital adequacy had a significant positive influence on liquidity risk while leverage had significant negative effect on liquidity risk. When all the independent variables were run together, ownership, size, leverage, capital adequacy and liquid asset ratio emerged as significant determinants of liquidity risk.

**KAMOYO (2006)** studied 30 banks of Kenya from 1995 to 2004 and using multiple linear regressions, found that liquidity of banks in Kenya depended on maturity and liquid liabilities significantly and positively. Liquidity depended on growth significantly negatively. Size, leverage, loan commitments and profitability insignificantly negatively affected liquidity. Cash flows and liquid assets affected liquidity insignificantly positively. Liquidity was measured as total deposit liabilities over total assets.

**Roman and Sargu (2015)** studied CEE countries including Hungary (8 banks), Lithuania (7 banks), Romania (15 banks), Bulgaria (11 banks), Poland (15 banks), Latvia (16 banks) and Czech Republic (14 banks) over the period 2004-2011. OLS regression analysis was used. Liquidity was measured as total loans over total banking assets. Hungarian bank analysis found that interest expense over deposits and bank size had a significant positive effect on liquidity. Return on average equity had a significant negative impact on liquidity indicator of Hungarian banks. It was further revealed that capital ratio had a significant negative effect on liquidity for Bulgarian banks. In Czech Republic banks, it was found that impaired loans ratio and return on average equity (profitability) had a significant positive influence over liquidity. Return on average assets (profitability) had a negative influence on liquidity of Czech Republic banks. Lithuanian banks showed positive significant effect of impaired loans on liquidity. For banks of Latvia, findings suggested significant positive effect of capital ratio on liquidity. Return on average equity had a significant positive effect on liquidity. Impaired loans ratio and capital ratio showed a significant positive effect on liquidity in case of Romanian banks.

**Roman and Sargu (2014)** analyzed banks of Romania (15 banks) and Bulgaria (11 banks) from 2003-2011. Multiple regression analysis was used to examine liquidity risk in

banks. Liquidity risk was measured by two liquidity indicators - liquid asset over total assets and net loans over total assets. In the case of Bulgaria, total capital ratio had a negative impact on both liquidity indicators. Impaired loans over loans had a positive effect on liquid assets. In the case of Romania, capital ratio, and impaired loans over gross loans had a negative impact on liquid assets while they showed a positive effect on net loans over total assets.

**Lei and Song (2013)** studied annual data of banks of China from 1988 to 2009. Sample included 4 state-owned banks, 18 foreign banks and 113 domestic banks. Data were analysed through pooled, fixed-effects, and random-effects regressions of liquidity creation on bank capital. In the fixed-effects and other models, the lagged EQ / TA was negative and significant at 1% level. This means that Chinese banks with more capital created less liquidity. Bank capital had a negative effect on bank liquidity creation.

**Raeisi** *et al.* **(2016)** investigated the association between bank liquidity and internal and external factors influencing it. The study considered 18 Iranian banks for the years 2000 to 2013. Multiple regression analysis was used on internal and external factors. Results showed that capital adequacy, bank stability, interbank funds, income to cost ratio, amount of demanding deposits and savings, interest rates on daily short-term and long-term 1 years investments, number of internal branches and inflation rate had positive effects and assets quality and unemployment rate had negative effects on bank liquidity.

**Mekbib (2016)** analysed liquidity of private banks operating in Ethiopia. Bank specific and macroeconomic variables were considered. The period considered was 2000 to 2015, and the sample comprised six private banks of Ethiopia. Using fixed effect regression, it was found that liquidity was measured as loan to deposit ratio, liquid asset over deposit and liquid asset over total assets. Loan growth and size had a statistical significant negative influence on liquidity. On other hand, inflation, non-performing loans and profitability had a significant positive influence on liquidity. GDP growth rate, interest rate margin, capital adequacy, short term interest rate and interest rate on loans had insignificant influence on liquidity.

**Cheruto1 and Muturi (2017)** aimed at assessing factors influencing the liquidity risk of banks of Kenya. Sample included monthly data from 2011 to 2015. 42 licensed banks were chosen. Liquidity risk was measured as gross loans to gross deposits. Using multiple regression, it was found that size, capital adequacy and profitability had a negative influence on liquidity risk. Non-performing loans had a positive influence on liquidity risk.

**Delechat** *et al.* **(2012)** investigated annual data of liquidity holding of 96 CAPDR banks. Studied sample consisted of 100 banks for the period 2006 to 2010. Liquidity was

calculated as liquid assets to deposits. Ordinary Least Squares and Generalized Methods of Moments analysis suggested that bank size was related to liquidity buffer but as bank size increased after a certain point, banks displayed marginal decreasing effect of size on liquidity. Liquidity showed negative association with loan loss reserve, low capitalization, less profitability and low efficiency. Foreign banks held less liquid buffer due to their access to parent banks in the case of an emergency.

**Karolina Patora (2016)** studied factors that drove the liquidity condition of Polish banks. The studied sample included foreign owned banks and the period considered was 2004 to 2014. Factors were divided as bank-specific and macroeconomic. After applying OLS, results revealed that interest rate (outstanding loans) had a negative relationship with liquidity. Cash flow had a positive influence on liquidity. Credit supply had a negative influence on liquidity. Parent bank's capital adequacy showed a positive relationship with liquidity.

**Lovin (2013)** examined variables that had an effect on interbank deposits in Romania from 2007(January) to 2012(December). Interbank deposits were considered as liquidity creation source. Applying OLS on banks' monthly data, it was found that previous month interbank deposits had a negative influence on interbank deposits. Foreign banks, term deposits and exchange rate showed a positive influence on interbank deposits.

**Belay Nega Belayneh (2016)** asserted that resilient and profitable banks could contribute immensely to the development of the financial sector in particular, and the country in general. The study employed autoregressive distributed lag (ARDL) to examine the relationship and behavior of liquidity and profitability of the commercial banking industry in Ethiopia. Quarterly consolidated financial statements of fifteen commercial banks that covered the period 2003Q2 – 2014Q3 were used for the study. Augmented Dickey Fuller (ADF) was used to test for unit root. In an attempt to draw valid conclusions, diagnostic tests were carried out for serial correlation, heteroscedasticity, and normality. In order to check the stability of long-run coefficients that formed the error-correction term in combination with short-run dynamics, the cumulative sum of recursive residuals test (CUSUM) and the cumulative sum of squares of recursive residuals test was applied to the residuals of the models. The estimation result of the error correction model showed that the speed of adjustment of liquidity and profitability to long run equilibrium was faster in the commercial banking industry of Ethiopia. The results of ARDL estimation showed that loan growth, bank size, credit risk, saving deposit growth, demand deposit growth, and fixed deposit growth were key determinants of liquidity both in the short and the long term. Non-interest income and operating expenses management were the key determinants of profitability both in the short and the long term. The result of

pairwise Granger causality test showed that neither unidirectional nor bidirectional pattern of causality existed between liquidity and profitability.

**Haan and van den End (2013**) examined Dutch banks for the period 2004 to 2010. Employing fixed bank effects regression, it was discovered that capitalization and financial crisis negatively influenced liquid assets of banks.

**Shen** *et al.* **(2009)** observed advanced economies from 1994 to 2006. Two-stage least squares (2SLS) estimates revealed a negative association between liquidity risk and profitability. Cost of funding, GDP and inflation showed a positive association with liquidity risk and negative influence on profitability. Size displayed a nonlinear effect on liquidity.

**Rauch** *et al.* **(2009)** analysed liquidity determinants of saving banks of Germany. Bank rate, unemployment rate, previous liquidity levels, banks' clientele base and its profitability emerged as important determinants of liquidity.

**Lucchetta (2007)** observed liquidity of European banks. Liquidity was positively impacted by interbank interest rate, size, and banks' interbank market behaviour. Rise in monetary policy rate, share of loans on total assets and share of loan loss provisions on net interest revenues decreased liquidity of banks. Unbalanced panel data for the period 1998 to 2004 were used. In context of European nations, it was found that risk-free (monetary policy) interest rate had a negative influence on banks' liquidity retention, and banks' decision to lend in the interbank market. Interbank interest rate positively impacted such decisions. Further, banks who lent displayed lower risk-taking behaviour and tended to be smaller in size than borrowers. More significantly, risk-free interest rate showed a positive correlation with loans investment and banks' risk-taking behaviour.

**Akhtar** *et al.* **(2011)** examined the effect of independent variables on liquidity risk (dependent variable) using descriptive, correlations and regression analysis. Liquidity risk was defined as cash over total assets. The analysis was further applied to examine, assess and compare liquidity risk of Pakistani banks (conventional and Islamic). Results of regression analysis revealed that both conventional and Islamic banks displayed positive correlation between the bank size and liquidity risk; albeit the first was insignificant. Net-working capital ratio also showed a positive association (insignificant) with liquidity risk. Return on equity (ROE) displayed positive and insignificant, and significant association with liquidity risk in case of conventional and Islamic banks respectively. Capital adequacy ratio showed positive and significant association with liquidity risk in case of conventional banks; the association was insignificant in case of Islamic banks. Return on assets (ROA) showed insignificant

positive association with liquidity risk for conventional banks. In case of Islamic banks, the association was significant.

**Akhtar** *et al.* **(2011)** sought to examine liquidity risk related with financial institution solvency, with the objective to assess liquidity risk management (LRM) by way of comparative analysis of Pakistani banks (conventional and Islamic). The paper studied significance of firm size, networking capital, return on equity, capital adequacy and return on assets (ROA), with liquidity risk management in Pakistani banks (conventional and Islamic). Secondary data were considered for the duration 2006-2009. In both models, positive and insignificant association of bank size and net-working capital to net assets with liquidity risk was found. Further, capital adequacy ratio in case of conventional banks and return on assets in case of Islamic banks was significantly positive at 10% significance level.

**Ahmed** *et al.* **(2011**) studied six Pakistani Islamic banks from 2006-2009. Data from secondary sources were considered. Pearson correlation was applied to establish relations between variables, while regression was used to arrive at coefficients. Bank size was directly associated with credit and liquidity risk. However, it showed negative insignificant association with operational risk. Liquidity and operational risks positively associated with asset management. Gearing ratio and non-performing loans ratio showed negative significant association with liquidity and operational risk. Those two ratios displayed direct links with credit risk. Capital adequacy exhibited negative significant association with credit and operational risk. It showed positive link with liquidity risk.

**Bourke (1989)** employed international data for the period 1972-1981, and observed that profitability positively associated with capital and liquidity ratios.

**Molyneux and Thornton (1992),** in context of European market for the period 1986-1989, revealed a negative reliance between liquidity and profitability.

**Acharya** *et al.*(2009), connected bank liquidity with institutional variables which included a nation's financial development with respect to disclosure quality along with the degree of stock and credit intermediation (associated with country size). It was found in country cross-sections that the correlation of average ratio of banking system of liquid assets to total deposits with macroeconomic ratios like accounting standards, total capitalization to GDP, domestic credit and deposits to GDP and stock market capitalization to GDP, was uniformly and significantly negative. The study also examined data on international stock market liquidity measured (three measures of stock market liquidity) through correlation to a banking system liquidity ratio.

**Nigist Melese and Laximikantham(2015)** assessed bank specific factors influencing liquidity of commercial banks of Ethiopia. The duration 2007-2013 was considered. Secondary data were employed for ten commercial Ethiopian banks. Analysis of bank specific variables was done using balanced panel fixed effect regression model. Results showed that capital adequacy and profitability significantly (statistically) impacted liquidity of Ethiopian commercial banks. Bank size showed positive and significant (statistically) effecton liquidity. Nonperforming loan and loan growth showed statistically insignificant/ no effect on Ethiopian commercial banks' liquidity for the considered time period.

**SAMUEL SIAW (2013)** examined liquidity risk determinants of banks in Ghana, and how liquidity risk impacted bank profitability. Unbalanced data set pertaining to 22 banks for the period 2002 and 2011 was considered. Random effects GLS regression based on Hausman was employed to assess bank liquidity risk determinants. Instrumental variables regression was applied with the help of two stage least squares (2SLS) method in order to assess influence of liquidity risk on profitability of banks. Owing to endogenous nature of liquidity risk as a determinant of bank profitability, other variables (capital adequacy, bank size, credit risk, non-interest income, operational expenditure, industry concentration and change in GDP) were controlled. Financing gap ratio (FGAPR) was used as a liquidity risk (dependent variable) measure with bank size, liquid assets ratio (classified as risky and less risky liquid assets), non-deposit dependence, ownership type, industry concentration and change in inflation as explanatory variables. Size of bank, non-deposit dependence and change in inflation showed a positive and significant (statistically) association with liquidity risk (financing gap ratio). This implies that if any one of the variables increased, liquidity risk also increased. . Risky liquid assets, less risky liquid assets and industry concentration displayed a significantly negative association. Ownership structure showed no significant link with financing gap ratio (dependent variable). To ensure robustness of results, ratio of net loans to total deposits (NLD) was employed as alternative measure for liquidity risk. Results emerged consistent with those attained by using financing gap ratio as a liquidity risk measure. Results pertaining to instrumental variables use for liquidity risk when controlling for other variables (determinants) also gave positive association between liquidity risk (both financing gap ratio and net loans to total deposits ratio) and bank profitability assessed by return on assets (ROA) and return on equity (ROE).

**Berhanu Berihun Engida (2015)** examined and identified key determinants of liquidity of commercial banks in Ethiopia, and established influence of determinants on profitability. Secondary data sources were considered for the study. Eight commercial banks

were included. The study period was 2002/03 to 2013/14. Data were analysed employing panel data regression analysis. Bank size and loan growth negatively and statistically significantly influenced liquidity of banks (measured through liquid assets to total assets). Real growth rate of gross domestic product on the level of basis price, interest rate on lending, non-performing loans in the total volume of loans, bank size, actual reserve ratio and short term interest rate had positive and statistically significant effect on liquidity. Of statistically significant factors influencing bank liquidity, bank size positively and statistically significantly impacted profitability. Growth rate of gross domestic product on the level of basis price, actual reserve rate and non-performing loans in the total volume of loans negatively impacted profitability. Thus, bank liquidity showed non-linear impact on profitability of commercial banks. Bank size, and adjusting the position of liquidity with better strategy for managing credit risk (NPL) showed positive influence on profitability.

**Bordeleau and Graham (2010)** gave empirical evidence with respect to the association between liquid asset holdings and profitability concerning a Canadian and U.S. bank panel for the duration 1997 to 2009. It was revealed that a nonlinear association existed, whereby bank profitability increased for such banks that held some amount of liquid assets; however, other things being equal, beyond a certain point, holding of more liquid assets diminished profitability of banks. Estimation results gave some proof that the link between liquid assets and profitability relied on the business model of banks and risk of funding market difficulties.

**Victor, Sameul and Eric (2013)** aimed to determine, for banks listed on the Ghana Stock Exchange, the association between bank liquidity and profitability through a descriptive study. The study employed longitudinal time dimension, in particular, panel method. Profitability and liquidity trends were established using time series analysis. Financial reports pertaining to the seven listed banks were considered and ratios computed. The key liquidity ratio was regressed on the profitability ratio. Profitability and liquidity of the listed banks were found to be declining for the duration 2005-2010. Further, for banks listed on the Ghana Stock Exchange, the association between bank liquidity and profitability was found to be positive but very weak.

**Laurine (2013)** sought to empirically investigate determinants of liquidity risk of commercial banks in Zimbabwe post the nation's adoption of usage of multiple currencies exchange rate system. Panel data regression analysis was employed on monthly data from March 2009- December 2012. Results showed capital adequacy and size to negatively and and significantly affect liquidity risk. Spread and non-performing loans showed significantly

positive link with liquidity risk. Reserve requirement ratios and inflation also showed significance in explanation of liquidity for the period under study.

**Bhati and DeZoysa (2013),** post financial liberalisation in 1991, management of liquidity in India has been challenging. The study aimed to observe liquidity management in India from 1998 to 2010, and study determinants of liquidity in an Indian context. For the study, liquidity in banks and nonbanking financial institutions was considered. Findings showed that on average, bank liquidity increased at 2.77% every quarter from 1998 to 2010. For non-banking financial institutions, liquidity increased at 1.13% every quarter from 1998 to 2010. For banks (in all cases), time durations of increase in liquidity followed time durations of decrease in liquidity. However, nonbanking financial institutions experienced a cumulative decrease of 27.7% in liquidity between 2007 and 2010. In comparison to banks in India, there was a relatively greater impact on nonbanking financial institutions (in terms of decrease in liquidity) in times of the global financial crisis. Discount rates and SLR displayed negative impact on bank liquidity. Rise in cash reserve ratio positively affected bank liquidity. With respect to liquidity in non-banking financial institutions, cash reserve ratio and discount rates emerged as determining factors.

**Uremedu (2009)** observed creation of liquidity in banks in Nigeria for the period 1980-2005. The study employed time series data analysis of financial system aggregates for the period 1980 to 2005. Impact multiplier and liquidity ratings of the financial system in Nigeria were evaluated with the help of market variables like treasury bills, treasury certificates, eligible development stocks, certificate of deposits, commercial papers and bankers' acceptance. Results showed that commercial papers significantly influenced liquidity of banks; treasury certificates, eligible developmental stocks and treasury bills followed. Commercial papers, treasury certificates, certificates of deposits and bankers' acceptance negatively impacted bank liquidity ratio. Eligible developmental stocks and treasury bills positively impacted bank liquidity ratio.

**Mishra** *et al.* **(2012)** put forth a systemic liquidity index (SLI) to assess liquidity conditions in an Indian context. The proposed index included corporate sector parameters and was not bank specific. The study considered four components in the systemic liquidity index - difference between call rates and repo rates, difference between commercial paper rate and certificate of deposit rate, implied deposit rate in forex market and expectation about the liquidity conditions in the form of overnight swap curve. The index was developed to observe short term trends in conditions of systemic liquidity.

**Wójcik-Mazur and Szajt (2015)** analysed determinants of commercial banks' liquidity risk (liquid assets over sum of short term funding and deposits and net loans over total deposits) through comparison of dependencies in two dichotomous groups. The groups included banks functioning in nations of the Old European Union (Austria, Belgium, Germany, Denmark, Spain, Finland, France, the UK, Greece, Ireland, Italy, Portugal) and New European Union (Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovenia, Slovakia). Difference was found between liquidity risk determinants particular to banks functioning in Old European Union and New European Union. However, a set of internal determinants (margin volume, credit risk level, and engagement in the interbank market) was found to influence liquidity risk level irrespective of the liquidity risk measure employed and the nation in which they operated. A long-term positive association was discovered between interest rate margin ratio and liquidity risk for banks functioning in the Old member group. A positive albeit short-term link was particular to banks in new member nations; interestingly, the association was found insignificant (statistically) in the long run. Further, for Old EU, the estimated negative association between liquidity risk and total assets return rate (in long and short runs) was found statistically significant. The existing negative association between credit risk and indicated liquidity predictor must be considered when observing liquidity risk determinants. For banks functioning in Old EU, this dependency occurred in short and long runs; it emerged statistically insignificant for banks operating in New EU nations. The link between leverage ratio and liquidity risk was significant (statistically) and negative in the long run for banks in Old EU nations.

**Sawada (2010)** examined liquidity risk (cash over asset ratio, security over asset ratio and sum of cash and securities over asset ratio) for Japanese market for the period 1926 - 1932. Panel data were employed with regression tests. It was suggested that in times of liquidity stress when banks were required to increase cash, banks traded securities on the market rather than liquidating their credit. The author observed that this type of improvement in the security market was particularly significant for nations having weaker financial structures. Coefficient of bank size was positive and significant when security-asset ratio or liquid asset ratio was a dependent variable. Contrarily, the ratio was insignificant when cash-assets ratio was a dependent variable. In all cases, contagion coefficients were found negative and significant (statistically). Regression analyses established negative and positive influence of liquidity shock on cash–asset ratio and security–asset ratio respectively.

**Jordan** *et al.* **(2013)** analysed trends in liquidity in The Bahamas for the period 2001-2012. Vector Autoregressive (VAR) methodology was employed for the duration 2001

Q1 to 2011 Q4. It was found that the observed considerable accumulation of domestic liquidity over the previous four years took place in several other developed and developing nations also. With respect to The Bahamas, this liquidity build up was due to slowed credit demand and a cautious approach of banks towards lending (owing to increased loan delinquencies). Further, contraction and expansion in output and government borrowing (particularly from external sources) respectively, played a key part in the substantial increase of excess reserves and liquid assets in the internal banking system.

**Rahman, M.L. and Banna, S.H., (2016)** analysed liquidity risk (cash over total assets) management for conventional and Islamic banks in Bangladesh for the period 2007-2011. Linear regression model was applied. Variables considered were - size, networking capital, return on equity, capital adequacy ratio and return on assets. Independent variables showing positive albeit insignificant association were – bank size and net working capital to liquidity risk (for Islamic banks). Bank size was negative for conventional banks. Return on assets was found to significantly impact liquidity risk at 10% level in conventional banks; it was insignificant for Islamic banks. Return on equity in Islamic as well as conventional banks was positive and insignificant. Capital adequacy ratio in both types of banks was insignificant and negative.

**Singh and Sharma (2016)** analysed bank-specific and macroeconomic factors determining Indian banks' liquidity. 59 banks for the period 2000-2013 were considered. OLS, fixed effect and random effect estimates were employed. Considered bank- specific factors included bank size, profitability, cost of funding, capital adequacy and deposits. GDP, inflation and unemployment constituted macroeconomic factors for the study. On the basis of ownership, liquidity trend analysis of Indian banks was carried out. Findings revealed influence of bank ownership on bank liquidity. On the basis of panel data analysis, it was suggested that bank-specific (except cost of funding) and macroeconomic (except unemployment) factors significantly influenced liquidity of banks. Such factors included bank size, deposits, profitability, capital adequacy, GDP and inflation. Bank size and GDP showed a negative influence on liquidity of banks. Deposits, profitability, capital adequacy and inflation exhibited positive influence on liquidity of banks. Cost of funding and unemployment had insignificant influence on bank liquidity.

Based on reviewed papers, following table 1.1 presents the significant findings of previous research and table 1.2 presents the measures of liquidity adopted by various researchers.

**Table 1.1 Literature Review**

| Author name and year | Findings | | |
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| | **Positive** | **Negative** | **Insignificant** |
| **Al-Khouri (2012)** | Capital ratio showed a positive influence on creation of liquidity. Further, bank size and previous liquidity levels proved significant for determining liquidity generated by banks. | Profitability negatively and significantly influenced creation of liquidity. | Government ownership insignificantly impacted liquidity. |
| **Belete (2015*)*** | Interest rate margin, Inflation, and capital strength, showed significant and positive association (statistically) with liquidity of banks. | Loan growth, on the other hand, displayed a negative and statistically significant link with liquidity of banks. | The associations for profitability, non-performing loans, gross domestic product and bank size emerged statistically insignificant. |
| **Cornett** *et al.* **(2011)** | Banks with higher levels of illiquid assets raised liquidity and decreased lending levels. | | |
| **Cucinelli (2013)** | Banks having greater capitalization offered better liquidity in the long run. Banks with greater asset quality were more probable to manage liquidity in the short run. Banks that were more capitalized showed better liquidity in the long run. | Banks specializing more in lending activities displayed greater vulnerability in funding structure. In times of crisis | |
| **Dinger (2009)** | Interbank rate displayed a positive influence on liquidity. It was discovered that Capital significantly and positively influenced liquid assets of banks. | Deposits rate significantly and negatively impacted liquid assets. Banks showed a tendency to invest less in low-return liquid assets when deposits were costly. GDP growth significantly and negatively impacted liquidity. | Size showed a nonlinear association with liquidity. |
| **Ferrouhi and Lahadiri (2013)** | Liquidity of Moroccan banks positively correlates with bank size, share of own bank's capital of the bank's total assets, external funding to total liabilities, monetary aggregate M3, foreign assets, foreign direct | It negatively correlated with return on assets, inflation rate, growth rate of gross domestic product, public deficit and financial crisis. | Conversely, bank's return on equity, equity to total assets and unemployment rate showed no influence on liquidity of foreign banks. |

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| | investment | | |
| **Subedi and Neupane (2011)** | Bank size positively and significantly impacted bank liquidity. | Capital adequacy, share of non-performing loans in the total volume of loans negatively and significantly (statistically) impacted bank liquidity. | Inflation rate showed a positive and insignificant influence on liquidity of banks. |
| **Vodova (2013)** | Liquid asset ratio of Czech banks was found to increase with increase in capital adequacy. growth rate of gross domestic product in the previous year | | |
| **Vodova (2012)** | Capital adequacy, GDP of last year, interest rate on loans displayed a positive influence on liquidity. Results show capital adequacy and inflation to positively influence liquidity | Interest rate on loans and interest rate on deposits displayed negative influence on L3. GDP and interest rate on interbank transactions showed negative impact on L4 (percentage of loans over deposits). | |
| **Diaz and Huang (2017)** | In crisis, ownership, compensation structure, progressive practices and CEO education significantly and positively influenced liquidity. Larger banks that were governed better were found to generate greater liquidity. | | Quarterly data pertaining to the period were considered. The considered time duration was divided in three phases - pre crisis, crisis and post crisis. |
| **Chalermchatvichien** *et al.* **(2014)** | | Financial crisis showed insignificant influence on the association among liquidity, ownership concentration and capital adequacy. | Current assets over current liabilities, loans over deposits, Basel III NSFR and Basel CAR were used as measures of liquidity. |

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| **Muharam (2013)** | Liquidity gaps displayed significant and positive impact on conventional banks' liquidity risk. ROA positively influenced liquidity risk of Islamic banks. NIM and ROE showed significant and positive impact on Islamic banks' liquidity risk. | ROE and CAR were found to significantly and negatively impact conventional banks' liquidity risk. | RLA and ROA, displayed insignificant positive influence on liquidity risk .NIM insignificantly and negatively impacted banks' liquidity risk. CAR insignificantly and negatively impacted Islamic banks.RLA and liquidity gaps exerted insignificant influence on liquidity risk of Islamic banks. |
| **Iqbal (2012)** | bank size, ROA, CAR and ROE significantly and positively associated with liquidity risk of conventional and Islamic banks. | NPL significantly and negatively impacted liquidity risk of both conventional and Islamic banks. | |
| **Mashamba (2014)** | Size significantly and positively impacted liquidity of banks. | NPL significantly and negatively impacted liquidity. | it was found that capital adequacy ratio and loan growth showed insignificant and positive impact on liquidity of banks. |
| **Abdillah et al. (2016)** | Capital adequacy ratio (CAR) had a significant positive impact on profitability. While capital adequacy ratio (CAR) had a significant positive influence on liquidity | Efficiency and quick ratio had a significant negative impact on profitability. efficiency (OER) had a significant negative effect on liquidity. | Non performing financing (NPF) showed insignificant effect on liquidity. |
| **Alger and Alger (1999)** | Capital had a positive effect on liquid assets. | demand deposits and bank size had a negative effect on liquid assets. | |
| **Aspachs** ***et al.*** **(2005)** | Foreign banks' interest margin had a positive effect on banks' liquid buffer. | Liquidity had a negative relation with policy rate and GDP growth. Domestic banks' interest margin had a negative effect on liquidity | Profit and size had an insignificant effect on liquidity. |
| **Bonner et al. (2013)** | when liquidity regulation was absent, profit and deposits had a positive effect on liquidity. | | Capital ratio had an insignificant effect on the size of liquidity buffer. |
| **Bonner et al. (2015)** | | Presence of liquidity regulation decreased liquidity volatility. | |

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| **Bunda and Desquilbet (2008)** | Gross domestic product, inflation, and capital adequacy had a positive impact on banks. | Bank size, lending interest rate and financial crisis had a negative effect on liquidity. | |
| **Bhati** et al. **(2015)** | Size had a positive influence on liquidity. | Capital had a negative effect on liquidity. | |
| **Choon** *et al.* **(2013)** | Non performing loans, profitability and gross domestic product had a positive effect on liquidity. | Size, capital adequacy and financial crisis had a negative effect on liquidity. | Interbank rate showed an insignificant impact on liquidity. |
| **Fielding and Shortland (2005)** | Bank liquidity was positively influenced by discount rate, rate of depreciation (black market exchange rate) and violent political incidence. | | |
| **Fungacova and Weill (2012)** | In terms of size, large banks contributed the most to liquidity creation. | Conversely, the detrimental impacts of the financial crisis were felt more acutely by smaller banks rather than larger banks. | |
| **Fungáčová et al. (2010)** | | Deposit insurance had a limited impact on the association between capital and liquidity creation which was negative (before and after the implementation of deposit insurance). the relationship between liquidity creation and capital was significantly negative for small and medium-sized banks. The association was significantly negative for private domestic banks. | The association was not significant for large banks. The relationship was not significant for state controlled and foreign banks. |
| **Johannes P. S. Sheefeni (2016)** | | | Capital adequacy, non performing loans, return on equity shows insignificant association with liquidity. |

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| **Kamran and Ali (2015)** | On the other hand, growth rate of gross domestic product, cost to income ratio and funding cost had a positive effect on liquidity. | Results revealed that TIER I capital ratio had a negative effect on liquidity. | |
| **Moussa (2015)** | ROE showed a positive effect on liquidity. | ROA, NIM, inflation rate and GDP growth rate had a negative effect on bank liquidity. | Bank size, deposits and financial expenses had an insignificant influence on bank liquidity. |
| **Moore (2010)** | | Fluctuation in cash to deposit and interest rate (money market) had a negative influence on liquidity. | |
| **Malik and Rafique (2013)** | Share of non-performing loan over total volume of loans, log of total assets, interest rate had a positive effect on liquidity. Bank size, interest rate and financial crisis showed a positive effect on bank liquidity . | Inflation had a negative effect on liquidity. Financial crisis negatively affected liquidity. | |
| **Michael et al. (2006)** | | NPA had a negative impact on liquidity. | |
| **Munteanu (2012)** | Loan loss provision, unemployment, and funding cost showed a positive impact on liquidity. For 2002 to 2010, Z-score, cost to income ratio credit risk had a positive impact on liquidity. For 2002-2007, loan loss provision had a positive impact on liquidity. showed a positive impact on liquidity (L2). 2008-2010 Z-score showed a positive impact on liquidity (L1). Loan loss provision, interest rate ROBOR 3M and inflation rate had a positive impact on bank liquidity (L2). | Impaired loans, Tier 1 capital and interbank funding showed a negative impact on liquidity. Interest rate ROBOR 3M had a negative impact on liquidity. Tier 1 capital, interbank funding and impaired loans showed a negative impact on liquidity. Inflation rate and credit risk rate had a negative impact on liquidity. Impaired loans had a negative impact on liquidity. | |
| **Nigist Melese (2015)** | Bank size had a positive effect on liquidity. | Real GDP, capital adequacy and profitability had a negative influence on liquidity. | Non-performing loan, loan growth, inflation rate, and interest rate margin had an insignificant effect on liquidity. |

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| **Patora (2013)** | Unemployment rate, opportunity cost, profitability ROA and market power had a positive effect on liquidity. | Capitalization had a negative effect on liquidity. | |
| **Rauch et al. (2010)** | | interest rate had a significant negative effect on liquidity. unemployment level had a negative influence on liquidity. | profitability, bank size had any effect on liquidity creation. |
| **Rim El Khoury (2015)** | Interbank rate and size had a positive effect on liquidity. | Liquidity had a negative relationship with financial crisis, loan growth rate and inflation. | |
| **Sudirman, I. (2014)** | Asset quality had a significant positive effect on liquidity, profitability had a positive significant effect on liquidity. capital market development had a significant positive effect on liquidity | funding was significantly negative against liquidity, interest rate had a significant negative effect on liquidity, inflation Had a significant effect on liquidity | |
| **Sheefeni and Nyambe (2016)** | real gross domestic product was the main determinant of commercial bank liquidity in Namibia and this relationship was positive as well as statistically significant. | There was negative effect of inflation on liquidity. | monetary policy rate, inflation insignificantly affected liquidity. |
| **Tesfaye (2012)** | it was found that bank size, capital adequacy, non-performing loans, interest rate, interest rate margin and inflation rate had a statistically significant and positive influence on liquidity. While analyzing the impact of statistically significant factors on financial performance, it was found that bank size and capital adequacy had a positive effect | short term interest rate and non performing loans had a negative effect on financial performance. | GDP and increased loan had an insignificant effect on liquidity. Inflation and interest rate margin had a statistically insignificant effect on financial performance. Effects of liquidity on financial performance were inconclusive. |
| **Trenca et al. (2015)** | | Increase in GDP, inflation, unemployment and public deficit lowered bank liquidity. | |

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| **Trinugroho et al. (2016)** | | deposit insurance coverage had a negative influence on liquidity | ownership structure didn't have a significant influence on bank liquidity and deposit insurance. |
| **Vodova (2011)** | | financial crisis had a negative effect on liquidity. Bank liquidity dropped mainly as a result of the financial crisis. Bank liquid assets, or more precisely the share of liquid assets in total assets and deposits and short term funding, also decreased with higher bank profitability, higher capital adequacy and bigger bank size. | interest rates (on loans, on interbank transaction and monetary policy interest rates), interest rate margin, share of non-performing loans and rate of inflation had no statistically significant effect on the liquidity of Slovak commercial banks. |
| **Vodova (2013)** | profitability, capital adequacy and interest rate had a positive impact on liquidity. | Interest margin, bank size, interbank interest rate, and monetary policy had a negative effect on liquidity. | |
| **Vodova (2011)** | A positive relation between capital adequacy, non performing loans, interest rates on interbank transaction and loans. | Inflation, financial crisis and business cycle had a negative impact on liquidity. | Profitability, interest margin, monetary policy and unemployment had an insignificant effect on liquidity. |
| **Vtyurina et al. (2012)** | Financial development, capital adequacy and size showed a positive association with liquidity holding. | GDP, loan loss reserve, profitability and net interest margin had a negative effect on liquidity. | |
| **Chagwiza (2014)** | a positive association was found between liquidity, bank size, capital adequacy, bank rate and gross domestic product. | Implementation of multi-currency, business cycle and inflation rate had a negative influence on bank liquidity. | |
| **Gautam, R 2016** | bank size, capital adequacy and inflation rate had a positive impact on liquidity. Capital adequacy, non-performing loan and profitability had statistically significant effects on the liquidly of Nepalese commercial banks. | non-performing loans, profitability and GDP growth rate showed a negative impact on liquidity of Nepalese commercial banks. | bank size, GDP growth rate and inflation rate had statistically insignificant impact on the liquidity of Nepalese commercial banks. |

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| **Muritala* and Taiwo (2014)** | bank size was significantly positively associated with capital. | | Liquidity and non performing assets had insignificant effect on capital. |
| **Aikaeli (2006)** | In the short run, increase in credit risk, cost of funds and rate of required reserves positively influenced excess liquidity accumulation. | an increase in the rate of required reserves lowered excess liquidity in commercial banks. | |
| **Horvath et al., 2014** | | capital had a negative Granger effect on liquidity(small banks). Also, financial crisis slowed down liquidity creation. Liquidity creation had a negative Granger-cause effect on capital. | |
| **Pana et al. (2010)** | merger had a positive impact on liquidity creation by banks having more deposit insurance. Merger showed positive impact on liquidity creation for an acquirer having large deposit insurance. | Negative association of economic growth level and liquidity creation was found in the case of a small acquirer during the mergers. | |
| **Nikbakht et al. (2016)** | total capital ratio had a significant positive effect on liquidity of banks listed on the Tehran stock exchange. | | |
| **Berger and Bouwman (2008)** | Bank value and liquidity creation had a positive association. For large banks, the association between liquidity creation and bank capital was positive | in the case of small banks, it was negative. | |
| **Alemayehu (2016)** | profitability and capital adequacy had a significant positive association with banks' liquidity. | National bank bill and loan growth had a significantly negative effect on banks' liquidity. | Bank size, gross domestic product, non-performing loans and inflation had insignificant association with liquidity. |
| **Qin and Pastory (2012)** | National microfinance bank had the highest level of liquidity as compared to CRDB and national bank of commerce. | | |

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| **Yaacob** *et al.* **(2016)** | Capital adequacy and inflation showed significant positive effect on LCR while GDP. GDP had a positive impact on liquidity risk | financing showed significant negative effect on LCR. This meant that capital adequacy and inflation had a negative impact on liquidity risk while GDP. Inflation had a negative effect on liquidity risk. | |
| **Ogilo and Mugenyah (2015)** | capital adequacy had a significant positive influence on liquidity risk | leverage had significant negative effect on liquidity risk. | |
| **KAMOYO (2006)** | liquidity of banks in Kenya depended on maturity and liquid liabilities significantly and positively. | Liquidity depended on growth significantly negatively. | Size, leverage, loan commitments and profitability insignificantly negatively affected liquidity. Cash flows and liquid assets affected liquidity insignificantly positively. |
| **Roman and Sargu (2015)** | In Czech Republic banks, it was found that impaired loans ratio and return on average equity (profitability) had a significant positive influence over liquidity. Lithuanian banks showed positive significant effect of impaired loans on liquidity. For banks of Latvia, findings suggested significant positive effect of capital ratio on liquidity. Return on average equity had a significant positive effect on liquidity. Impaired loans ratio and capital ratio showed a significant positive effect on liquidity in case of Romanian banks. | Return on average equity had a significant negative impact on liquidity indicator of Hungarian banks. It was further revealed that capital ratio had a significant negative effect on liquidity for Bulgarian banks. | |

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| **Roman and Sargu (2014)** | In the case of Bulgaria, Impaired loans over loans had a positive effect on liquid assets. In the case of Romania they showed a positive effect on net loans over total assets. | In the case of Bulgaria, total capital ratio had a negative impact on both liquidity indicators. In the case of Romania, capital ratio, and impaired loans over gross loans had a negative impact on liquid assets | |
| **Lei and Song (2013)** | | the lagged EQ / TA was negative and significant at 1% level. Bank capital had a negative effect on bank liquidity creation. | |
| **Raeisi et al. (2016)** | capital adequacy, bank stability, interbank funds, income to cost ratio, amount of demanding deposits and savings, interest rates on daily short-term and long-term years investments, number of internal branches and inflation rate had positive effects. | assets quality and unemployment rate had negative effects on bank liquidity. | |
| **Mekbib (2016)** | inflation, non performing loans and profitability had a significant positive influence on liquidity. | Loan growth and size had a statistical significant negative influence on liquidity. | GDP growth rate, interest rate margin, capital adequacy, short term interest rate and interest rate on loans had insignificant influence on liquidity. |
| **Cherutoand Muturi** | Non-performing loans had a positive influence on liquidity risk. | it was found that size, capital adequacy and profitability had a negative influence on liquidity risk. | |
| **Delechat** *et al.* **(2012)** | | Liquidity showed negative association with loan loss reserve, low capitalization, less profitability and low efficiency. Foreign banks held less liquid buffer due to their access to parent banks in the case of an emergency. | |

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| **Karolina Patora (2016)** | Cash flow had a positive influence on liquidity. Parent bank's capital adequacy showed a positive relationship with liquidity. | interest rate (outstanding loans) had a negative relationship with liquidity. Credit supply had a negative influence on liquidity. | |
| **Lovin (2013)** | Foreign banks, term deposits and exchange rate showed a positive influence on interbank deposits. | previous month interbank deposits had a negative influence on interbank deposits. | |
| **Belay Nega Belayneh (2016)** | The speed of adjustment of liquidity and profitability to long run equilibrium was faster in the commercial banking industry of Ethiopia. | | The result of pairwise Granger causality test showed that neither unidirectional nor bidirectional pattern of causality existed between liquidity and profitability. |
| **Haan and van den End (2013**) | | capitalization and financial crisis negatively influenced liquid assets of banks. | |
| **LUCCHETTA (2007)** | Liquidity was positively impacted by interbank interest rate, size, and banks' interbank market behavior . Interbank interest rate positively impacted such decisions. More significantly, risk-free interest rate showed a positive correlation with loans investment and banks' risk-taking behaviour. | risk-free (monetary policy) interest rate had a negative influence on banks' liquidity retention, and banks' decision to lend in the interbank market. | |
| **Akhtar et al. (2011)** | both conventional and Islamic banks displayed positive correlation between the banksize and liquidity risk. Capital adequacy ratio showed positive and significant association with liquidity risk in case of conventional banks. | | albeit the first was insignificant. Net-working capital ratio also showed a positive association (insignificant) with liquidity risk. the association was insignificant in case of Islamic banks. Return on assets (ROA) showed insignificant positive association with liquidity risk for conventional banks. |

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| **Ahmed et al. (2011**) | Liquidity and operational risks positively associated with asset management. It showed positive link with liquidity risk. | Gearing ratio and non-performing loans ratio showed negative significant association with liquidity and operational risk. Capital adequacy exhibited negative significant association with credit and operational risk. | Bank size showed negative insignificant association with operational risk. |
| **Nigist Melese1 Dr. Laximikantham(2015)** | Bank size showed positive and significant (statistically) effecton liquidity. | | Nonperforming loan and loan growth showed statistically insignificant/ no effect on Ethiopian commercial banks' liquidity for the considered time period. |
| **SAMUEL SIAW (2013)** | Size of bank, non-deposit dependence and change in inflation showed a positive and significant (statistically) association with liquidity risk (financing gap ratio). | Risky liquid assets, less risky liquid assets and industry concentration displayed a significantly negative association. | Ownership structure showed no significant link with financing gap ratio (dependent variable). |
| **Berhanu BerihunEngida (2015)** | Gross domestic product on the level of basis price, interest rate on lending, non-performing loans, bank size, actual reserve ratio and short term interest rate had positive and statistically significant effect on liquidity. | Growth rate of gross domestic product on the level of basis price, actual reserve rate and non-performing loans in the total volume of loans negatively impacted profitability. Bank size and loan growth negatively and statistically significantly influenced liquidity of banks | |
| **Laurine (2013)** | Spread and non-performing loans showed significantly positive link with liquidity risk. | capital adequacy and size negatively and and significantly affect liquidity risk. | |
| **Bhati and DeZoysa(2013)** | Rise in cash reserve ratio positively affected bank liquidity. | Discount rates and SLR displayed negative impact on bank liquidity. | |
| **Uremedu (2009)** | Eligible developmental stocks and treasury bills positively impacted bank | Commercial papers, treasury certificates, certificates of | |

| | | | |
|---|---|---|---|
| | liquidity ratio. | deposits and bankers acceptance negatively impacted bank liquidity ratio. | |
| **Wójcik-Mazur and Szajt (2015)** | A long-term positive association was discovered between interest rate margin ratio and liquidity risk. A positive albeit short-term link was particular to banks in New member nations | for Old EU, the estimated negative association between liquidity risk and total assets return rate was found statistically significant. The existing negative association between credit risk and indicated liquidity predictor must be considered when observing liquidity risk determinants. The link between leverage ratio and liquidity risk was significant (statistically) and negative in the long run for banks in Old EU nations. | The association was found insignificant (statistically) in the long run. It emerged statistically insignificant for banks operating in New EU nations. |
| **Sawada (2010)** | Coefficient of bank size was positive and significant when security-asset ratio or liquid asset ratio was a dependent variable. | In all cases, CONTAGION coefficients were found negative and significant (statistically). | Contrarily, the ratio was insignificant when cash-assets ratio was a dependent variable. |
| **Rahmanand Banna (2016)** | | Bank size was negative for conventional banks. | ROE, capital adequacy, size, ROA and net working capital to liquidity risk it was insignificant for banks. |
| **Singh and Sharma (2016)** | Deposits, profitability, capital adequacy and inflation exhibited positive influence on liquidity of banks. | Bank size and GDP showed a negative influence on liquidity of banks. | Cost of funding and unemployment had insignificant influence on bank liquidity. |

**Table 1.2 Liquidity measures**

| Author name and year | Liquidity Measures |
|---|---|
| **Dinger (2009)** | Liquidity was measured as ratio of liquid assets to customer and short term funding. |
| **Subedi and Neupane (2011)** | Liquidity was measured as liquid assets over total assets, and loans over sum of deposits and short term financing. |
| **Vodova (2012)** | Liquid assets over deposits, Liquid assets over total assets and Loans over deposits. |
| **Fadare (2011)** | Loan-to-deposit ratios. |
| **Chalermchatvichien** *et al.* **(2014)** | Current assets over current liabilities, loans over deposits, Basel III NSFR and Basel CAR were used as measures of liquidity. |
| **Muharam (2013)** | Cash over total assets was used as measure of liquidity. |
| **Iqbal (2012)** | Sum of cash and cash equivalents over total assets |
| **Abdillah et al. (2016)** | Liquidity was measured as quick ratio. |
| **Alger and Alger (1999)** | Three different measures of liquid assets were used - cash, securities and the sum of cash and securities. |
| **Aspachs** *et al.* **(2005)** | Sum of securities invested in, reverse repos, bills, commercial papers and cash. Other liquidity ratios used were - liquid assets over total assets, and liquid assets over total deposits. |
| **Bonner et al. (2013)** | Sum of cash and due from banks over total assets, and total deposit over total assets. |
| **Bonner et al. (2015)** | Liquidity was considered dependent variable and measured as percentage of sum of government bonds, cash, and due from banks over total assets. |
| **Bunda and Desquilbet (2008)** | Four liquidity ratios were used - liquid assets/ total assets, net loans / total assets, liquid asset/ customer and short term funding, and liquid assets / total deposits and borrowings |
| **Fielding and Shortland (2005)** | Liquidity was calculated as logarithm of reserve assets ratio. |
| **Johannes P. S. Sheefeni (2016)** | Liquid assets over total assets. |
| **Malik and Rafique (2013)** | Liquidity was measured as cash and cash equivalents over total assets (L1) and advances net of provision over total assets (L2). |
| **Munteanu (2012**) | To investigate the relationship between related variables and liquidity, the study considered two liquidity ratios - net loans over total assets(L1) and liquid assets over deposits and short term Funding (L2). , |
| **Nigist Melese (2015)** | Liquidity was measured as average loan-average deposits/ total assets. |
| **Sudirman, I. (2014)** | liquidity in the previous year (LIQt-1) |
| **Sheefeni and Nyambe (2016)** | Liquidity indicator [loans/total assets (LTA)]. |
| **Trenca** *et al.* **(2015)** | Liquidity was measured as net loans to total deposits. |
| **Trinugroho** *et al.* **(2016)** | The study used liquid assets over total assets, liquid assets over deposits, cash over total assets and loans over total assets as measures of bank liquidity. |
| **Vodova (2011)** | Liquidity measured by the share of liquid assets in total assets and share of loans in total assets |

| | |
|---|---|
| **Vodova (2011)** | In the study, four liquidity measures were used - liquid assets/ total assets(L1), liquid assets/ deposits+ short term borrowings(L2), loans/ total assets (L3) and loans/ deposits+ short term financing(L4). |
| **Yaacob** *et al.* **(2016)** | LCR and NSER were liquidity measurements so as to obtain the objective of liquidity risk analysis. |
| **Ogilo and Mugenyah (2015)** | Liquidity risk was calculated as loans to deposit ratio and it was found that when independent variables were analyzed individually, |
| **KAMOYO (2006)** | Liquidity was measured as total deposit liabilities over total assets. |
| **Roman and Sargu (2015)** | Liquidity was measured as total loans over total banking assets. |
| **Roman and Sargu (2014)** | Liquidity risk was measured by two liquidity indicators - liquid asset over total assets and net loans over total assets. |
| **Mekbib (2016)** | Liquidity was measured as loan to deposit ratio, liquid asset over deposit and liquid asset over total assets. |
| **Acharya** *et al.* **(2009)** | Liquid assets to total deposits with |
| **Samuel siaw (2013)** | Financing gap ratio (FGAPR) was used as a liquidity risk (dependent variable), liquid assets ratio (classified as risky and less risky liquid assets), Robustness of results, ratio of net loans to total deposits (NLD) was employed as alternative measure for liquidity risk. |
| **Berhanu BerihunEngida (2015)** | Liquid assets to total assets. |
| **Sawada (2010)** | Cash asset ratio |

## 1.2 Research GAP

Analysis of literature accessible on liquidity measures, its' determinants and its' effects on liquidity of banking system suggests that ample of empirical studies had been conducted. It also explains the determinants of liquidity and its impact banks' liquidity Nevertheless, literature has very few empirical evidences to support the same claims in developing countries particularly in India. As far as, literature in Indian context is concerned there is a few work in the interlinked branches of liquidity analysis, liquidity determinants and its impact on Indian banks' liquidity.

To the best of the researcher's knowledge, none of the study in the pure Indian context attempts to investigate the effect on liquidity determinants on liquidity of banks of different ownership structure, bank sizes and in different time period. There is insufficient literature in the context of Indian banks' liquidity and different ownership structure and sizes. A robust study in this emerging area may provide a holistic view of the Indian banking system and bring forth the major recommendations and suggestion to policymakers and investors.

Another issue which is thoroughly untouched in the Indian banking context is the effect of different time period, i.e. pre-crisis period (2000 to 2006), crisis period (2007-09) and post-crisis period (2010 to 2015) on liquidity determinants and effect of these determinants on

Indian banks' liquidity. A good deal of literature provides evidences in the backdrop of a major effect of liquidity determinants on banks' liquidity. However studies on the issue of effect of different time periods on Indian banks' liquidity do not have any empirical evidences. This is another thrust area and the gap found from the reviewed literature.

# CHAPTER 3

# RESEARCH DESIGN

## 3.1 Introduction

This study analyses factors affecting banks' liquidity. Analysis comprised several steps. In the first step, liquidity trends of banks operating in India were analysed considering ownership structure and bank size. The effect of financial crisis on liquidity was also examined. The second step comprised empirical investigation of the link among bank-specific and macro-economic factors and bank liquidity. The third step examined change in influence of bank-specific and macroeconomic factors on bank liquidity with change in ownership structure. Fourth step observed how bank size impacted the effect of bank-specific and macroeconomic factors on banks' liquidity. Effect of bank–specific and macro-economic variables on banks' liquidity during pre-crisis period, crisis period and post-crisis period was analysed in the fifth step. The research design adopted by this study has been described in the following sub-sections.

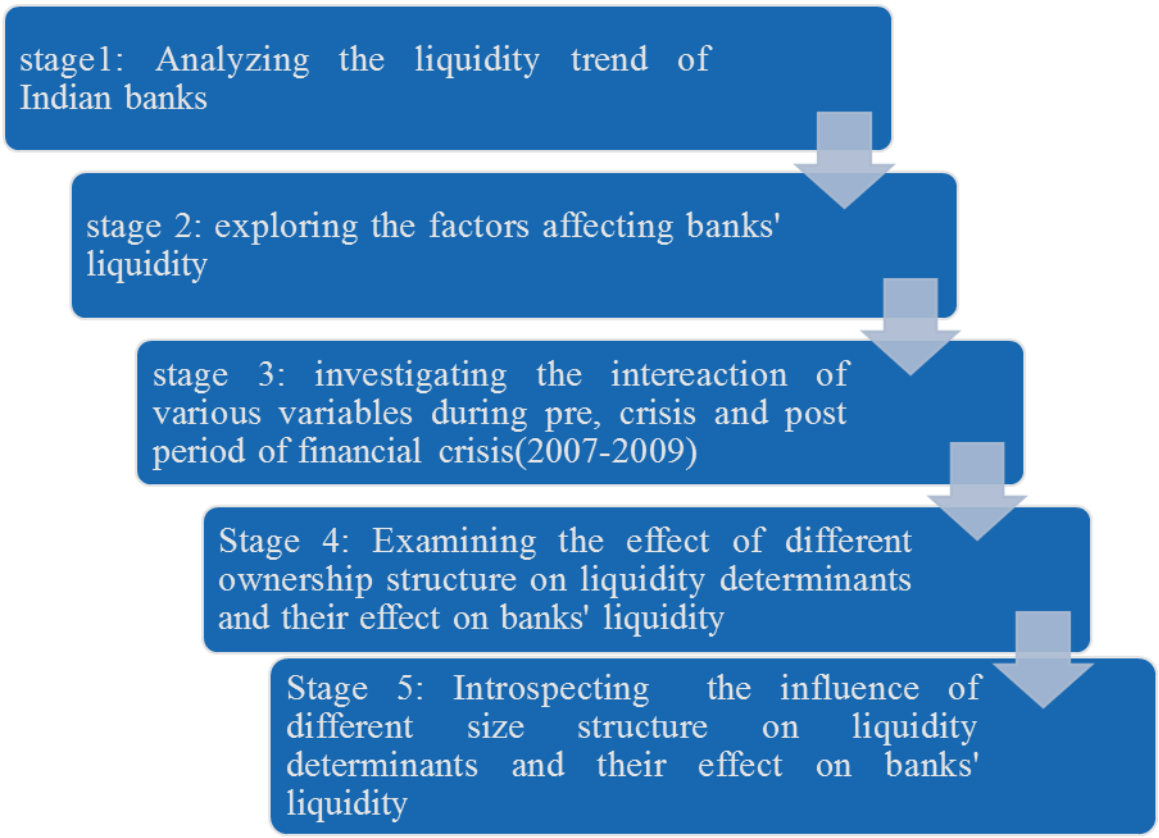



**Fig 3.1**

The following sections lay down the hypotheses and research methodology adopted in this study.

## 3.2 Hypotheses

H01: Bank specific and macro specific factors share no significant relationship with bank liquidity.

H02: There is no significant difference in impact of bank-specific and macro-economic factors on liquidity during pre-crisis, crisis and post-crisis period.

H03: Liquidity determinants (bank-specific factors and macro-economic variables) have same effect on liquidity of banks of different ownership structures.

H04: There is no significant difference in influence of liquidity determinants on bank liquidity with change in bank size.

### 3.2.1 Research Methodology

Research Methodology refers to the methodical analysis of the methods employed in a study area. It includes theoretical analysis of principles and methods related with a field of knowledge. The present study employs panel data regression for analysing the impact of various bank specific and macro-economic variables on bank liquidity. Data regression analysis includes fixed effect estimates and random effect estimates. Descriptive analysis, correlation matrix, stationarity test, and heteroscedasticity test are also included. Liquidity patterns and trends in relation with various ownership structures and bank sizes have been shown graphically. Other relevant information has also been presented in the form of graphs, charts, figures and tables.

Results of the study have been validated by a pilot survey (conducted after analysis) of banking professionals.

#### 3.2.1.1 Data and Sample

The present study examines the influence of macroeconomic [gross domestic product (GDP), inflation (INFLA), unemployment (UNEM), and crisis (CRISIS)] and bank-specific [return on assets (ROA), bank size (SIZE), deposits (DEP), cost of funding (COF), capital adequacy ratio (CAR), net interest margin (NIM), non-performing assets (NPAs)] factors on liquidity of banks (public, private and foreign) in India. Further, the study examines how the influence of aforementioned determinants changes with change in bank size and ownership, and in normal (non-crisis) and abnormal (crisis) situations.

This study takes into account the time period 2000-2018 (including the crisis of 2007-2009) and divides it into pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2018) to ascertain the change in the effect of determinants on liquidity in the considered time frames. The study considers 63 scheduled commercial banks (public, private and foreign) operating in India during the period 2000-2018. The study observes change in influence of determinants on bank liquidity during the three periods, as well as during the entire period. Balanced panel data have been employed, this means that equal number of banks have been considered in all time periods. Panel regression model (fixed effect estimates and random effect estimates) has been used. Results of the study have been validated by a pilot survey (conducted after analysis) of 25 banking professionals (50 banking professionals were contacted, but 25 responded).

#### 3.2.1.1.1 Variable Specification

The current study examines the impact of bank-specific and macro-economic variables on bank liquidity. Liquid assets over total assets, liquid assets over total deposits, cash over total assets and loans over total assets are considered dependent variables and deposits, capital adequacy, non performing assets, net interest margin, cost of funding, profitability, bank size, inflation, gross domestic product and financial crisis are taken as independent variables in this study. Among these, bank size, deposits, capital adequacy, non-performing assets, net-interest margin, cost of funding and profitability are bank specific while gross domestic product, financial crisis and inflation are macro-economic variables.

### 3.2.2 Determinants of liquidity of banks operating in India

Determinants of liquidity of banks operating in India have been explained in the following sub-sections.

#### 3.2.2.1 Bank-specific factors

**Bank size**: Majority of studies have shown bank size to significantly impact bank liquidity (Kashyap et al. (2002) and Delechat et al. (2012) (Bonfim and Kim, 2012; Bonner et al., 2013; Dinger, 2009; Tesfaye, 2012). Some studies however, reveal insignificant impact of bank size on liquidity of banks, (Aspachs et al. (2005) and significant negative relationship (Choon et al., 2013 and Rauch et al., 2010) between the two.

**Profitability**: Studies have shown profitability to positively affect bank liquidity (Choon et al., 2013; Vodova, 2013 and Lartey et al., 2013). Delechat et al. (2012), Rauch et al. (2010), and Valla et al. (2006) revealed negative impact of profitability on bank liquidity.

Aspachs et al. (2005), however, reported profitability to share an insignificant association with bank liquidity.

**Deposits:** Moussa (2015) showed insignificant impact of deposits on bank liquidity. Bonner et al. (2013) and Kashyap et al. (2002) reported a positive association between demand deposits and liquidit asset holdings. Alger and Alger (1999) opined that at a given deposit level, banks must increase liquid assets if there was higher risk to borrowers (as in an economic recession). Dinger (2009) established a negative relation between deposit rate and bank liquidity.

**Capital** - High capital has been found to increase risk bearing capability of banks (Berger and Bouwman, 2009), and also. liquidity generation capacity(Vodova (2013), Munteanu (2012) and Dore (2013). Distinguin et al. (2013) found that European and US commercial banks engaged in trading practices during 2000-2006 reduced their capital ratio when faced by liquidity problems. Also, a smaller bank reinforced its standards of solvency when faced by problems of liquidity. Choon et al. (2013), Berger and Bouwman (2010), Delechat et al. (2012), Chen and Phuong (2014), Moussa (2015), Bunda and Desquilbet (2008), Bhati and DeZoysa (2012) and Bhati et al. (2015) found a significant negative effect of capital adequacy on liquidity of banks.

**Ownership:** Delechat et al. (2012) and Dinger (2009) reported that foreign banks held less liquid buffer as compared to other banks.

**Cost of funding**: Alger and Alger (1999) and Munteanu (2012) explained that if refinancing cost increased, banks increased their investments in liquid assets. This implied that with increase in liability cost, banks relied more on liquid assets instead of interbank market.

#### 3.2.2.2 Macroeconomic factors

**GDP:** Moussa (2015), Bunda and Desquilbet (2008) and Choon et al. (2013) reported a positive impact of GDP on bank liquidity. Valla et al. (2006), Dinger (2009), Vodova (2011) and Aspachs et al. (2005) showed negative associations between the two. Aspachs et al. (2005) reported smaller liquidity holdings by UK banks in case of increased GDP, and vice versa (1985-2003).

**Crisis:** Studies have shown serious impacts of financial crisis on bank liquidity. (Choon et al., 2013) viewed crisis as a time when assets and institutions were valued at less than their nominal value, resulting in losses. Vodová (2013), Vodova (2011), Bunda and Desquilbet (2008) and Choon et al. (2013) established negative correlation between financial

crisis and liquidity. Insufficient bank liquidity may cause financial crisis, and vice versa. on the other hand, Chen and Phuong (2014) revealed that banks held greater liquidity during crisis.

**Inflation:** Moussa (2015) reported, in context of banks in Tunisia, that change in inflation rates negatively impacted liquidity of banks. In an Indian context, Bhati et al. (2015) revealed that rate of inflation had a negative impact on bank liquidity. Tesfay (2012) reported a positive effect of inflation on liquidity. Horvath et al. (2014) found insignificant effect of inflation on liquid assets of banks.

Table 3.1 describes dependent and independent variables employed in the present study to analyse the liquidity of banks considered in this study.

**Table 3.1 Dependent and Independent Variables Specifications**

| Variables | Description | Remarks if any |
|---|---|---|
| **Size** | Natural logarithm of bank's total assets | _ |
| **Cost of funding** | Funding cost | - |
| **Capital Adequacy** | Capital Adequacy Ratio | Proxy variable for capital strength of Indian banks |
| **Deposits** | Deposits over assets | - |
| **Net interest margin** | Net interest margin | - |
| **NPA** | Net NPA to Net Advances | Proxy variable for problem loans and non-performing assets |
| **Profitability** | Return on total assets | _ |
| **GDP** | GDP growth rate | Proxy variable for economic conditions |
| **Inflation** | % change in consumer price index | Proxy variable for economic conditions |
| **Financial Crisis** | Dummy equals 1 for all observations during 2007-08, 2008-09 and 2009-10 | Proxy variable to test the impact of Financial crisis of 2007-09 on Indian banking |

### 3.2.3 Sample

The study considers 63 scheduled commercial banks (public, private and foreign) operating in India during the period 2000-2015. The Indian banking sector is broadly categorised into two main categories - commercial banks and co-operative financial institutions. Operations of commercial banks significantly influence the entire banking sector. This study focuses on commercial banks only. Commercial banks can further be categorised into scheduled commercial banks and RRBs.

As RRBs differ from scheduled commercial banks in nature (their primary focus is on the agricultural sector), they have been excluded from the study. Sample for this study comprises scheduled commercial banks including SBI and its associate banks, nationalised banks, private banks and foreign banks operating in India. The considered duration of time for the study is 2000-2015 (this includes the crisis of 2007-2009). This duration is broken up into pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2015) periods in order to understand what difference exists in the influence that determinants exert on bank-liquidity in the aforementioned time periods. Also, it has been examined what relationship bank ownership shares with determinants, and what influence determinants exert on liquidity as a result of this association. Similarly, change in the influence of determinants on liquidity with change in bank size has been observed. Thus, this study is limited to 16 years and uses balanced panel data set of banks, including the same number of banking units each year for analysis.

### 3.2.4 Data Source

Mainly secondary data sources have been used for the study, including RBI's annual reports, annual statements of banks, and Prowess - a financial database of Centre for Monitoring Indian Economy Private Ltd. (CMIE)[1]. All variables (including independent and dependent variables) have primarily been drawn from these sources.

The balanced panel data set includes equal number of cross-sectional units across the 16-year period of study. The published reports constitute refined data for all variables. Therefore, there is no need for further data editing because published reports are expected to be free from measurement errors or noise, and exhibit adequate reliability.

### 3.2.5 Tools and Techniques

To evaluate influence of determinants on banks' liquidity, this study implements panel models and stationarity test.

### 3.2.6 Panel Data Regression Model

Panel data represent longitudinal data which consist of observations in time-series of a number of cross-sections, such as those of individuals and respondents. Therefore, panel data include data gathered from several individuals at two or more points in time. Panel data set determines two dimensions of data set and cross-sectional observations over a time-series. Cross-sectional dimension is indicated by subscript *i* whereas period dimension is denoted by subscript *t*.

Panel data is a pooling of observations on a cross-section of individuals, countries, firms, household over several periods (Baltagi, 2005). Hence, the panel data set enhances the deterministic power of sample as it receives multiple observations on each individual in the sample.

Panel data accounts for random error and unobserved heterogeneity of observations which is difficult to measure precisely. Socio-economic factors, cultural factors and other dimensions which vary over time but not across the cross-sections (GDP, inflation and qualitative regulatory practices) are difficult to measure precisely. It depicts a hierarchical structure or more complex clusters of multilevel data (Hsiao, 2006; Luke, 2004). Panel data provides multi-level structures suitable for hierarchical modelling and therefore depicts several advantages over the single cross-sectional or time-series data (Hsiao, 2003). Considering its multiple advantages, it is widely being used in the social and economic studies.

If each cross-sectional unit have equal number of time-series observations, then such data set term as balanced panel data. If the number of cross-sections varies across the time-series then it is said to be an unbalanced panel data set.

### 3.2.6.1 Panel Data Regression

A regression model which exhibits relationship between dependent and independent variables and these variables have double indexing of both cross-sectional denoting individuals and time-series denoting time period, is known as Panel data regression model. A simple Panel regression model can be expressed as follows:

$$y_{it} = \alpha + \beta X_{it} + u_{it}, \text{ i = 1, 2, 3, ……, N; t =1,2, 3,……, T} \qquad (3.3.1)$$

Where i refer to the cross-sectional magnitude and t refers to the time-series aspect. $y_{it}$ is the dependent variable of the relationship model, $\alpha$ is a scalar constant, $\beta$ is a vector of coefficient which is to be estimated and $X_{it}$ is an independent observation on $i^{th}$ cross-section in $t^{th}$ time period on explanatory variables, $u_{it}$ denotes an error component of the model which can be expressed as one-way or two-way form and $u_{it} = \mu_i + v_{it}$ in a one-way form of the disturbances, $\mu_i$ refers to the unobservable cross-sectional specific time invariant effect and $v_{it}$ refers to the remainder disturbances (Baltagi, 2005). $u_{it}$ captures the unobservable effects in the relationship model which is difficult to measure explicitly.

The two-way form of error component is considered an additional time specific individual invariant component and can be expressed as follows:

$$u_{it} = \mu_i + \lambda_t + v_{it} \quad (3.3.2)$$

Where $\lambda_t$ refers to individual invariant and time specific trend such as macro-economic conditions, GDP, inflation etc.

Based on role of error term in a relationship model, Panel data regression model can further be defined as a fixed effect model or random effect model. The fixed effect model refers to error term which is to be assumed as a fixed component whereas random effect model considers the error term as having random variations.

### 3.2.6.2 Types of Panel Data Regression Models

The role of error term in the relationship model divides estimation models in the fixed effect model and random effect model. In case of fixed effect model, $\mu_i$ and $\lambda_t$ are assumed to be as fixed parameters to be estimated and the remainder disturbance stochastic with $v_{it}$ independent and identically distributed $(0, \alpha_v^2)$. $X_{it}$ are assumed as independent of $v_{it}$ for all i and t.

In the random effect model the $\mu_i$ and $\lambda_t$ are assumed to be as random parameters where $\mu_i$ IID (0, $\alpha_\mu^2$), $\lambda_t$ IID (0, $\alpha_\lambda^2$) and $v_{it}$ IID (0, $\alpha_v^2$) in addition to $X_{it}$ are assumed as independent of $v_{it}$ for all i and t (Baltagi, 2005). However, when a relationship model assumes that the intercept and slope coefficient are constant across the time & space and only the error term captures difference over time & cross-sections then Panel data regression model follows pooled OLS estimation method (Gujarati, 2003).

### 3.2.6.3 Fixed Effects Model

Fixed effect model also known as least square dummy variable estimator used to estimate coefficient for a fixed effect with one-way error component. Time invariant component of error term is assumed as fixed constant. The fixed effect model considers the "individuality" of each cross-section unit when the intercept is varying for each cross-section with the slope coefficients which is constant across the cross-sections (Gujarati, 2003). The fixed effect model assumes that the slope coefficients of the regressor do not vary across cross-sections (Gujarati, 2003).

The vector form of the Panel data regression model expressed as follows:

$$Y=\begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_N \end{bmatrix}=\alpha+\begin{bmatrix} e \\ 0 \\ . \\ . \\ . \\ 0 \end{bmatrix}\mu_1+\begin{bmatrix} 0 \\ e \\ . \\ . \\ . \\ e \end{bmatrix}\mu_2+.....+\begin{bmatrix} 0 \\ 0 \\ . \\ . \\ . \\ e \end{bmatrix}\mu_N+\beta\begin{bmatrix} x_1 \\ x_2 \\ . \\ . \\ . \\ x_N \end{bmatrix}+\begin{bmatrix} \mu_1 \\ \mu_2 \\ . \\ . \\ . \\ \mu_N \end{bmatrix} \quad (3.2.6)$$

Where,

$$\underset{Tx1}{y_i}=\begin{bmatrix} y_{i1} \\ y_{i2} \\ . \\ . \\ . \\ y_{iT} \end{bmatrix},\ \underset{Tx1}{X_i}=\begin{pmatrix} x_{1i1} & \cdots & x_{Ki1} \\ \vdots & \ddots & \vdots \\ x_{1iT} & \cdots & x_{KiT} \end{pmatrix}$$

K is the vector of $\beta$ coefficients,

$$\underset{Tx1}{e'}=(1,1,.....1),\ \underset{Tx1}{u_i'}=(u_{i1},u_{i2},.....,u_{iT})$$

$$E(u_i)=0,\ E(u_iu'_i)=\sigma_u^2 I_T,\ E(u_iu'_j)=0 \text{ if } i\neq j$$

$I_T$ is an identity matrix of TxT. The BLUE for equation 3.2.6 is the OLS estimator and can be obtained by minimising following equation:

$$\sum_{i=1}^{N}u_i'u_i=\sum_{i=1}^{N}\sum_{t=1}^{T}v_{it}^2=\sum_{i=1}^{N}\sum_{t=1}^{T}(y_i-e\mu_i-\beta x_i-\alpha)'(y_i-e\mu_i-\beta x_i-\alpha) \quad (3.2.7)$$

Subject to restriction

$$\sum_{i=1}^{N}\mu_i=0 \quad (3.2.8)$$

utilising the restriction and solving the marginal conditions yield

$$\hat{\alpha}=\bar{y}-\beta'\bar{x} \quad (3.2.9)$$

$$v_i=\bar{y}_i-\hat{\alpha}-\beta'\bar{x}_i \quad (3.2.10)$$

Where,

$$\bar{y}=\frac{1}{NT}\sum_{i=1}^{N}\sum_{t=1}^{T}y_{it,}\quad \bar{x}=\frac{1}{NT}\sum_{i=1}^{N}\sum_{t=1}^{T}x_{it,} \quad (3.2.11)$$

When substituting (3.2.9) and (3.2.10) into (3.2.11) and taking partial derivatives with respect to β, it is obtained as

$$\hat{\beta} = \left[ \sum_{i=1}^{N} \sum_{t=1}^{T} \left( x_{it} - \bar{x}_i \right) \left( x_{it} - \bar{x}_i \right)' \right]^{-1} \left[ \sum_{i=1}^{N} \sum_{t=1}^{T} \left( x_{it} - \bar{x}_i \right) \left( y_{it} - \bar{y}_i \right) \right] \quad (3.2.12)$$

### 3.2.6.4 Random Effect Model/ Generalised Least Squares (GLS) Estimator

If a relationship model includes several cross-sections then the fixed effect model may mislead results due to high degrees of freedom (Gujarati, 2003). Random effect model avoids this situation and consider the time and cross-section dummy as a part of error term and disturbance. Therefore, it is also known as an error component model. The basic Panel data regression model can be expressed as:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \ldots\ldots\ldots + \beta_N X_{Nit} + u_{it} \quad (3.2.13)$$

Instead of treating $\beta_{1i}$ as fixed, the random effect model assumes it as a random variable with a mean value of $\beta_1$ and the intercept value for individual cross-sections and can be defined as follows:

$$\beta_{1i} = \beta_1 + e_i \text{ , i = 1, 2, ……., N} \quad (3.2.14)$$

Where $e_i$ is a random term with a mean value zero and variance of $\sigma_e^2$; substituting the values of equation 3.2.14 in equation 3.2.13, the redefined equation is as follows:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \ldots\ldots\ldots + \beta_N X_{Nit} + u_{it} + e_i$$

$$= \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \ldots\ldots\ldots + \beta_N X_{Nit} + w_{it} \quad (3.2.15)$$

Where,

$$w_{it} = e_i + u_{it} \quad (3.2.16)$$

$w_{it}$ is a composite error term which consist $e_i$, the cross-section specific error component and $u_{it}$, the combined cross-section and time-series error component. Due to these error components, random effect model is also named as an error component model.

The basic assumptions of the error component model are:

$e_i$ is IID with $N(0, \sigma_e^2)$

$u_{it}$ is IID with $N(0, \sigma_u^2)$

$E(e_i u_{it}) = 0$ $E(e_i e_j) = 0$ $(i \neq j)$

$$E(u_{it}u_{is}) = E(u_{it}u_{jt}) = E(u_{it}u_{js}) = 0 \ (i \neq j, t \neq s) \quad (3.2.17)$$

Equation 3.2.17 illustrates that the individual error components are not correlated with each other and not autocorrelated across both cross-sections and time-series units.

Therefore,

$$E(w_{it}) = 0 \quad (3.2.18)$$

$$\text{var}\, w_{it} = \sigma_e^2 + \sigma_u^2 \quad (3.2.19)$$

### 3.2.6.5 Fixed Effect versus Random Effect Model

Studies have shown that results from both models differ substantially when observations are few (Hsiao, 2003). Researcher's assumptions regarding the likely correlation between the cross-section specific error component $e_i$ and the X's regressors play a decisive role when choosing one of the two models.

If it is assumed that $e_i$ and the X's are uncorrelated, then random effect is a more suitable model. However, if assumed that $e_i$ and the X's are correlated, then fixed effect may offer more accurate estimations. Baltagi (2005) proposed appropriateness of fixed effect model when focus of the study was on a specific set of cross-sections and inferences drawn were restricted to a particular set only. Judge *et al*. (1982) made a few valuable observations to consider when choosing one of the two:

- **If** T > N, (T is number of time period and N is number of cross-sections) that means the time-series observation are large enough from the number of cross-sections, **then** there is a negligible difference in the estimates of both the models. In this case any of the models can be applied as per the convenience of the researcher. The fixed effect model is comparatively easy than the random effect and therefore fixed effect may be preferred.
- **When** N > T then the estimates of both the models differ significantly, in this case **if** the cross-sections are not randomly drawn from the population, fixed effect is appropriate. However**if** the cross-sections are randomly drawn from the population **then** the random effect model should be preferred.
- **If** the cross-sectional error component $e_i$is correlated with one or more regressors**then** the estimates derived from random effect may be biased and therefore fixed is appropriate.

Apart from these observations, a test was developed by the Hausman (1978) to choose between two of these models. The underlying null hypothesis is that the fixed effects and

random effects estimates do not differ significantly. If the null hypothesis is rejected then the random effect is not an appropriate model and fixed effect is a better model.

$$H_0 : E\left(u_{it} \mid X_{it}\right) = 0 \qquad (3.2.20)$$

**3.2.6.6 Test for Stationarity**

Examination of stationarity in a data set is a test for existence of unit root in the series. Existence of unit root in a data set leads to non-stationarity series. As the data set is panel in nature therefore the study need to conduct panel unit root tests to check for stationarity in the data set. A stationary time-series is stationary in nature which moves around a constant mean value. Unit root test to check for the stationarity is an autoregressive statistical model of a time-series and expressed as follows:

Y (t+1) = ay (t) + other terms (3.2.21)

Where y (t) is data series, 'a' is an unknown constant term and underlying hypothesis in the unit root test is that a = 1 and the alternative hypothesis is that modulus 'a' is less than 1. This study adopts the unit root tests advocated by Levin, Lin and Chu (LLC, 2002) with individual effects and individual linear trend. If a series found to be non-stationarity at level then the series, need to be differenced to further test for stationarity.

A narrative discussion of LLC test is specified in the following section.

**3.2.6.7 Levin-Lin-Chu (LLC) Test**

LLC test for panel unit root is a first unit root test developed for panel data by Levin and Lin as originally appeared in the working paper in 1992 and 1993 and finally published with the co-author Chu, in 2002. The LLC test may be interpreted as pooled Augmented Dickey- Fuller (ADF), potentially with differing lag lengths across the units of the panel and applicable to both small and large panels.

The conventional ADF test for single equation can be expressed as follows:

$$\Delta X_{i,t} = \alpha_i + \beta_i X_{i,t-1} + \gamma_i t + \sum_{j=1}^{k} \theta_{ij} \Delta X_{i,t-j} + \varepsilon_{i,t} \qquad (3.2.22)$$

In the given equation the unit root null hypothesis of $\beta_i = 0$ is tested against the one-side alternative hypothesis of $\beta_i < 0$ which corresponds to $X_{i,t}$ being stationary. This is based on the test statistics $t_{\beta_i} = \beta_i' / se(\beta_i')$ where $\beta_i'$ is the OLS estimate of $\beta_i$ and $se(\beta_i')$ is the standard error. However, this single equation based ADF test may exhibits low power when the data are

generated by a near unit root but stationary process and therefore to avoid this problem Levin, Lin and Chu (2002) contributed panel approach in the ADF test as a panel approach substantially increase the power of finite samples. Levin, Lin and Chu (2002) proposed a panel based version of ADF test that restricts $\beta_i$' by keeping it identical across cross-sections and can be expressed as follows:

$$\Delta X_{i,t} = \alpha_i + \beta X_{i,t-1} + \gamma_i t + \sum_{j=1}^{k} \theta_{ij} \Delta X_{i,t-j} + \varepsilon_{i,t} \qquad (3.2.27)$$

The test involves the null hypothesis $H_0$: $\beta_1 = \beta_2 = ..... = \beta = 0$ against the alternative hypothesis $H_A : \beta_1 = \beta_2 = ..... = \beta < 0$. LLC assumes that the individual processes are cross-sectional independent.

This stage uses E-views-7 version to assess Tobit regression model, Panel data regression model and requisite tests (LLC test and other). The models specifications of Tobit and Panel data regression models have been detailed in chapter 5 of this study along with the empirical results.

### 3.3 Pilot Study

Results of the study have been validated by a pilot survey (conducted after analysis) of 25 banking professionals. 50 people working in various banks in India were contacted, and 25 responded.

Questionnaire is attached below.

### 3.4 Conclusion

This chapter laid down the research design adopted in this study. Sample, study period, research variables, tools and techniques and models used for analysis were described. Chapters 4, 5, 6 and 7 explain analyses carried out to obtain the objectives of the study.

**Notes**

1. ***CMIE*** is a business information company which is a data warehouse for Indian economy and business. Prowess is a product of CMIE which provides data on financial performance of Indian companies. It covers both the listed and non-listed companies from all Indian industries and sectors.
2. ***E-views* 7** is an advanced version of econometric and statistical software package designed for econometric, statistical, time-series analysis and forecasting.

3. ***STATA-12*** a fast, powerful statistical package designed for researchers of all disciplines. It is a command- and menu-driven software package for statistical analysis. It is available for Windows, Mac, and Linux operating systems.

***Heteroscedasticity*** is a condition when the variance of a variable varies over time.

# CHAPTER 4

# ANALYSIS OF LIQUIDITY TRENDS OF BANKS OPERATING IN INDIA AND EFFECT OF DETERMINANTS ON BANK LIQUIDITY IN DIFFERENT TIME PERIODS

## 4.1 Introduction

This chapter analyses the trend of liquidity of banks (considering banks under different forms of ownership – public, private and foreign – and of different sizes – small, medium, large, and largest) operating in India for the period 2000-2018. The effect of liquidity determinants (bank-specific and macroeconomic) on bank liquidity during the period is also observed. This chapter examines hypotheses I and II (which are given in chapter 1) of the study. The present chapter is divided into two different sections - Section A representing stage 1, and Section B representing stage 2 of the study. Section A (Stage 1) analyses liquidity trends of banks operating in India from 2000 to 2018. Section B (Stage 2) observes the effect of bank-specific (size, deposits, profitability, NIM, NPA, COF, capital adequacy) and macroeconomic (GDP, inflation and crisis) variables (or liquidity determinants) on bank liquidity. Panel data regression models have been used on the data set of banks operating in India to investigate the influence of determinants on bank liquidity.

## SECTION - A

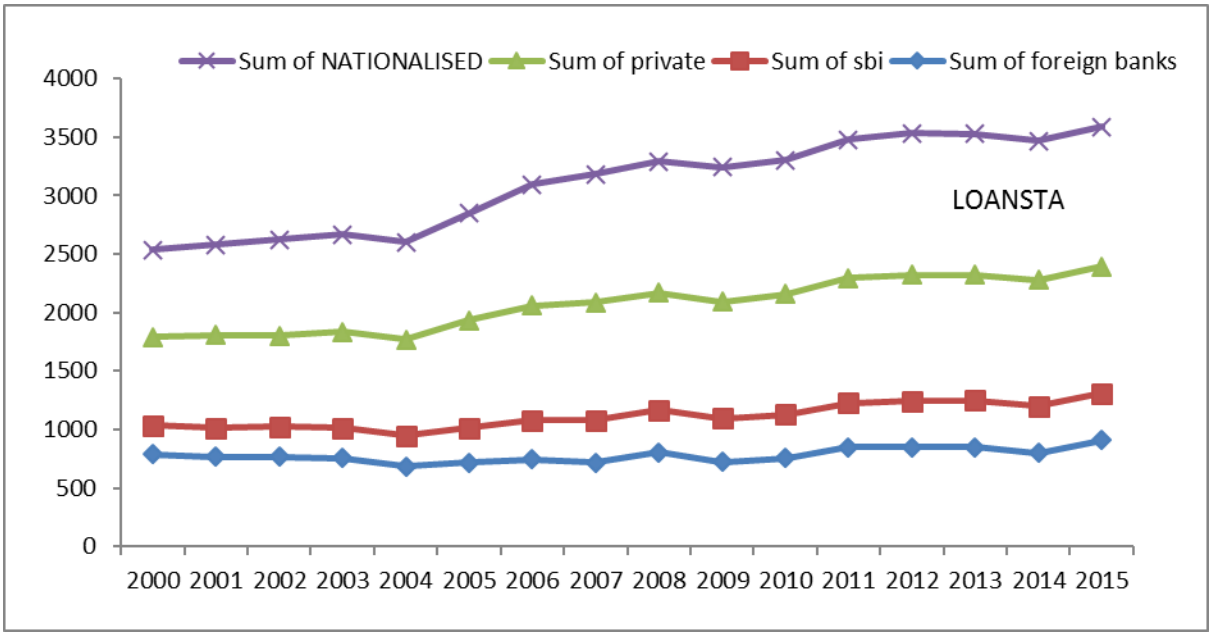
### Analysis of liquidity trends, and determinants of liquidity of banks operating in India

## 4.2 Analysis of liquidity trends, and determinants of liquidity of banks operating in India

This section graphically represents liquidity trends and results of analysis of determinants of Indian banks' liquidity for the time period 2000-2018. First, it examines descriptive statistics of independent and dependent variables employed to explore banks' liquidity and explains the results obtained by applying fixed effect model and random effect model.

LoansTA, LATA, LATD and CATA are indicators of liquidity. The first sub-section graphically represents liquidity trends of banks (considering different ownership structures). The second sub-section shows liquidity trends of different bank sizes.

**Chart 4.1 Liquidity (LoansTA) Trend Analysis of Banks of Different Ownership Structure**




LoansTA represents the ratio of loans over assets. Chart 4.1 shows that nationalized banks maintained the highest ratio of loans over assets, followed by nationalized banks, private banks, SBI and its associates, and foreign banks. Foreign banks showed lowest loans over assets. This implies that nationalized banks provide more loans to customers than private banks, SBI and its associates, and foreign banks. Chart 4.1 also shows that while all banks experienced an upward trend in loan disbursement even in 2008, the trend fell in 2009 after which it picked up again.

**Chart 4.2 Liquidity (LATD) Trend Analysis of Banks of Different Ownership Structure**

Liquid assets over deposits indicate liquidity. Chart 4.2 shows that foreign banks held highest liquidity while SBI and its associates held lowest liquidity during the study period.

**Chart 4.3 Liquidity (CATA) Trend Analysis of Banks of Different Ownership Structure**

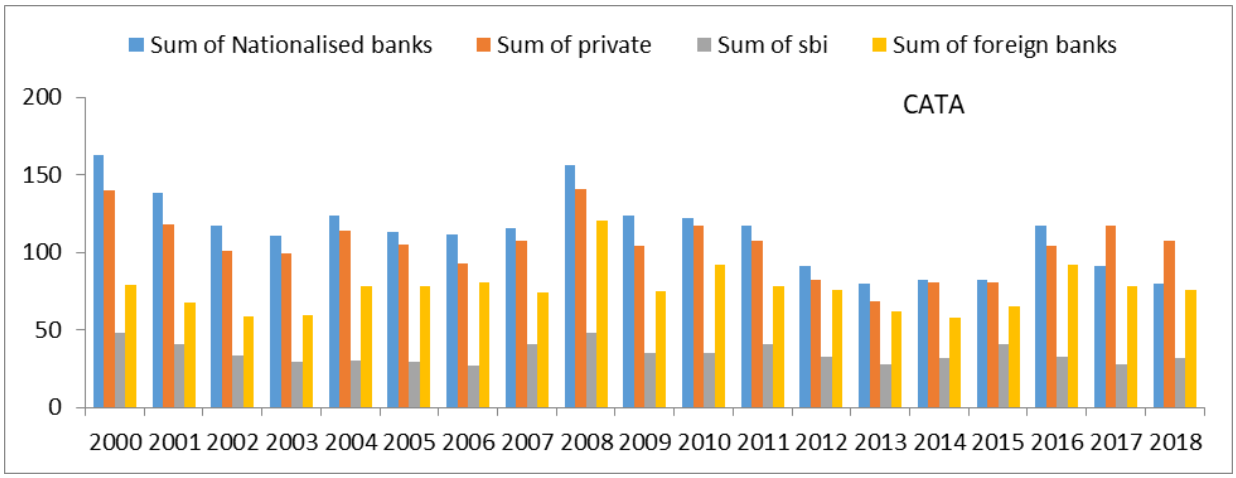



Chart 4.3 shows that nationalized banks maintained highest levels of cash over assets throughout the study time period, i.e. 2000 to 2018, followed by private banks, foreign banks and SBI and its associates. It can be observed that around the year 2008, nationalized, private and foreign banks held highest levels of liquidity in recent years. A sudden dip is observed after this peak.

**Chart 4.4 Liquidity (LATA) Trend Analysis of Banks of Different Ownership Structure**

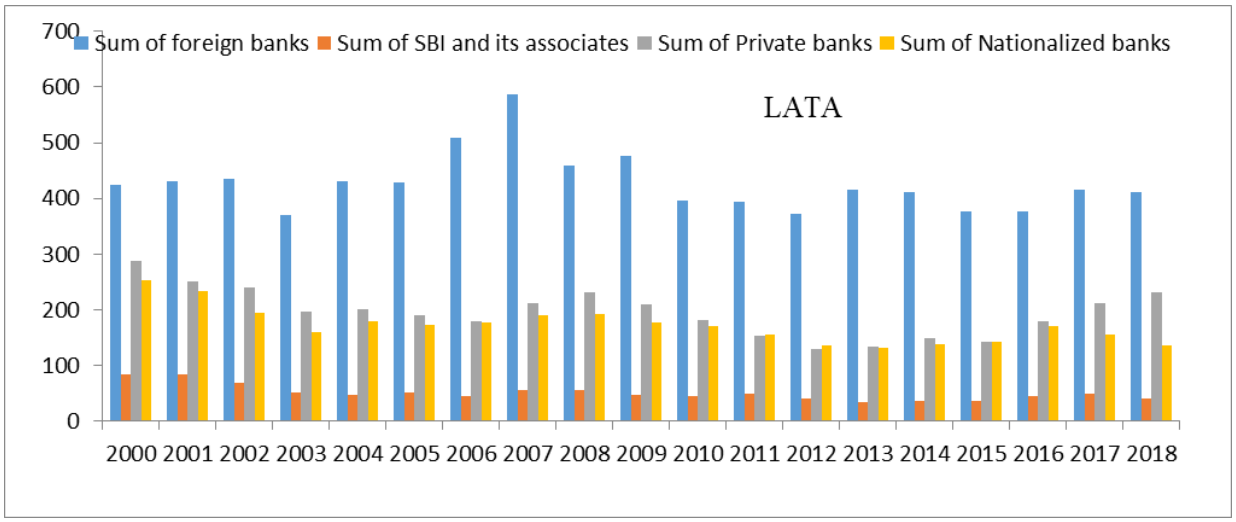



Chart 4.4 represents the trend of LATA in banks (considering ownership). As in most cases above, SBI help lowest LATA ratio while foreign banks held highest LATA ratio. Trends of private and nationalized banks remained close to each other.

**Liquidity trends of banks considering bank size**

**Chart 4.5 Liquidity (LATA) Trend Analysis of Banks of Different Sizes**

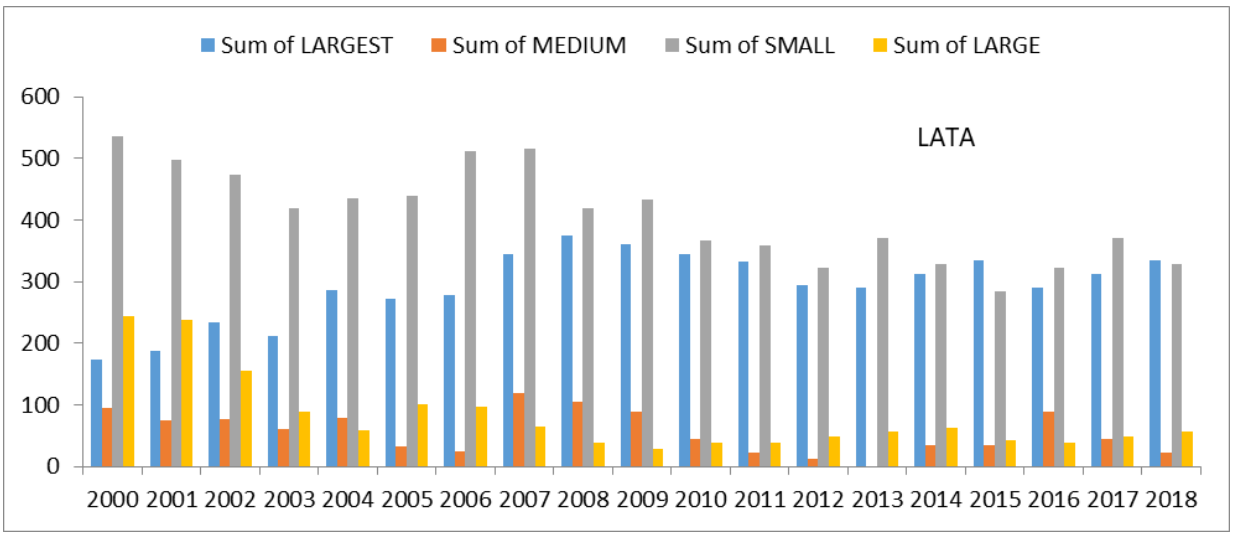



Chart 4.5 shows that small banks maintained highest levels of liquidity followed by largest size banks. Trends of large and medium sized banks get intertwined with each other at times while following their own paths. It is noteworthy that from 2000 to 2018, large banks witnessed a continuous dip in liquidity trends. Further, while liquidity trends of small banks dipped in 2008 and saw a very small rise thereafter, those of largest banks showed increase until 2008 and then kept dipping until 2013.

**Chart 4.6 Liquidity (LATD) Trend Analysis of Banks of Different Sizes**

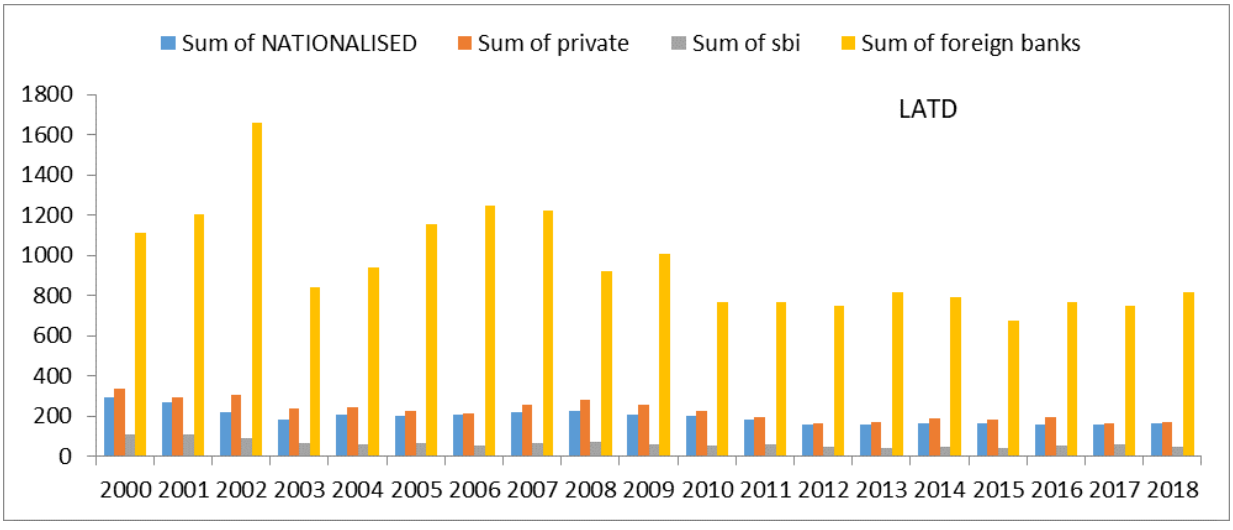



Chart 4.6 shows that small banks maintained highest levels of liquidity amongst all banks, followed by largest banks. For most of the study duration, trends of medium and large sized banks remained close to each other.

**Chart 4.7 Liquidity (CATA) Trend Analysis of Banks of Different Sizes**

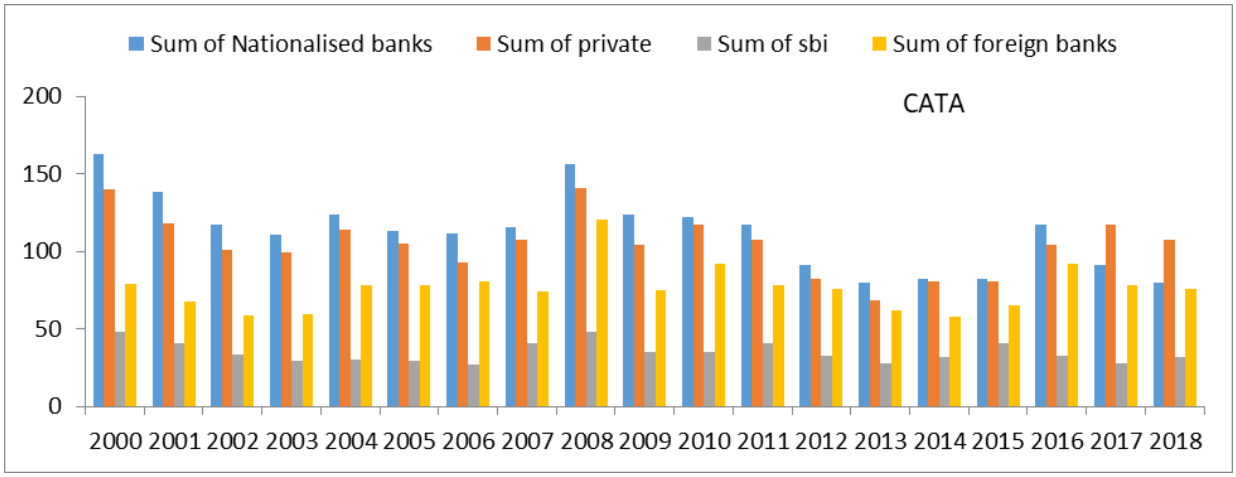



Chart 4.7 indicates that largest sized banks maintained highest level of cash over assets, followed by small sized banks.

**Chart 4.8 Liquidity (LoansTA) Trend Analysis of Banks of Different Sizes**

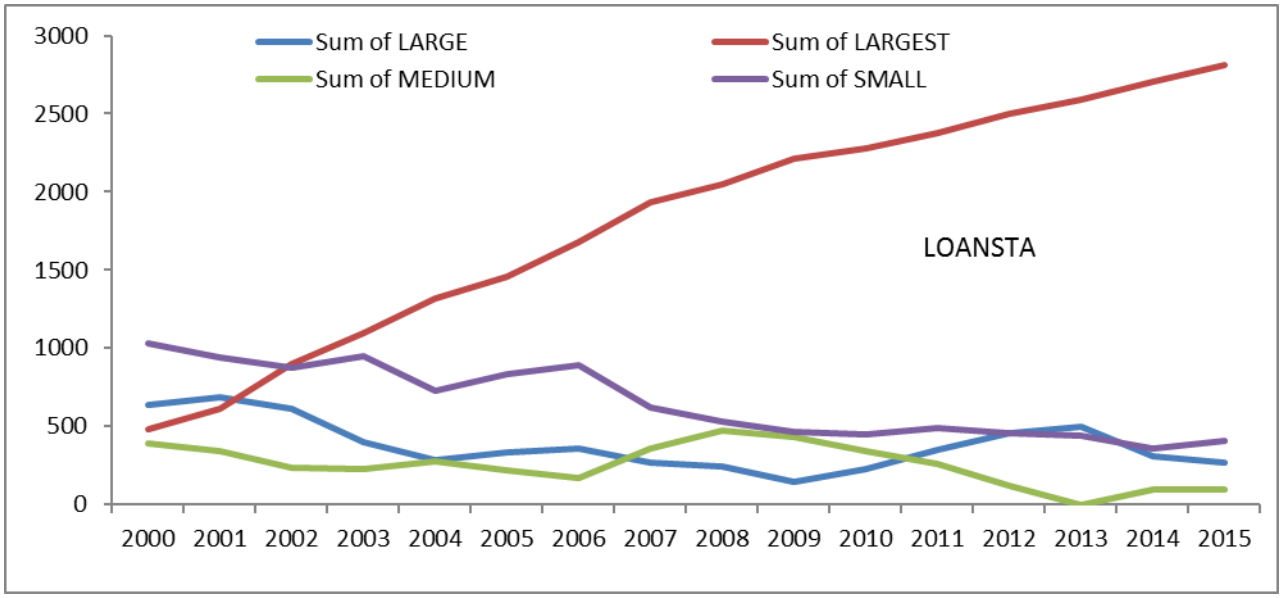



Chart 4.8 shows that by far, largest sized banks held the highest loans over assets ratio.

## SECTION – B

## INFLUECE OF BANK-SPECIFIC AND MACROECONOMIC DETERMINANATS ON LIQUIDITY OF BANKS OPERATING IN INDIA

### 4.3 Determinants of Liquidity of Banks of Small Size

This section of the study explains unit root test, descriptive statistics, correlation matrix and regression analysis of banks operating in India. Banks considered include those with different ownership structures (public, private and foreign) and sizes (small, medium, large and largest). Given below is the asset worth defining bank size:

Small: Upto Rs. 50 billion

Medium: Between Rs. 50 billion and Rs. 100 billion

Large: Between Rs. 100 billion and Rs. 200 billion

Largest: Above Rs. 200 billion

For analysis in this section, bank-specific (size, deposits, profitability, NIM, NPA, COF, capital adequacy) and macroeconomic (GDP, inflation and crisis) variables have been treated as independent. Cash over assets (CATA), loans over assets (LoansTA), liquid assets over total assets (LATA) and liquid assets over deposits (LATD) have been considered dependent variables. First, stationarity of data set was checked; second, descriptive statistics were carried out for the data set; third, correlation analysis was performed; finally, regression analysis was conducted.

#### 4.3.1 Test for stationarity

Before applying panel regression analysis, stationarity test of data sets must be conducted. The data set includes all variables (dependent variables and independent variables), except dummies. Table 4.1 shows result of LLC panel unit root test for regression variables. This study tests without time trend and with time trend of the data series, and checks the presence of unit root. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. It is apparent through the results presented in table 4.1 that non-stationarity is absent in the data series, i.e. data set are stationary.

**Table 4.1: Results of Unit Root Test for Panel data Variables (Full Sample)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -2.94225 | 0.0016 | -3.12627 | 0.0009 |
| **Deposits** | -3.76655 | 0.0001 | -3.72838 | 0.0001 |
| **ROA** | -4.33459 | 0.0000 | -6.04753 | 0.0000 |
| **CAR** | -11.6837 | 0.0000 | -1.33098 | 0.0916 |
| **D(CAR)** | | | -16.7604 | 0.0000 |
| **NIM** | -4.45668 | 0.0000 | -5.18008 | 0.0000 |
| **NPA** | -24.3737 | 0.0000 | -12.5356 | 0.0000 |
| **COF** | -9.63137 | 0.0000 | -8.75564 | 0.0000 |
| **GDP** | -30.1967 | 0.0000 | -27.1972 | 0.0000 |
| **Inflation** | -1.94777 | 0.0257 | 14.4268 | 1.0000 |
| **D(Inflation)** | | | -6.04274 | 0.0000 |
| **CATA** | -6.39396 | 0.0000 | -4.51744 | 0.0000 |
| **LATA** | -8.24464 | 0.0000 | -7.74051 | 0.0000 |
| **LoansTA** | -5.77715 | 0.0000 | 0.42488 | 0.6645 |
| **D(LoansTA)** | | | -9.28219 | 0.0000 |
| **LATD** | -8.62837 | 0.0000 | -8.37786 | 0.0000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 4.3.2 Descriptive Analysis of Dependent and Independent Variables

Table 4.2 demonstrates descriptive statistics related with regression variables. Over the considered period (2000 to 2018), banks operating in India revealed, on average, 13.409% (liquid assets over assets), 23.332% (liquid assets over deposits) and 5.243 % (cash over assets) liquidity. Maximum NPA were 36.040%, while maximum capital over assets was 80.847%. Minimum profitability (ROA) was 0.000%; this indicates that some banks reported nil profitability. Maximum profitability was shown to be 10.230%; this shows that banks were also able to generate return over assets. Average profitability illustrated by banks was 1.302 %; this highlights difference in profitability generated by banks. Maximum cost of funding shown was 12.678% while average cost of funding was 5.843%; this suggests that highest interest paid by banks for funds was 12.678% and average interest paid by banks for funds was 5.843%. It is also revealed that cost of funding rose upto 12.678%, which was significantly more than the minimum cost of funding of 0.325%.

**Table 4.2 Descriptive Statistics of Liquidity Determinants (Full Sample)**

| | Mean | Median | Maximum | Minimum | Std. Dev. |
|---|---|---|---|---|---|
| **LATA** | 13.409 | 9.222 | 76.321 | 1.415 | 12.578 |
| **LATD** | 23.332 | 11.808 | 660.178 | 4.235 | 39.600 |
| **CATA** | 5.243 | 5.041 | 16.104 | 0.205 | 2.177 |
| **LoansTA** | 49.245 | 52.450 | 83.429 | 0.185 | 14.633 |
| **COF** | 5.843 | 5.859 | 12.678 | 0.325 | 1.800 |
| **Deposits** | 73.593 | 82.840 | 103.052 | 6.481 | 18.790 |
| **GDP** | 6.985 | 7.563 | 10.260 | 3.804 | 2.013 |
| **Inflation** | 6.802 | 6.146 | 11.992 | 3.685 | 2.776 |
| **NIM** | 3.054 | 2.923 | 8.540 | 0.609 | 1.031 |
| **NPA** | 2.700 | 1.290 | 36.040 | 0.000 | 3.936 |
| **ROA** | 1.302 | 1.090 | 10.230 | 0.000 | 1.080 |
| **Size** | 14.216 | 14.674 | 19.138 | 8.009 | 2.268 |
| **Crisis** | 0.188 | 0.000 | 1.000 | 0.000 | 0.391 |
| **CAR** | 5.459 | 0.779 | 80.847 | 0.000 | 11.108 |

### 4.3.3 Correlation matrix of Dependent and Independent Variables

Table 4.3 illustrates correlation matrix for banks operating in India. Correlation matrix portrays the degree of association between variables. Variables having high degree of relationship indicate the presence of the problem of multicollinearity.

Table 4.3 presents correlation coefficients of independent and dependent variables; it illustrates high correlation between LATA and LATD. As both are dependent variables and in this study, different models have been developed for each dependent variable, there is no problem of multicollinearity. In case of independent variables, deposits showed high correlation with other independent variables. After transforming deposits, it still showed high correlation with other variables. Hence, we eliminated deposits from the data set. We have taken log of capital and differentiated the size variable to reduce multicollinearity. Thus, the data set has been freed from the multicollinearity problem.

**Table 4.3 Correlation Matrix of Liquidity and its Determinants (Full Sample)**

| | CATA | COF | DSize | GDP | Inflation | LCAR | LATD | LATA | ROA | NPA | NIM | LoansTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1.000 | | | | | | | | | | | |
| **COF** | 0.097 | 1.000 | | | | | | | | | | |
| **DSize** | 0.059 | -0.070 | 1.000 | | | | | | | | | |
| **GDP** | -0.082 | -0.343 | -0.093 | 1.000 | | | | | | | | |
| **Inflation** | 0.018 | -0.133 | 0.099 | 0.158 | 1.000 | | | | | | | |
| **LCAR** | -0.284 | -0.350 | -0.020 | 0.017 | -0.029 | 1.000 | | | | | | |
| **LATD** | -0.271 | -0.316 | -0.043 | -0.034 | -0.072 | 0.423 | 1.000 | | | | | |
| **LATA** | -0.097 | -0.374 | -0.023 | -0.013 | -0.054 | 0.376 | 0.752 | 1.000 | | | | |
| **ROA** | -0.208 | -0.441 | 0.040 | 0.008 | 0.060 | 0.298 | 0.356 | 0.355 | 1.000 | | | |
| **NPA** | -0.018 | 0.285 | -0.183 | -0.199 | -0.363 | 0.068 | 0.180 | 0.080 | -0.214 | 1.000 | | |
| **NIM** | -0.116 | -0.345 | 0.034 | -0.026 | -0.003 | 0.326 | 0.292 | 0.221 | 0.454 | -0.122 | 1.000 | |
| **LoansTA** | 0.189 | 0.268 | 0.054 | 0.036 | 0.294 | -0.425 | -0.530 | -0.654 | -0.308 | -0.179 | -0.095 | 1.000 |

### 4.3.4 Empirical Results and Conclusion

This section presents empirical results of regression applied on panel data models. Models are presented in equations4.5.1, 4.5.2 and 4.5.3. Model specifications have been chosen on the basis of Hausman Test (to select among random effects and fixed effects regression models). Based on Hausman Test, fixed effects estimations were found to be best regression models. Results related with Hausman test and fixed effects estimations are given in table.

Table 4.4 shows results of regression analysis of Model 1, Model 2, Model 3 and Model 4, where liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) were utilised as a proxy of liquidity of banks operating in India. The four models are regressed at significance levels 10%, 5% and 1%.

According to Hausman test for Model 1, fixed effect estimates are accepted for result estimations, so null hypothesis is rejected. Hence, fixed effect model has been chosen to determine the relationship between dependent (LATA) and independent variables. Regression analysis reveals that at a significance level of 1%, profitability and crisis (2007-2009) have a significant positive effect on liquidity. Inflation has a significant, negative effect on liquidity at a significance level of 1%. At significance level of10%, capital shows a significant positive effect on liquidity. The problem of heteroskedasticity has been removed by using robust-standard error.

Regression analysis of Model 2 highlights that at significance level of 1 %, crisis has a significant positive effect on liquidity (LATD). F-statistics highlight model fitness at significance level of 1%. Robust standard error has been applied on data set to remove heteroskedacity. Hausman test has been used to select among fixed effect estimates and random effect estimates. Fixed effect estimates have been selected over random effect estimates because p-value was less than 5%.As a result, null hypothesis is rejected. Hence, Model 2 accepts the fixed effect estimates to explain the association between dependent (LATD) and independent variables.

Regression analysis of Model 3 portrays results of panel data regression where dependent variable is CATA. It illustrates that at a significance level of 1%, capital and crisis (2007-2009) have a significant positive effect on banks' liquidity. On the other hand, cost of funding and GDP show significant negative influence on banks' liquidity at a significance level of 1%. At a significance level of 10%, NPA has a significant positive effect on liquidity. Robust standard error removed the heteroscedasticityproblem from the dataset. Hausman test suggests selection of fixed effect estimates over random effect estimates. So, null hypothesis gets rejected and fixed effect estimations are accepted. Therefore, present model accepts the

fixed effect estimates to explain the association between dependent (CATA) and independent variables.

Model 4 regression estimates reveal that at 1% significance level, NIM has a significant positive effect on banks' liquidity. Capital and profitability have a significant negative effect on liquidity at a significance level of 1%. At 1% significance level, macroeconomic variable - inflation - has a significant negative impact on liquidity (LoansTA).At 1% significance level, F-statistics highlight model fitness of 1%. Heteroscedasticityproblem has been removed from data set using robust standard error. Hausman test p-value is 0.000, which indicates that the fixed effect estimations be selected for result estimations and rejection of null hypothesis. Therefore, Model 4 accepts fixed effect estimations and describes the influence of independent variables on dependent variables (LoansTA).

From the estimations of Model 1, Model 2, Model 3 and Model 4, it can be concluded that among bank-specific variables, NPA, NIM, profitability, cost of funding, and capital are key determinants of bank liquidity. Macroeconomic variables - crisis, inflation and GDP - have a significant effect on liquidity.

**Table 4.4 Results of Regression Analysis of Panel Data (Full Sample)**
**(Dependent Variable: Liquidity)**

| | | | | |
|---|---|---|---|---|
| | **CATA**<br>**Coef.**<br>**Std. Err.** | **LoansTA Coef.**<br>**Std. Err.** | **LATA**<br>**Coef.**<br>**Std. Err.** | **LATD**<br>**Coef.**<br>**Std. Err.** |
| **Dsize** | -0.554<br>(0.366) | -0.048<br>(3.136) | -3.290<br>(2.437) | -13.527<br>(10.799) |
| **Inflation** | -0.040<br>(0.027) | **1.436*****<br>**(0.163)** | **-0.404*****<br>**(0.139)** | -0.410<br>(0.680) |
| **GDP** | **-0.186*****<br>**(0.034)** | 0.009<br>(0.156) | -0.231<br>(0.210) | 0.095<br>(0.745) |
| **LCAR** | **0.460*****<br>**(0.169)** | **-6.272*****<br>**(1.743)** | **2.352***<br>**(1.356)** | 5.635<br>(3.827) |
| **NPA** | 0.036*<br>(0.021) | -0.370<br>(0.237) | 0.007<br>(0.149) | 1.759<br>(1.549) |
| **COF** | **-0.163*****<br>**(0.060)** | -0.344<br>(0.345) | -0.213<br>(0.551) | -0.072<br>(1.996) |
| **ROA** | -0.003<br>(0.089) | **-2.362*****<br>**(0.651)** | **1.700*****<br>**(0.588)** | 5.336<br>(4.190) |
| **NIM** | -0.102<br>(0.144) | **2.459*****<br>**(0.811)** | -1.013<br>(0.718) | 3.960<br>(7.966) |
| **Crisis** | **1.090*****<br>**(0.121)** | -0.353<br>(0.805) | **2.615*****<br>**(0.588)** | **5.527*****<br>**(1.887)** |
| **Constant** | **7.866*****<br>**(0.766)** | **37.836*****<br>**(3.440)** | **20.089*****<br>**(4.878)** | 3.670<br>(39.707) |

| | | | | |
|---|---|---|---|---|
| **$R^2$ within** | 0.132 | 0.332 | 0.119 | 0.101 |
| **$R^2$ overall** | 0.000 | 0.291 | 0.221 | 0.281 |
| **F-statistic** | 15.89 | 18.01 | 15.80 | 3.94 |
| **Robust hausman test** | 0.000 | 0.000 | 0.000 | 0.000 |
| **No. Of obs.** | 1005 | 1005 | 1005 | 1005 |
| **No. of group** | 63 | 63 | 63 | 63 |

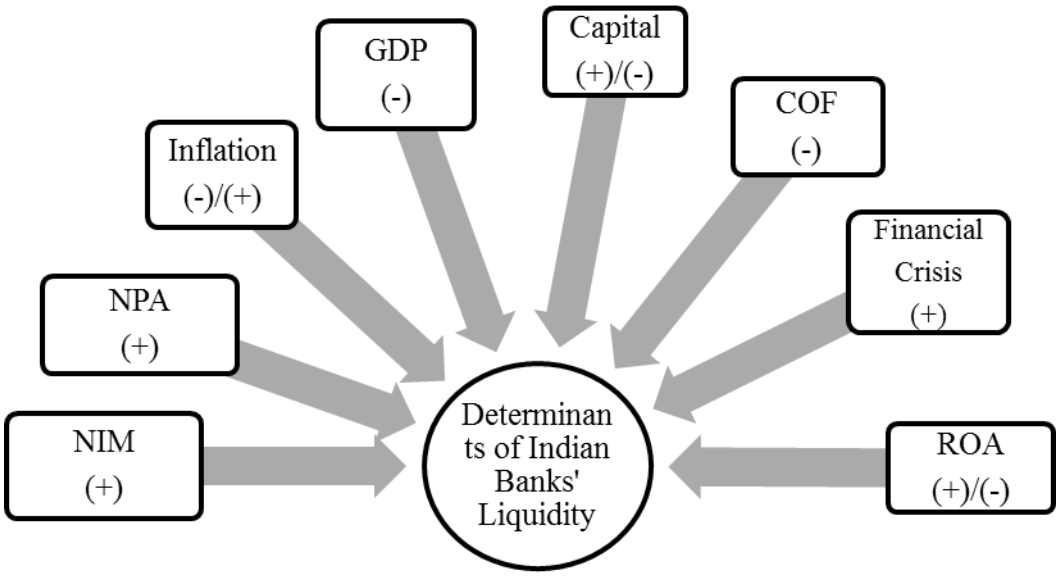



**Figure 4.9: Determinants of Liquidity**

## EFFECT OF DETERMINANTS ON BANK LIQUIDITY IN DIFFERENT TIME PERIOD

### 4.4 Introduction

This section investigates how bank-specific and macroeconomic determinants influence liquidity of banks in times before, during and after crisis. This section examines hypotheses I and II of the study given in chapter 1.This section of the study explains unit root test, descriptive statistics, correlation matrix and regression analysis of banks operating in India. Banks considered include those with different ownership structures (public, private and foreign) and sizes (small, medium, large and largest).

For analysis in this section, bank-specific (size, deposits, profitability, NIM, NPA, COF, capital adequacy) and macroeconomic (GDP, inflation and crisis) variables have been treated as independent. Cash over assets (CATA), loans over assets (LoansTA), liquid assets over total assets (LATA) and liquid assets over deposits (LATD) have been considered dependent variables.

First, stationarity of data set was checked; second, descriptive statistics were carried out for the data set; third, correlation analysis was performed; finally, to analyse the effect of specific time-periods on determinants and the effect of determinants on bank liquidity, interaction of different time-periods (pre-crisis, crisis and post-crisis) with liquidity determinants was examined.

### 4.5 Test for Stationarity

Before applying panel regression analysis, stationarity test of data sets must be conducted. The data set includes all variables (dependent variables and independent variables) except dummies. Table (4.5) shows LLC panel unit root test results for regression variables. This study tests without time trend and with time trend of the data series, and checks the presence of unit root. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. It is apparent through the results presented in table (4.5) that non-stationarity is absent in the data series, i.e. data sets are stationary.

**Table 4.5: Results of Unit Root Test for Panel data Variables**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -2.94225 | 0.0016 | -3.12627 | 0.0009 |
| **Deposits** | -3.76655 | 0.0001 | -3.72838 | 0.0001 |
| **ROA** | -4.33459 | 0.0000 | -6.04753 | 0.0000 |
| **CAR** | -11.6837 | 0.0000 | -1.33098 | 0.0916 |
| **D(CAR)** | | | -16.7604 | 0.0000 |
| **NIM** | -4.45668 | 0.0000 | -5.18008 | 0.0000 |
| **NPA** | -24.3737 | 0.0000 | -12.5356 | 0.0000 |
| **COF** | -9.63137 | 0.0000 | -8.75564 | 0.0000 |
| **GDP** | -30.1967 | 0.0000 | -27.1972 | 0.0000 |
| **Inflation** | -1.94777 | 0.0257 | 14.4268 | 1.0000 |
| **D(Inflation)** | | | -6.04274 | 0.0000 |
| **CATA** | -6.39396 | 0.0000 | -4.51744 | 0.0000 |
| **LATA** | -8.24464 | 0.0000 | -7.74051 | 0.0000 |
| **LoansTA** | -5.77715 | 0.0000 | 0.42488 | 0.6645 |
| **D(LoansTA)** | | | -9.28219 | 0.0000 |
| **LATD** | -8.62837 | 0.0000 | -8.37786 | 0.0000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

## 4.6 Descriptive statistics of independent and dependent variables during pre-crisis, crisis and post-crisis periods

**Table 4.6 Descriptive analysis of Liquidity and its Determinants during Pre-crisis period**

| | **Mean** | **Maximum** | **Minimum** | **Standard Deviation** |
|---|---|---|---|---|
| **CAR** | 5.778 | 80.847 | 0.000 | 12.329 |
| **CATA** | 5.416 | 16.104 | 0.205 | 2.461 |
| **COF** | 6.150 | 12.678 | 1.170 | 1.932 |
| **Deposits** | 74.241 | 92.911 | 6.481 | 19.550 |
| **GDP** | 6.686 | 9.285 | 3.804 | 2.276 |
| **Inflation** | 4.293 | 6.146 | 3.685 | 0.794 |
| **NIM** | 3.078 | 8.540 | 0.609 | 1.089 |
| **NPA** | 4.495 | 36.040 | 0.000 | 5.109 |
| **ROA** | 1.226 | 9.640 | -3.380 | 1.140 |
| **Size** | 13.462 | 17.716 | 8.009 | 2.038 |
| **LoansTA** | 42.980 | 70.659 | 0.185 | 12.968 |
| **LATA** | 14.482 | 70.460 | 1.830 | 11.905 |
| **LATD** | 27.545 | 660.178 | 5.322 | 52.012 |

Table 4.6 shows descriptive analysis of variables utilized in regression models of panel data set of banks pertaining to pre-crisis (2000-2006) period. The table reveals significant statistical values of the study variables. During pre-crisis period, banks held an average liquidity of 14.482% (liquid assets over assets), 5.416% (cash over assets), and 27.545% (liquid

assets over deposits). Maximum profitability (ROA) reported by banks during the pre-crisis period was 9.640% while minimum profitability was -3.380%. Average profitability was 1.226% which is quite lower than maximum profitability. Minimum NPA shown is 0.000%; this suggests that during the pre-crisis period, banks were able to receive full loan repayment. Maximum NPA reported was 36.040%which is higher than the maximum profitability of banks. It is clear that pre-crisis, banks generated significant amounts of NPA.

**Table 4.7 Descriptive analysis of Liquidity and its Determinants during Crisis period**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **CAR** | 5.844 | 57.051 | 0.003 | 10.995 |
| **CATA** | 6.043 | 13.964 | 0.783 | 2.159 |
| **COF** | 5.443 | 8.679 | 0.587 | 1.456 |
| **Deposits** | 73.687 | 89.954 | 18.971 | 17.785 |
| **GDP** | 6.993 | 8.608 | 3.891 | 2.200 |
| **Inflation** | 8.533 | 10.877 | 6.370 | 1.849 |
| **LATD** | 25.351 | 205.666 | 5.171 | 30.327 |
| **LATA** | 15.318 | 72.727 | 2.363 | 13.115 |
| **LoansTA** | 51.438 | 76.911 | 5.529 | 14.544 |
| **NIM** | 3.095 | 7.001 | 1.361 | 1.089 |
| **NPA** | 0.925 | 14.960 | 0.000 | 1.475 |
| **ROA** | 1.477 | 10.230 | -1.250 | 1.297 |
| **Size** | 14.263 | 18.384 | 8.191 | 2.254 |

Table 4.7 shows descriptive analysis of variables utilized in regression models of panel data set of banks pertaining to crisis (2007-2009) period. The table reveals significant statistical values of the study variables. During crisis, banks held average liquidity of 15.318% (liquid assets over assets), 6.043% (cash over assets), and 25.351% (liquid assets over deposits). Maximum profitability (ROA) reported by banks during crisis was 10.230%, while minimum profitability was -1.250%. Average profitability was 1.477% which is significantly lower than maximum profitability.

**Table 4.8 Descriptive analysis of Liquidity and its Determinants during Post-crisis period**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **CAR** | 4.886 | 51.162 | 0.001 | 9.536 |
| **CATA** | 4.632 | 10.578 | 0.715 | 1.585 |
| **COF** | 5.682 | 11.513 | 0.325 | 1.739 |
| **Deposits** | 72.779 | 103.052 | 20.597 | 18.382 |
| **GDP** | 7.335 | 10.260 | 5.619 | 1.453 |
| **Inflation** | 8.891 | 11.992 | 5.872 | 2.220 |
| **LATA** | 11.174 | 76.321 | 1.415 | 12.780 |
| **LoansTA** | 55.541 | 83.429 | 1.756 | 13.499 |
| **NIM** | 3.005 | 7.342 | 0.918 | 0.926 |

| | | | | |
|---|---|---|---|---|
| **NPA** | 1.477 | 11.930 | 0.000 | 1.683 |
| **ROA** | 1.201 | 7.050 | -3.320 | 0.993 |
| **Size** | 15.085 | 19.138 | 8.277 | 2.223 |
| **LATD** | 17.328 | 139.535 | 4.235 | 22.365 |

Table 4.8 shows descriptive analysis of variables utilized in regression models of panel data set of banks pertaining to post-crisis (2010-2018) period. The table reveals significant statistical values of the study variables. In the post crisis period, banks held an average liquidity of 11.174% (liquid assets over assets), 4.632% (cash over assets), and 17.328% (liquid assets over deposits). Maximum profitability (ROA) reported by banks post crisis was 7.050% while minimum profitability shown was -3.320%. Average profitability was 1.201% which is significantly lower than maximum profitability. Minimum NPA shown was 1.477%; this suggests that post crisis, banks were able to receive full loan repayment. Maximum NPA presented was 11.930% which is higher than the maximum profitability of post crisis period banks; this indicates that post crisis, banks generated significant amounts of NPA.

## 4.7 Correlation Matrix

Table 4.9 illustrates correlation matrix for banks operating in India. Correlation matrix portrays the degree of association between variables. Variables having high degree of relationship indicate the presence of the problem of multicollinearity.

Table 4.9 presents correlation coefficients of independent and dependent variables; it illustrates high correlation between LATA and LATD. As both are dependent variables and in this study different models have been developed for each dependent variable, there is no problem of multicollinearity. In case of independent variables, deposits showed high correlation with other independent variables. After transforming deposits, it still showed high correlation with other variables. Hence, we eliminated deposits from the data set. We have taken log of capital and differentiated the size variable to reduce multicollinearity. Thus, the data set has been freed from the multicollinearity problem.

**Table 4.9 Correlation Matrix of variables**

| | CATA | COF | DSize | GDP | Inflation | LCAR | LATD | LATA | ROA | NPA | NIM | LoansTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1.000 | | | | | | | | | | | |
| **COF** | 0.097 | 1.000 | | | | | | | | | | |
| **DSize** | 0.059 | -0.070 | 1.000 | | | | | | | | | |
| **GDP** | -0.082 | -0.343 | -0.093 | 1.000 | | | | | | | | |
| **Inflation** | 0.018 | -0.133 | 0.099 | 0.158 | 1.000 | | | | | | | |
| **LCAR** | -0.284 | -0.350 | -0.020 | 0.017 | -0.029 | 1.000 | | | | | | |
| **LATD** | -0.271 | -0.316 | -0.043 | -0.034 | -0.072 | 0.423 | 1.000 | | | | | |
| **LATA** | -0.097 | -0.374 | -0.023 | -0.013 | -0.054 | 0.376 | 0.752 | 1.000 | | | | |
| **ROA** | -0.208 | -0.441 | 0.040 | 0.008 | 0.060 | 0.298 | 0.356 | 0.355 | 1.000 | | | |
| **NPA** | -0.018 | 0.285 | -0.183 | -0.199 | -0.363 | 0.068 | 0.180 | 0.080 | -0.214 | 1.000 | | |
| **NIM** | -0.116 | -0.345 | 0.034 | -0.026 | -0.003 | 0.326 | 0.292 | 0.221 | 0.454 | -0.122 | 1.000 | |
| **LoansTA** | 0.189 | 0.268 | 0.054 | 0.036 | 0.294 | -0.425 | -0.530 | -0.654 | -0.308 | -0.179 | -0.095 | 1.000 |

## 4.8 Regression Analysis

This section studies how the effect of liquidity determinants on bank liquidity differs in pre-crisis (2000 to 2006), crisis (2007 to 2009) and post-crisis periods (2010 to 2018). Models are presented in equations 6.1, 6.2 and 6.3. Model specification has been chosen on the basis of Hausman Test (to select among random effects and fixed effects regression models). Based on Hausman Test, fixed effects estimations were found to be best regression models. Results related to Hausman test and fixed effects estimations are given in table.

Table 4.10 shows results of regression analysis of Model 1, Model 2, Model 3 and Model 4, where liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) were utilised as proxy of liquidity of banks operating in India. The four models are regressed at significance levels 10%, 5% and 1%.

On the basis of Hausman test applied to Model 1, fixed effect estimates are accepted for result estimations, so null hypothesis gets rejected. Hence, fixed effect model has been chosen to determine the relationship between dependent (LATA) and independent variables (bank-specific and macroeconomic factors). The problem of heteroskedasticity has been removed by using robust- standard error. Pre-crisis period analysis suggests that at 1% significance level, GDP has a significant negative effect on liquidity. At a significance level of 10%, profitability has a significant positive effect on liquidity. Crisis period analysis for various variables suggests that GDP has a significant positive impact on liquidity at a significance level of 1%. At a significance level of 5%, capital has a significant positive impact on liquidity. At a significance level of 10%, size has a significant negative impact on liquidity. Post crisis period estimations suggest that during 2010 to 2015, GDP and deposits had a significant positive effect on liquidity at a significance level of 5%. Post crisis period shows a significant negative effect on liquidity.

Empirical analysis of Model 2 shows that during pre-crisis period (2000 to 2006), at a significance level of 1%, deposits have a significant negative effect on liquidity. During crisis period (2007 to 2009), at a significance level of 1%, bank size has a significant negative effect on liquidity. At a significance level of 10%, inflation and NIM have a significant negative effect on liquidity. At a significance level of 5%, COF and profitability have a significant positive effect on liquidity. During post crisis period (2010-2015), at significance level of 1%, deposits have a significant positive effect on liquidity. At a significance level of 10%, post crisis period and size have a significant negative effect on liquidity. GDP has a significant positive effect on banks' liquidity at a significance level of 10%. F-statistics highlights model

fitness at significance level of 1%. Robust standard error has been applied on data set to remove heteroscedasticity. Hausman test has been used to select among fixed effect estimates and random effect estimates. If the p-value is less than 5%, fixed effect estimates are selected over random effect estimates; thus, null hypothesis is rejected. Hence, Model 2 accepts the fixed effect estimates to explain the association between dependent (LATD) and independent variables.

Regression analysis of Model 3 outlines results of panel data regression, where dependent variable is CATA. Analysis shows that during pre-crisis period, at a significance level of 1%, bank size and GDP have a significant negative effect on liquidity (CATA). Deposits show a significant positive effect on liquidity at a significance level of 1%. At a significance level of 5%, capital has a significant positive effect on liquidity. Studied variables during crisis period suggest that at a significance level of 1%, GDP has a significant negative effect on liquidity. At a significance level of 10%, profitability showed a significant negative effect on liquidity and crisis displayed a significant positive effect on liquidity. Relationship of post crisis period (2010-2015) with liquidity determinants has been studied and it has been found that post crisis period has a significant negative effect on liquidity at a significance level of 5%. GDP has a significant positive effect on liquidity during post crisis period at a significance level of 1%. Size has a significant positive effect on liquidity at a significance level of 5%. COF has a significant negative effect on liquidity at a significance level of 5%. At a 10% significance level, NPA has a significant negative effect on liquidity. Robust standard error removed heteroscedasticity from the dataset. Hausman test suggests that fixed effect estimates be selected over random effect estimates. So, null hypothesis gets rejected and fixed effect estimations are accepted for estimations. Therefore, present model accepts fixed effect estimates to explain the association between dependent (CATA) and independent variables.

Model 4 regression estimations explain that during pre-crisis period (2000 to 2006), at a significance level of 1%, inflation and NIM have a significant positive effect on liquidity while capital has a significant negative effect on liquidity. At a 5% significance level, profitability has a significant negative effect on liquidity. Crisis period empirical analysis reveals that inflation has a significant negative effect on liquidity at a significance level of 1% and at the same significance level, deposits has a significant positive effect on liquidity. At 5% significance level, GDP has a significant negative effect on liquidity. Post crisis period analysis shows that at a significance level of 1%, inflation has a significant negative impact on liquidity. At 5% significance level, deposits have a significant positive effect on liquidity. At 10% significance level, GDP shows a significant negative impact on liquidity.

At a significance level of 1%, F-statistics highlights model fitness of 1%. heteroscedasticity problem has been removed from data set using robust standard error. Hausman test p-value is 0.000 which indicates that fixed effect estimations should be selected for result estimations and rejection of null hypothesis. Therefore, Model 4 accepts fixed effect estimations and describes the influence of independent variables on dependent variables (LoansTA).

Thus, from the estimations of Model 1, Model 2, Model 3 and Model 4, it can be concluded that among bank-specific variables, NPA, NIM, profitability, cost of funding, and capital are key determinants of banks' liquidity. Macroeconomic variables -crisis, inflation and GDP - have a significant effect on liquidity.

**Table 4.10 Interaction between liquidity determinants and different time duration (pre-crisis, crisis & post crisis period)**

| | CATA<br>Coef.<br>Std. Err. | LATA<br>Coef.<br>Std. Err. | LATD<br>Coef.<br>Std. Err. | LoansTA<br>Coef.<br>Std. Err. |
|---|---|---|---|---|
| ***Post-Crisis X dSize*** | 1.528<br>0.929 | -4.078<br>5.305 | -14.139<br>13.889 | -2.003<br>5.597 |
| ***Crisis X dSize*** | 1.268<br>0.997 | -9.024<br>5.540 | **-41.562****<br>**18.862** | 7.211<br>6.508 |
| ***Dsize*** | **-1.939****<br>**0.772** | 0.635<br>4.690 | 2.331<br>14.345 | -0.940<br>3.927 |
| ***Inflation*** | -0.123<br>0.119 | 0.568<br>0.655 | 3.984<br>2.412 | **2.446*****<br>**0.461** |
| ***Post-Crisis X Inflation*** | 0.185<br>0.123 | -0.622<br>0.668 | -3.653<br>2.397 | **-2.516*****<br>**0.587** |
| ***Crisis X Inflation*** | 0.119<br>0.134 | -1.511<br>0.912 | **-6.703****<br>**3.185** | **-2.086*****<br>**0.605** |
| ***Post-Crisis X GDP*** | **0.366*****<br>**0.064** | **1.308*****<br>**0.466** | **2.641****<br>**1.281** | -0.901<br>0.589 |
| ***Crisis X GDP*** | **-0.287*****<br>**0.068** | **1.394*****<br>**0.375** | **2.857*****<br>**0.950** | **-0.899****<br>**0.411** |
| ***GDP*** | **-0.158****<br>**0.063** | **-1.132*****<br>**0.402** | **-2.207****<br>**1.085** | 0.503<br>0.412 |
| ***LCAR*** | 0.204<br>0.125 | 2.100<br>1.461 | **9.556***<br>**5.105** | **-4.250****<br>**1.682** |
| ***Crisis X CAR*** | 0.250<br>0.206 | **2.467*****<br>**0.917** | -3.728<br>4.640 | **-3.906****<br>**1.794** |
| ***Post-Crisis X CAR*** | 0.140<br>0.207 | -0.505<br>1.173 | -8.910<br>5.345 | -2.342<br>1.470 |
| ***Post-Crisis*** | -0.077<br>0.059 | 0.302<br>0.393 | -0.798<br>1.317 | -0.658<br>0.412 |
| ***Crisis X NPA*** | -0.045<br>0.059 | -0.046<br>0.265 | -0.433<br>0.945 | -0.460<br>0.561 |
| ***NPA*** | 0.005<br>0.022 | -0.104<br>0.176 | 2.020<br>1.753 | 0.098<br>0.207 |

| | | | | |
|---|---|---|---|---|
| ***Post-Crisis X COF*** | **-0.268*** ** | 0.226 | **4.392** ** | **1.288*** |
| | **0.093** | 0.775 | **1.924** | **0.731** |
| ***Crisis X COF*** | 0.015 | 1.747 | **5.102*** | 1.105 |
| | 0.141 | 1.162 | **2.848** | 1.153 |
| ***COF*** | -0.059 | -0.784 | -2.777 | -0.567 |
| | 0.078 | 0.789 | 1.882 | 0.605 |
| ***Post-Crisis X ROA*** | -0.141 | 0.216 | 3.157 | 0.131 |
| | 0.143 | 1.776 | 6.720 | 1.540 |
| ***Crisis X ROA*** | **-0.248** ** | 0.679 | 7.003 | -1.323 |
| | **0.112** | 0.676 | 5.297 | 0.908 |
| ***ROA*** | 0.011 | **1.414** ** | 3.818 | **-1.467** ** |
| | 0.111 | **0.662** | 5.527 | **0.717** |
| ***Post-Crisis X NIM*** | 0.035 | -0.039 | -9.721 | -1.327 |
| | 0.218 | 1.192 | 10.275 | 1.567 |
| ***Crisis X NIM*** | 0.134 | -0.392 | -14.185 | 0.907 |
| | 0.193 | 1.294 | 10.341 | 1.476 |
| ***NIM*** | -0.039 | -1.111 | 9.131 | **3.353*** ** |
| | 0.175 | 0.968 | 11.146 | **1.082** |
| ***Crisis*** | 1.892 | -7.032 | 37.003 | **14.714*** |
| | 1.170 | 10.636 | 46.144 | **8.350** |
| ***Post-Crisis*** | **-3.008*** ** | -10.851 | -3.777 | **26.964*** ** |
| | **0.878** | 10.080 | 40.680 | **9.011** |
| ***Constant*** | **7.754*** ** | **26.442*** ** | -0.210 | **23.913*** ** |
| | **1.189** | **9.297** | 57.157 | **6.668** |
| ***R2(within)*** | 0.2756 | 0.1850 | 0.1951 | 0.4992 |
| ***R2(overall)*** | 0.0498 | 0.2299 | 0.2932 | 0.3783 |
| ***F-statistics*** | 19.21 | 27.73 | 5.67 | 31.30 |
| ***Robust Hausman test*** | 0.000 | 0.000 | 0.000 | 0.000 |
| ***No. Of observations*** | 1006 | 1006 | 1006 | 1006 |
| ***No. Of groups*** | 63 | 63 | 63 | 63 |

Pictorial presentation of results in different time periods (Pre-crisis period, crisis period and post-crisis period)

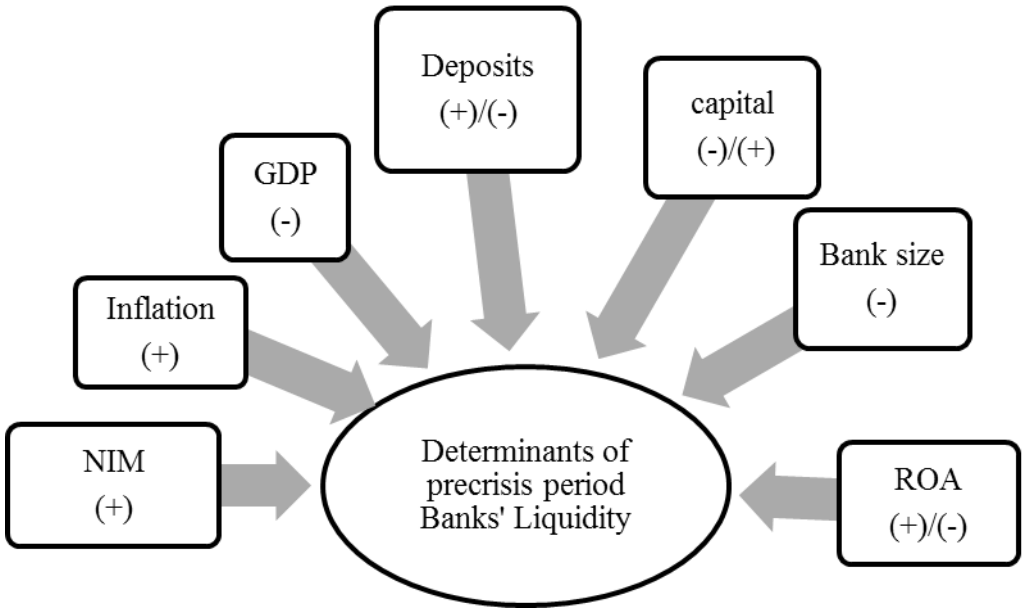



**Figure 4.10: Determinants of Liquidity during pre-crisis period**

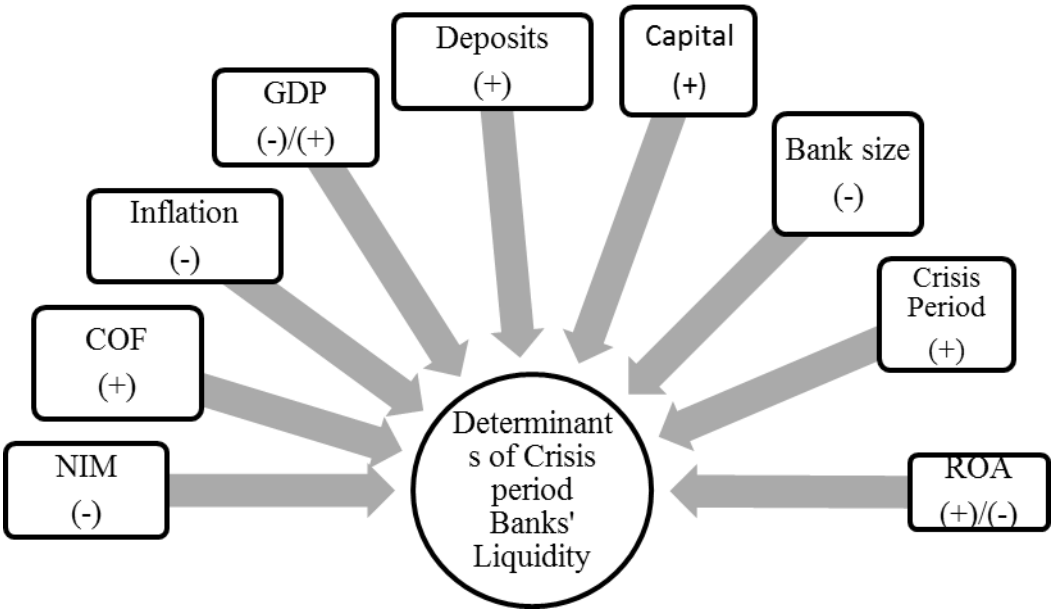



**Figure 4.11: Determinants of Liquidity during crisis period**

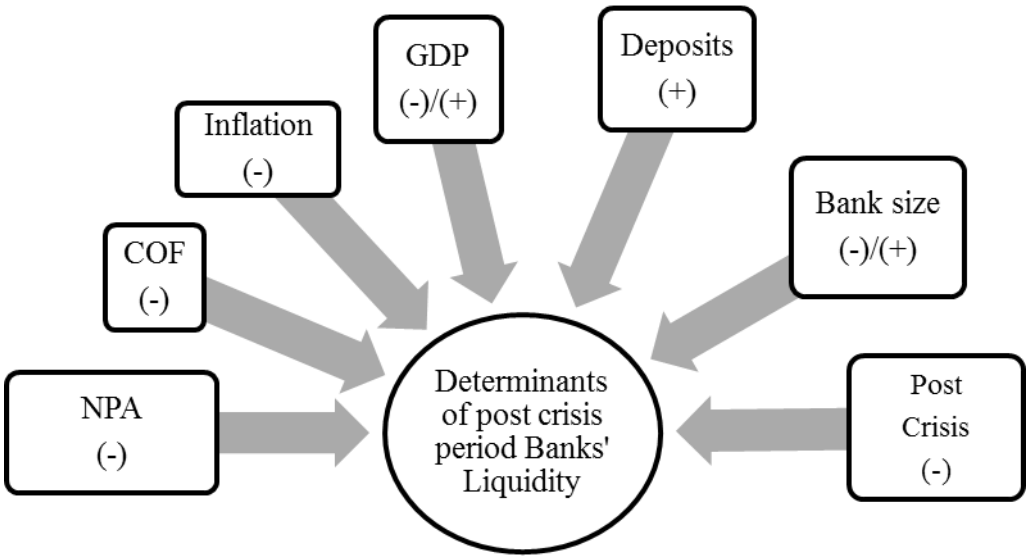



**Figure 4.12: Determinants of Liquidity during post- crisis period**

## 4.9 CONCLUSION

This chapter explored the impact of various bank-specific and macroeconomic variables on liquidity of banks operating in India during 2000-2015. This time period was classified into pre-crisis (2000-2006), crisis (2007- 2009) and post-crisis (2010-2018) periods). Liquidity was measured by four variables - - liquid assets over assets, liquid assets over deposits, cash over assets and loans over assets. For analyses, all bank-specific variables and macroeconomic variables were run on dependent variables (LATA, LATD, CATA and LoansTA). Heteroscedasticitytest was run on data test to remove heteroscedasticityproblem from the data set. Additionally, Hausman test was performed to choose between fixed effect regression and random effect regression.

Regression was applied on Model 1, Model 2, Model 3 and Model 4, and based on Hausman test, fixed effect estimations were chosen for all model regression estimations. On the basis of empirical analysis, it was concluded that bank-specific variables and macroeconomic variables influenced liquidity of banks operating in India. Among bank-specific factors, profitability, capital, NPA, COF and NIM were key liquidity determinants of liquidity; among macroeconomic variables, crisis, inflation and GDP emerged significant factors that affected liquidity of banks operating in India.

Crisis period (2007 to 2009) showed significant positive effect on liquidity. This highlights the fact that during a critical situation such as a financial crisis, Indian banks increase liquidity to combat liquidity crunch and maintain stability. Profitability was found to

have a negative effect on liquidity; this explains the association between liquidity and profitability of banks in India. It also means that as banks' profitability increases, their liquidity decreases Inflation shows significant negative effect on liquidity. This implies that as inflation rises, bank liquidity decreases.

# CHAPTER 5

# IMPACT OF DIFFERENT OWNERSHIP STRUCTURES ON LIQUIDITY OF BANKS OPERATING IN INDIA

## 5.1 Introduction

This section explores the association between ownership structure and liquidity of banks operating in India. The chapter answers the following question:

- Does impact of liquidity determinants on liquidity of banks operating in India vary with change of bank ownership structure?

This section lays the foundation for stage III and stage IV of the study and examines hypotheses III and IV. The aim of present chapter is to analyse:

Whether there is a significant association between ownership structure and effect of bank-specific and macro-economic variables on banks' liquidity. Further, if such an association exists, then how does the influence of the aforementioned variables change with change in ownership structure? The hypotheses are tested with the help of various bank-specific and macro-economic variables. The variables are chosen on the basis of reviewed literature. Panel data technique has been applied to investigate the impact of these variables on liquidity of banks with different ownership structures.

This chapter is divided into four parts. The first part presents empirical results and discusses liquidity determinants of public sector banks operating in India. The second part presents empirical results and discusses liquidity determinants of private sector banks operating in India. The third part lays down empirical results and discusses liquidity determinants of foreign banks operating in India. The fourth part of the chapter comprises findings of empirical analyses and conclusion.

## 5.2 Ownership Structure and Changes in Liquidity of Banks Operating in India

It is clear from the literature reviewed in chapter 2 that there is a gap in literature regarding the association between bank liquidity and ownership structure. While the literature review shows that some studies have observed the association between liquidity and ownership structure of banks, no study has explored this relationship in the context of Indian banks. Results given in chapter 5 indicate that different ownership structures differently and significantly impact liquidity determinants. Bank-specific and macro-economic factors influence liquidity of banks (operating in India) with different ownership structures.

Analyses carried out in this chapter empirically examine the association between bank liquidity and liquidity determinants considering different ownership structures of banks. Regression analysis has been performed on panel regression models of banks with different ownership structures.

## 5.3 Modelling of Dependent Variable (Liquidity) and Independent Variables (Liquidity Determinants) with Different Ownership Structures of Banks Operating in India.

To set up a statistical association among liquidity determinants and bank liquidity with change in bank ownership, panel regression models have been used. This chapter regresses bank-specific (size, deposits, capital adequacy, profitability, non-performing assets, net interest margin and cost of funding) and macro-economic factors (crisis, GDP and inflation) over liquidity (liquid assets over total assets, liquid assets over deposits, cash over assets, and loans over assets). The chapter includes bank-specific variables and macro-economic variables as independent variables and liquidity as the dependent variable. Banks' liquidity and liquidity determinants models are defined as follows:

Models shown below-

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it}$$

**(5.1)**

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it}$$

**(5.2)**

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it}$$

**(5.3)**

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it}$$

**(5.4)**

Where, $LATA_{it}$ , $LATD_{it}$, $CATA_{it}$ and $LoansTA_{it}$represent annual liquidity of i[th] bank of different ownership at t[th] time period; $Deposits_{it}$, $ROA_{it}$ $NPA_{it}$ $NIM_{it}$, $Size_{it}$, $NIM_{it}$ and $COF_{it}$ denote deposits, profitability, non-performing assets, net interest margin, size and cost of funding of i[th] bank at the t[th] time period. $\varepsilon_{it}$ captures error terms for i = 1,2,……., N cross-sectional units (i.e. 63 banks) observed for dated period t= 1,2,……..,T (i.e. 16 financial years from 2000 to 2015).

## 5.4 Empirical Results of Analysis of the Association between Bank Liquidity and Liquidity Determinants Considering Change in Bank Ownership Structure

To examine hypothesis IV, this chapter includes all banks of different ownership structures (public, private and foreign) operating in India. The time period considered is 2000 to 2018. Panel data regression has been applied. Analyses carried out before applying panel data regression include LLC (Levin-Lin-Chu) test, descriptive analysis of independent variables and dependent variables, multicollinearity test, heteroscedasticity test and Hausman test.

LLC test checks for the presence of unit roots in a data set. Presence of unit root in the data set indicates that the data set is non-stationary series. When a data set is stationary, it means that the series has a nature of moving around the constant mean value. As the used data set has the properties of panel data, this study applies panel data set unit root test as given by Levin, Lin and Chu (2002). Multicollinearity test is done to check the correlation among variables. When correlation is high, variables are said to have multicollinearity problem. When multicollinearity is found among variables, variable transformation is done to reduce the problem of multicollinearity and achieve robust results. We do not perform regression estimation on a heterogeneous data set. Rather, we use heteroscedasticity test to check for presence of heteroscedasticity in the data. When the data set is homogeneous in nature, it undergoes regression estimations.

Therefore, in this section of study, the data set (based on different ownership structures) undergoes different prerequisite tests, and finally, regression estimations are performed. Fixed effect estimation and random effect estimations are performed on panel data set of banks. Finally, we apply Hausman test to choose among fixed effect estimations and random effect estimations. The chosen estimates explain our model and results based on selected data set.

## 5.5 Determinants of Public Banks' Liquidity

This section presents unit root test, descriptive statistics, and correlation matrix and regression analysis of public sector banks. We have considered State bank of India and its

subsidiaries, and nationalised banks for analysis of public banks' liquidity. First, we check the stationarity of data set; second, descriptive statistics of data set are performed; third, correlation analysis of public banks is conducted; and finally, regression analysis is carried out.

### 5.5.1 Test for Stationarity

Before applying panel regression analysis, it is obligatory to perform stationarity test of data sets. Table 5.1 shows the LLC panel unit root test results for regression variables. This study tests without time trend and time trend of data series and checks the presence of unit root. It is apparent from the results presented in Table 5.1 that non-stationarity is absent in the data series, i.e. data set is stationary. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. In the data series of public banks, NIM found was found to be non-stationary. Thus, it has been differentiated to make it stationary. After differentiating the NIM series at level, it becomes stationary. In regression models, differentiated NIM has been used.

**Table 5.1: Results of Unit Root Test for Panel data Variables (Public Banks)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -4.803 | 0.0000 | 1.980 | 0.976 |
| **D(Size)** | | | 0.705 | 0.760 |
| **D(Size)** | | | -8.122 | 0.000 |
| **Deposits** | -2.814 | 0.002 | -2.664 | 0.004 |
| **ROA** | -4.269 | 0.000 | -5.559 | 0.000 |
| **CAR** | -9.734 | 0.000 | -2.172 | 0.015 |
| **NIM** | -0.746 | 0.223 | -0.871 | 0.192 |
| **D(NIM)** | -2.801 | 0.003 | | |
| **NPA** | -12.687 | 0.000 | -3.859 | 0.000 |
| **COF** | -5.382 | 0.000 | -6.749 | 0.000 |
| **GDP** | -11.434 | 0.000 | -9.735 | 0.000 |
| **Inflation** | -1.926 | 0.027 | 10.905 | 1.000 |
| **D(Inflation)** | | | -5.124 | 0.000 |
| **CATA** | -5.298 | 0.000 | -4.744 | 0.000 |
| **LATA** | -6.862 | 0.000 | -6.758 | 0.000 |
| **LATD** | -7.046 | 0.000 | -7.125 | 0.000 |
| **LoansTA** | -5.533 | 0.000 | 0.923 | 0.822 |
| **D(LoansTA)** | | | -7.504 | 0.000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 5.5.2 Descriptive Analysis

Table 5.2 shows descriptive analysis of variables utilized in regression models of panel data set of public sector banks. Statistics related with independent variables and dependent variables of regression models reveal significant nature of variables. Studied time period for this panel is 2000 to 2018. Descriptive analysis shows that public banks hold an average liquidity of 9.122% (liquid assets over assets), 6.026% (cash over assets), 10.746% (liquid assets over deposits). Maximum profitability (ROA) reported by public banks is 2.010%, while minimum profitability shown is 0.000%. Average profitability is 84.2%; it is quite lower than the maximum profitability. Minimum NPA shown is 0.000%; this discloses that public banks are also able to receive full loan payment. Maximum NPA presented is 18.370%, which is higher than the maximum profitability of public banks. This explains that public banks generate significant amounts of NPA.

**Table 5.2 Descriptive Statistics of Public banks Liquidity and its Determinant**

| | **Mean** | **Maximum** | **Minimum** | **Standard Deviation** |
|---|---|---|---|---|
| **LATA** | 9.122 | 21.290 | 3.747 | 3.056 |
| **LoansTA** | 54.490 | 70.614 | 23.390 | 10.102 |
| **CATA** | 6.026 | 16.104 | 2.459 | 1.863 |
| **LATD** | 10.746 | 25.085 | 4.587 | 3.685 |
| **CAR** | 0.990 | 12.930 | 0.013 | 1.821 |
| **COF** | 6.119 | 9.880 | 4.027 | 1.093 |
| **Deposits** | 85.091 | 103.052 | 72.772 | 3.753 |
| **GDP** | 6.984 | 10.260 | 3.804 | 2.010 |
| **Inflation** | 6.809 | 11.992 | 3.685 | 2.777 |
| **NIM** | 2.798 | 4.540 | 1.541 | 0.548 |
| **NPA** | 2.878 | 18.370 | 0.000 | 2.867 |
| **ROA** | 0.842 | 2.010 | 0.000 | 0.387 |
| **Size** | 15.843 | 19.138 | 13.627 | 1.044 |

### 5.5.3 Correlation matrix

Table 5.3 shows Correlation matrix for public banks. Correlation matrix depicts the degree of association of variables. Variables showing high degree of relationship indicate that the variables have the problem of multicollinearity.

Table 5.3 presents correlation coefficients of independent variables and dependent variables. It illustrates high correlation among LATD and LATA. As both the variables are dependent variables and in this study a different model has been developed for each dependent variable, multicollinearity problem does not exist. Multicollinearity problem exists when two

independent variables show high correlation with each other. Independent variables - COF, Inflation, NPA - show high correlation with other independent variables. Unit root test shows that NIM has a unit root. After taking the difference at level, NIM was converted into stationary series. All other variables show stationarity in nature. Thus, they have been kept as they were in the stationarity test for further analysis. We tried to transform some of the variables (those showing high correlation with other variables), but as variables after transformation showed high correlation with other variables, the variables were dropped. In this study, NPA and COF have been dropped as they showed high correlation with other variables even after transformation. We have taken log of LoansTA to reduce high correlation with inflation. After taking the log of LoansTA, it was clear that multicollinearity was not a problem. As we dropped the variables showing high correlation with other variables even after transformation, and transformed LoansTA to make it free from multicollinearity, our data set has been free from multicollinearity.

**Table 5.3 Correlation Analysis of Public Banks Variables**

| | CAR | CATA | COF | Deposits | GDP | Inflation | LATD | LATA | LoansTA | NIM | NPA | ROA | Size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAR** | 1.000 | | | | | | | | | | | | |
| **CATA** | 0.087 | 1.000 | | | | | | | | | | | |
| **COF** | 0.129 | 0.101 | 1.000 | | | | | | | | | | |
| **Deposits** | 0.006 | 0.102 | -0.005 | 1.000 | | | | | | | | | |
| **GDP** | -0.144 | -0.272 | -0.619 | 0.051 | 1.000 | | | | | | | | |
| **Inflation** | -0.274 | -0.115 | -0.147 | 0.008 | 0.247 | 1.000 | | | | | | | |
| **LATD** | -0.004 | 0.456 | 0.056 | -0.158 | -0.290 | -0.302 | 1.000 | | | | | | |
| **LATA** | 0.001 | 0.479 | 0.048 | -0.014 | -0.286 | -0.304 | 0.988 | 1.000 | | | | | |
| **LoansTA** | -0.509 | -0.323 | -0.245 | -0.013 | 0.277 | 0.730 | -0.462 | -0.466 | 1.000 | | | | |
| **NIM** | -0.035 | 0.119 | -0.223 | -0.082 | 0.015 | -0.479 | 0.149 | 0.140 | -0.380 | 1.000 | | | |
| **NPA** | 0.339 | 0.144 | 0.553 | 0.023 | -0.461 | -0.561 | 0.261 | 0.264 | -0.645 | 0.102 | 1.000 | | |
| **ROA** | -0.213 | 0.098 | -0.414 | -0.137 | 0.224 | 0.123 | 0.051 | 0.032 | 0.072 | 0.400 | -0.528 | 1.000 | |
| **Size** | -0.324 | -0.348 | -0.213 | -0.129 | 0.190 | 0.509 | -0.158 | -0.178 | 0.638 | -0.410 | -0.415 | -0.035 | 1.000 |

### 5.5.4 Hypothesis

Hypothesis (2) studies the effect of various liquidity determinants (bank-specific and macro-economic factors) on liquidity of public sector banks. For the purpose of analysis, panel data regression models have been applied on public banks' data set. In used models, liquid assets over total assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) are employed as representatives of bank liquidity. Size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital (CAR) represent bank-specific factors and are considered control variables. Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are considered macroeconomic factors for this study.

Thus, four panel regression models (5.5, 5.6, 5.7 and 5.8) were formed to study hypothesis 01. The four panel regression equations formed are presented below hypothesis 01.

**H01: There is no significant influence of bank-specific and macro-economic factors on liquidity of public banks.**

Models are shown below-

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.5)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.6)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.7)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.8)}$$

### 5.5.5 Empirical results public banks

Table 5.4 presents the results of empirical analysis of Model 1, Model 2, Model 3 and Model 4, where liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) are utilised as a proxy of liquidity of public sector banks operating in India. The four models are regressed at significance levels 10%, 5% and 1%.

From the analysis of Model 1, it is found that at a significance level of 1%, bank size and GDP have a significant negative influence on banks' liquidity. At a significance level of 5%, crisis (2007-2009) has a significant positive effect on LATA and at a significance level of 10%, capital has a significant negative influence on LATA. F-statistics values showed model fitness at significance level of 1%. Robust standard error removed the heteroscedasticityof the dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts the fixed effect estimates to explain the relationship between dependent and independent variables.

Results of Model 2 reveal that at a significance level of 1 %, bank size and GDP have a significant negative effect on banks' liquidity. At a significance level of 5%, capital has a significant negative effect on banks' liquidity, and crisis (2007-2009) has a significant positive effect on banks' liquidity. At a significance of 10%, deposits show a significant negative effect on banks' liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts the fixed effect estimates to explain the relationship between dependent and independent variables.

Results from analysis of Model 3 show that at 1% significance level, bank size and GDP have a significant negative effect on bank liquidity. At 1% significance level, crisis and inflation show a significant positive effect on liquidity. At a significance level of 5%, deposits display a significant positive influence on liquidity. F-statistics values showed model fitness at 1% significance level. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts the fixed effect estimates to explain the association between dependent and independent variables.

Model 4 estimates indicate that at 1% significance level, bank size, inflation and crisis have a significant positive effect on liquidity. At 5% significance level, GDP has a significant positive, while capital has a significant negative effect on liquidity. F-statistics values show model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts fixed effect estimates to explain the association between dependent and independent variables.

Thus, bank size, capital, and deposits are key bank-specific factors that influence liquidity of public banks. Considered macroeconomic variables - GDP, crisis and inflation - were found to significantly influence liquidity of public banks.

Crisis shows a significant positive impact on public banks' liquidity. This means that during financial crisis (2007-2009), public banks increased their liquidity. Size was found to have a significant negative effect on LATA, LATD and CATA. This indicates that as size of public banks increases, they start holding less liquidity. Based on results, the study provides a pictorial representation of the significant determinants of public banks' liquidity. It is given in Figure 5.1.

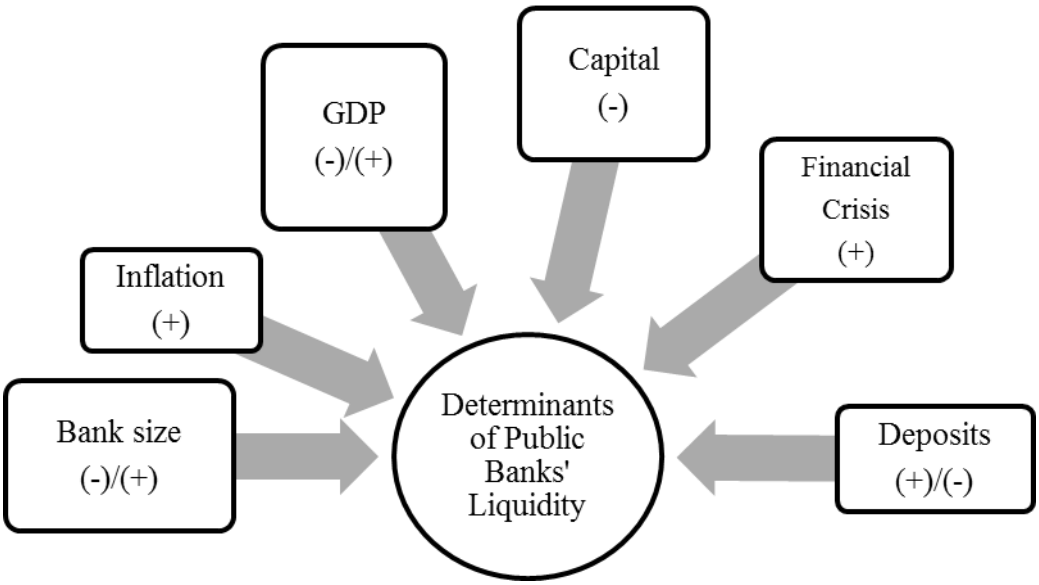



**Figure 5.1: Determinants of Public banks' liquidity**

**Table 5.4 Results of Regression Analysis of Panel Data (Public Banks) (Dependent Variable: Liquidity)**

| | **LLoansTA Coef. Std. Err.** | **LATD Coef. Std. Err.** | **LATA Coef. Std. Err.** | **CATA Coef. Std. Err.** |
|---|---|---|---|---|
| **DNIM** | -0.011(0.007) | -0.086(0.454) | -0.122(0.368) | 0.260(0.194) |
| **Size** | **0.077***(0.007)** | **-2.607***(0.619)** | **-2.167*** (0.515)** | **-1.164***(0.175)** |
| **Inflation** | **0.005*** (0.001)** | 0.094(0.074) | 0.085 (0.064) | **0.114***(0.033)** |
| **GDP** | **0.002** (0.001)** | **-0.301***(0.088)** | **-0.253*** (0.074)** | **-0.200***(0.037)** |
| **CAR** | **-0.010** (0.004)** | **-0.319**(0.150)** | **-0.243* (0.118)** | -0.006(0.054) |
| **ROA** | 0.008 (0.007) | -0.797(0.540) | -0.663 (0.462) | 0.161(0.360) |
| **Deposits** | 0.000 (0.002) | **-0.151*(0.077)** | -0.010 (0.059) | **0.074**(0.028)** |
| **Crisis** | **0.033*** (0.004)** | **0.761**(0.320)** | **0.660** (0.274)** | **0.950***(0.222)** |
| **Constant** | **0.444** (0.210)** | **67.402***(13.104)** | **46.434***(10.469)** | **18.053***4.377** |
| **R2(within)** | 0.859 | 0.357 | 0.355 | 0.307 |
| **R2(overall)** | 0.560 | 0.056 | 0.051 | 0.213 |
| **F-Stat** | 58.74 | 17.64 | 17.59 | 45.42 |
| **Robust Hausman test (p-value)** | 0.000 | 0 | 0 | 0 |
| **No. Of obs** | 400 | 400 | 400 | 400 |
| **No. Of grps** | 25 | 25 | 25 | 25 |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of t-statistics are presented in parentheses.

## 5.6 Determinants of Private Banks' Liquidity

This section presents the unit root test, descriptive statistics, correlation matrix and regression analysis of private sector banks. We have considered old and new private banks for analysis of private banks' liquidity. First, we check the stationarity of data set; second, descriptive statistics of data set have been carried out; third correlation analysis of public banks has been conducted; and finally, regression analysis was performed.

### 5.6.1 Stationarity Test

Before applying panel regression analysis, it is obligatory to perform stationarity test of data sets. Table 5.5 shows the LLC Panel unit root test results for regression variables. This study tests without time trend and time trend of data series and checks the presence of the unit

root. It is apparent through the results presented in table 5.5 that non-stationarity is absent in the data series, i.e. data set is stationary. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. In the data series of private banks, Deposits were found to be non-stationary. Thus, it was differentiated to make it stationary. In regression models, differentiated Deposits has been used. Similarly, Inflation was found to be non-stationary; it was made stationary by differentiating it and differentiated Inflation was used in regression for further analysis.

**Table 5.5: Results of Unit Root Test for Panel data Variables (Private Banks)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -3.265 | 0.000 | -2.044 | 0.021 |
| **Deposits** | -0.794 | 0.214 | -1.292 | 0.098 |
| **D(Deposits)** | -9.809 | 0.000 | -9.580 | 0.000 |
| **ROA** | -2.636 | 0.004 | -3.061 | 0.001 |
| **CAR** | -5.572 | 0.000 | 0.741 | 0.771 |
| **2ND DIFF CAR** | | | -5.477 | 0.000 |
| **NIM** | -2.074 | 0.019 | -4.218 | 0.000 |
| **NPA** | -11.020 | 0.000 | -2.434 | 0.008 |
| **COF** | -4.485 | 0.000 | -4.739 | 0.000 |
| **GDP** | -9.702 | 0.000 | -8.260 | 0.000 |
| **Inflation** | -1.634 | 0.051 | 9.253 | 1.000 |
| **D(Inflation)** | -4.784 | 0.000 | -4.348 | 0.000 |
| **CATA** | -3.507 | 0.000 | -2.340 | 0.010 |
| **LATD** | -4.059 | 0.000 | -4.079 | 0.000 |
| **LATA** | -4.458 | 0.000 | -4.602 | 0.000 |
| **LoansTA** | -3.315 | 0.001 | -2.299 | 0.011 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 5.6.2 Descriptive Analysis

Table 5.6 illustrates descriptive analysis of independent variables and dependent variables chosen for regression models. Results show that average liquidity of 5.777% (cash over assets), 13.057% (liquid assets over deposits) and 10.742 %( liquid assets over assets) was held by private banks from 2000 to 2015. Maximum profitability generated by private banks is 3.380% and average profitability is 1.122%. Some banks of the private sector are able to maintain 0.000% of NPA, however, some private sector banks displayed NPAs as high as 15.850% (maximum). Minimum cost of funding for private banks is 2.910% and maximum cost of funding of private banks is 9.660%. Minimum capital over assets is 0.001%, while average capital over assets hold is 0.803%.

**Table 5.6 Descriptive Statistics of Private Banks Variables**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **CATA** | 5.770 | 15.639 | 1.704 | 1.839 |
| **LoansTA** | 53.161 | 68.636 | 19.754 | 9.069 |
| **LATD** | 13.057 | 43.883 | 4.235 | 6.768 |
| **LATA** | 10.742 | 32.766 | 3.568 | 5.669 |
| **CAR** | 0.803 | 10.165 | 0.001 | 1.093 |
| **COF** | 6.565 | 9.660 | 2.910 | 1.399 |
| **Deposits** | 82.715 | 92.911 | 30.819 | 8.814 |
| **GDP** | 6.984 | 10.260 | 3.804 | 2.011 |
| **Inflation** | 6.809 | 11.992 | 3.685 | 2.778 |
| **NIM** | 2.881 | 4.690 | 0.960 | 0.717 |
| **NPA** | 2.520 | 15.850 | 0.000 | 2.875 |
| **ROA** | 1.122 | 3.380 | 0.000 | 0.518 |
| **Size** | 14.193 | 17.984 | 10.820 | 1.521 |

### 5.6.3 Correlation Matrix

Correlation coefficients display the degree of association among the variables. If the correlation coefficient is more than 0.5, it highlights that variables have high dependency on each other. When high dependency is found among independent variables, it may result in multicolinerity. Table 5.7 illustrates correlation matrix of independent and dependent variables chosen for this study.

Matrix of correlation given in table 5.7 depicts high correlation among some variables. In this study, loans over assets, liquid assets over deposits, liquid assets over assets are dependent variables. We have formed different regression models for each dependent variable, hence, high dependency among dependent variables doesn't affect the results. Therefore, it is acceptable. Inflation shows a correlation coefficient value of -0.564, which is not acceptable. During stationarity test also, it showed non stationarity in nature, thus, we have taken first difference of this variable. During regression estimation, we have taken first difference of some of the variables. After taking the first difference of inflation, it showed low correlation with NPA and LoansTA variables. Rest of the variables like GDP, NIM, ROA, Size, Deposits, COF, and CAR showed low dependency on one another. This means that panel regression models show the absence of multicollinearity, and that models are acceptable.

**Table 5.7 Correlation Matrix of Private Banks Liquidity and its Determinants**

| | CATA | LATD | LATA | LoansTA | CAR | COF | Deposits | GDP | Inflation | NIM | NPA | ROA | Size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1 | | | | | | | | | | | | |
| **LATD** | 0.363 | 1 | | | | | | | | | | | |
| **LATA** | 0.430 | 0.954 | 1 | | | | | | | | | | |
| **LoansTA** | -0.356 | -0.653 | -0.674 | 1 | | | | | | | | | |
| **CAR** | 0.198 | 0.448 | 0.400 | -0.228 | 1 | | | | | | | | |
| **COF** | 0.028 | -0.188 | -0.080 | 0.031 | -0.125 | 1 | | | | | | | |
| **Deposits** | 0.226 | -0.098 | 0.165 | -0.074 | -0.144 | 0.422 | 1 | | | | | | |
| **GDP** | -0.182 | -0.195 | -0.188 | 0.261 | 0.013 | -0.506 | -0.020 | 1 | | | | | |
| **Inflation** | -0.126 | -0.180 | -0.209 | 0.524 | 0.017 | -0.082 | -0.136 | 0.244 | 1 | | | | |
| **NIM** | 0.067 | 0.178 | 0.229 | -0.072 | 0.040 | -0.167 | 0.088 | 0.055 | 0.062 | 1 | | | |
| **NPA** | 0.1235 | 0.006 | 0.042 | -0.334 | -0.006 | 0.464 | 0.236 | -0.328 | -0.564 | -0.280 | 1 | | |
| **ROA** | -0.115 | 0.008 | -0.021 | 0.010 | -0.110 | -0.132 | -0.191 | 0.027 | 0.070 | 0.426 | -0.228 | 1 | |
| **Size** | -0.345 | -0.370 | -0.506 | 0.455 | -0.391 | -0.315 | -0.572 | 0.146 | 0.372 | -0.072 | -0.468 | 0.251 | 1 |

### 5.6.4 Hypothesis

Hypothesis 02 studies the effect of various liquidity determinants (bank-specific and macro-economic factors) on liquidity of private sector banks. For the purpose of analysis, panel data regression models have been applied on private banks' data set. In used models, liquid assets over total assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) are employed to represent liquidity of banks. Size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital (CAR) represent bank-specific factors and are considered control variables. Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are considered macroeconomic factors for this study.

Four panel regression models were formed to study hypothesis 02. The four panel regression equations are presented below hypothesis 02.

**H02: There is no significant influence of bank-specific and macro-economic factors on liquidity of private sector banks.**

Models are shown below:

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.9)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.10)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.11)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.12)}$$

### 5.6.5 Empirical Analysis

Table (5.8) indicates empirical estimation of Model 1, Model 2, Model 3 and Model 4. These models are developed for determinants of liquidity of private banks. In these models, liquidity is measured by four ratios and these ratios are considered dependent variables. Dependent variables used are: liquid assets over assets (LATA); liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA). The regressions are regressed at significance levels 10%, 5% and 1%.

Results from the estimations of Model 1 suggest that at a significance level of 1%, bank size has a significant negative effect while crisis (2007-2009) has a significant positive effect on liquidity. At the significance level of 10 %, COF and profitability have a significant positive effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Analysis of Model 2 indicates that at a significance level of 1%, crisis has a significant positive effect on liquidity while size has a significant negative effect on liquidity. Capital has a significant positive effect on liquidity at a 5% of significance level. At 10% significance level, GDP has a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error removed the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts the fixed effect estimates to explain the association between dependent and independent variables.

Model 3 estimations suggest that at 1% significance level, crisis has a positive effect on liquidity while bank size and inflation have a significant negative effect on liquidity. Results also indicate that at 5% significance level, COF and capital have a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts the fixed effect estimates to explain the association between dependent and independent variables.

Results obtained from Model 4 estimation illustrate significant positive effect of bank size on liquidity at significance level of 1%. Further, significant positive effect of crisis on private banks' liquidity, and significant negative effect of COF on banks' liquidity is suggested at a significance level of 5%. F-statistics values show model fitness at a significance level of 1%. Robust standard error has removed the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Thus, results suggest that the following bank-specific factors - bank size, cost of funding, profitability and capital – significantly influence liquidity of private banks. Inflation, GDP and crisis are key macroeconomic factors influencing private banks' liquidity.

Crisis shows a significant positive impact on liquidity. This highlights that during financial crisis (2007-2009), private banks increase their liquidity. The inverse relationship of bank size with private banks' liquidity shows that as the size of private banks increases, liquidity holding of banks decreases.

Based on results, the study provides a pictorial representation of significant determinants of private banks' liquidity (see Figure 5.2).

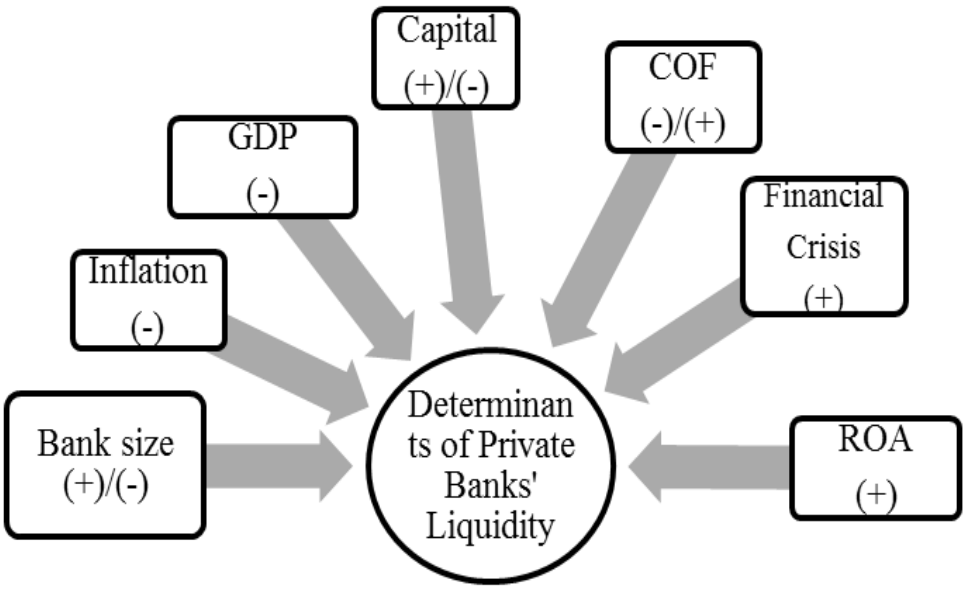



**Figure 5.2: Determinants of Private banks' liquidity**

**Table 5.8 Results of Regression Analysis of Panel Data (Private Banks)**
**(Dependent Variable: Liquidity)**

| | LATA | LoansTA | LATD | CATA |
|---|---|---|---|---|
| **CAR** | 0.435<br>(1.52) | (0.536)<br>(0.45) | **0.513****<br>**(2.60)** | **0.104****<br>**(-2.78)** |
| **DInflation** | 0.105<br>(-0.86) | (0.221)<br>(-1.33) | 0.124<br>(-0.78) | **0.051*****<br>**(-4.71)** |
| **DDeposits** | 0.048<br>(-0.63) | (0.096)<br>(-0.77) | 0.049<br>(-0.22) | 0.028<br>(-0.36) |
| **Size** | **0.512*****<br>**(-5.47)** | **(1.108) *****<br>**(5.66)** | **0.405*****<br>**(-6.34)** | **0.242*****<br>**(-5.84)** |
| **GDP** | 0.089<br>(-1.40) | (0.169)<br>(1.26) | **0.187***<br>**(-2.04)** | 0.066<br>(-1.01) |
| **NPA** | 0.177<br>(-0.79) | (0.361)<br>(-0.14) | 0.179<br>(-0.20) | 0.069<br>(-0.86) |
| **COF** | **0.212***<br>**(2.05)** | **(0.447) ****<br>**(-2.16)** | 0.422<br>(0.01) | **0.094****<br>**(-2.60)** |
| **ROA** | **0.451***<br>**(2.10)** | (1.164)<br>(-1.57) | 0.699<br>(1.72) | 0.265<br>(-1.05) |
| **NIM** | 0.528<br>(0.91) | (0.925)<br>(0.71) | 0.768<br>(0.04) | 0.224<br>(0.47) |
| **Crisis** | **0.476*****<br>**(3.60)** | **(0.871) ****<br>**(2.30)** | **0.586*****<br>**(3.10)** | **0.253*****<br>**(3.83)** |
| **Constant** | **7.364*****<br>**(6.59)** | (18.551)<br>(-1.27) | **9.236*****<br>**(5.50)** | **4.420*****<br>**(6.86)** |
| **$R^2$ (within)** | 0.460 | 0.6999 | 0.399 | 0.318 |
| **$R^2$ (overall)** | 0.3140 | 0.199 | 0.247 | 0.158 |
| **F-statistics** | 26.340 | 29.630 | 22.210 | 55.730 |
| **Robust-hausman test(p-value)** | 0.000 | 0.000 | 0.000 | 0.000 |
| **No. Obs** | 288 | 288 | 288 | 288 |
| **No. Of grps** | 18 | 18 | 18 | 18 |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of t-statistics are presented in parentheses.

## 5.7 Determinants of Foreign Banks' Liquidity

This section presents unit root test, descriptive statistics, correlation matrix and regression analysis of foreign sector banks. We have considered foreign banks continuously operating in India from 2000 to 2018 for analyses. First we check the stationarity of the data set; second descriptive statistics of data set are carried out; third, correlation analysis of foreign banks is performed; and finally, regression analysis is done.

### 5.7.1 Test for Stationarity

Before applying panel regression analysis, it is obligatory to perform stationarity test of data sets. Table (5.9) shows LLC panel unit root test results for regression variables. This study tests without time trend and time trend of data series, and checks for the presence of unit root. It is apparent from the results presented in table (5.9) that non-stationarity is absent in the data series, thus, data set is stationary. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. In the data series of foreign banks, Size was found to be non-stationary. Thus, it was differentiated to make it stationary. After differentiating the Size series at level, it became stationary in case of time trend. After further differentiating at level, it became stationary in case of without time trend. In regression models, differentiated Size at level has been used. CAR was also non-stationary, so it was made stationary by differentiating at level. In regression analysis, differentiated capital at level was used for analysis. Among independent variables, LATA, CATA and LoansTA were non-stationary, and were made stationary by differentiating at level. Few variables were not stationary even after differentiating; they were made stationary by taking first difference and second difference.

**Table 5.9: Results of Unit Root Test for Panel data Variables (Foreign Banks)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -0.097 | 0.462 | 0.111 | 0.544 |
| **D(Size)** | -2.507 | 0.006 | -1.393 | 0.082 |
| D(Size,2) | | | -3.809 | 0.000 |
| **Deposits** | -2.774 | 0.003 | -2.310 | 0.011 |
| **ROA** | -6.085 | 0.000 | -6.343 | 0.000 |
| **CAR** | -1.380 | 0.084 | 0.494 | 0.689 |
| **D(CAR)** | -5.522 | 0.000 | -5.537 | 0.000 |
| **NIM** | -4.178 | 0.000 | -4.209 | 0.000 |
| **NPA** | -10.510 | 0.000 | -10.084 | 0.000 |
| **COF** | -6.669 | 0.000 | -3.373 | 0.000 |
| **GDP** | -10.227 | 0.000 | -8.707 | 0.000 |
| **Inflation** | -1.722 | 0.043 | 9.754 | 1.000 |
| **D(Inflation)** | | | -4.583 | 0.000 |
| **CATA** | -0.962 | 0.168 | 1.152 | 0.875 |
| **D(CATA)** | -4.296 | 0.000 | -2.711 | 0.003 |
| **LATD** | -3.325 | 0.000 | -2.684 | 0.004 |
| **LATA** | -2.336 | 0.010 | -1.207 | 0.114 |
| **D(LATA)** | | | -6.127 | 0.000 |
| **LoansTA** | 1.313 | 0.905 | 2.325 | 0.990 |
| **D(LoansTA)** | -2.686 | 0.004 | -1.448 | 0.074 |
| **D(LoansTA,2)** | | | -7.016 | 0.000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 5.7.2 Descriptive Analysis

Table (5.10) provides descriptive analysis of various variables of foreign banks. Selected time period for this analysis is 2000 to 2015. Descriptive statistics reveal that average liquidity held by foreign banks for the period 2000 to 2018 was 21.292%(liquid assets over assets), 48.708%(liquid assets over deposits), and 3.765%(cash over assets). Minimum profitability held during this period by foreign banks was 0.010% and maximum profitability held was 10.230%. Minimum NPA held by foreign banks was 0.000%; this means that some banks were able to get full loan payment from their customers. Maximum NPA reported by foreign banks was 36.040%, and average NPA shown was 2.638%; this clearly indicates the huge variation between the percentages of NPAs held by foreign sector banks. Maximum cost of funding for foreign banks was12.678% and average cost of funding was 4.831%; this shows that foreign banks pay the highest rate - 12.768% =- for funds. On an average, they pay 4.831% for funds.

**Table 5.10 Descriptive Analysis of Variables of Foreign Banks Liquidity and its Determinants**

| | Mean | Maximum | Minimum | Std. Dev. |
|---|---|---|---|---|
| **LATA** | 21.292 | 76.321 | 1.415 | 19.270 |
| **LATD** | 48.708 | 660.178 | 4.349 | 63.249 |
| **CATA** | 3.765 | 13.964 | 0.205 | 2.097 |
| **LoansTA** | 39.004 | 83.429 | 0.185 | 18.003 |
| **CAR** | 15.391 | 80.847 | 0.000 | 15.625 |
| **COF** | 4.831 | 12.678 | 0.325 | 2.331 |
| **Deposits** | 50.653 | 92.824 | 6.481 | 16.282 |
| **Inflation** | 6.786 | 11.992 | 3.685 | 2.783 |
| **GDP** | 6.988 | 10.260 | 3.804 | 2.025 |
| **NPA** | 2.638 | 36.040 | 0.000 | 5.600 |
| **NIM** | 3.537 | 8.540 | 0.609 | 1.483 |
| **ROA** | 2.051 | 10.230 | 0.010 | 1.556 |
| **Size** | 12.172 | 16.490 | 8.009 | 2.313 |

### 5.7.3 Correlation Matrix

Correlation matrix is the representation of the degree of relationship of one variable with another. High degree of association between two variables shows presence of multicollinearity. Table (5.11) depicts correlation matrix of independent and dependent variables of foreign banks. It presents the correlation of more than 0.5 among some variables. Size, LATA, CAR, LATD, LoansTA show high correlation coefficients. Among all variables,

CAR, CATA and Size show a non-stationary nature. To make them stationary, we have taken the difference at level of the variables and transformed them into stationary data series. Similarly, we have transformed the variables to make the data free from multicollinearity. For this, we have taken the difference at level of CATA, Size and Capital. As LATD, LoansTA and LATA are dependent variables, the problem of multicollinearity does not arise. Other variables like Inflation, NIM, NPA, COF, ROA, CATA, GDP, Deposits have shown that they are free from the problem of multicollinearity. So, for regression estimation, we have taken these variables as they were presented in correlation matrix.

**Table 5.11 Correlation Matrix of Foreign banks Liquidity and its Determinants**

| | CATA | LATD | LATA | Loans TA | CAR | COF | Deposits | GDP | Inflation | NIM | NPA | ROA | Size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1 | | | | | | | | | | | | |
| **LATD** | -0.215 | 1 | | | | | | | | | | | |
| **LATA** | 0.035 | 0.701 | 1 | | | | | | | | | | |
| **LoansTA** | 0.131 | -0.451 | -0.619 | 1 | | | | | | | | | |
| **CAR** | -0.336 | 0.603 | 0.331 | -0.085 | 1 | | | | | | | | |
| **COF** | -0.158 | -0.134 | -0.273 | 0.124 | -0.080 | 1 | | | | | | | |
| **Deposits** | 0.381 | -0.329 | 0.142 | -0.119 | -0.497 | 0.119 | 1 | | | | | | |
| **GDP** | -0.023 | -0.048 | 0.030 | -0.065 | 0.066 | -0.374 | 0.005 | 1 | | | | | |
| **Inflation** | 0.115 | -0.107 | -0.022 | 0.057 | 0.025 | -0.365 | -0.062 | 0.249 | 1 | | | | |
| **NIM** | 0.001 | 0.247 | 0.101 | 0.214 | 0.459 | -0.209 | -0.220 | -0.107 | 0.177 | 1 | | | |
| **NPA** | -0.066 | 0.206 | 0.079 | -0.039 | 0.117 | 0.270 | 0.045 | -0.132 | -0.235 | -0.136 | 1 | | |
| **ROA** | -0.023 | 0.196 | 0.217 | -0.144 | 0.210 | -0.332 | -0.119 | 0.007 | 0.081 | 0.336 | -0.165 | 1 | |
| **Size** | -0.011 | -0.463 | -0.614 | 0.266 | -0.515 | 0.010 | -0.036 | 0.051 | 0.194 | -0.018 | -0.243 | -0.157 | 1 |

### 5.7.4 Hypothesis

Hypothesis 03 studies the effect of various liquidity determinants (bank-specific and macro-economic factors) on liquidity of foreign banks operating in India. For the purpose of analysis, panel data regression models have been applied on foreign banks' data set. In used models, liquid assets over total assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) were employed to represent liquidity of banks. Size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital (CAR) represent bank-specific factors and are considered control variables. Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are considered macroeconomic factors for this study.

Four panel regression models were formed to study hypothesis 03. The four panel regression equations are presented below hypothesis 03.

**H03: There is no significant association between foreign banks' liquidity and various liquidity determinants.**

Models are shown below:

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.13)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.14)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.15)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(5.16)}$$

### 5.7.5 Empirical Analysis

Table (5.12) provides an empirical estimation of Model 1, Model 2, Model 3 and Model 4. These models are developed for determinants of liquidity of foreign banks operating in India. In these models, liquidity is measured by four ratios and these ratios are considered dependent variables. Dependent variables used are: liquid assets over assets (LATA); liquid assets over deposits (LATD); cash over assets (CATA); and loans over assets (LoansTa). The regressions are regressed at significance levels 10%, 5% and 1%.

Model 3 estimates show that at a significance level of 1%, crisis and GDP have a significant positive effect on liquidity while capital and NIM have a significant negative effect on liquidity. At a significance level of 5%, inflation has a significant negative effect on liquidity. At a significance level of 10%, COF and deposits have a significant negative effect on liquidity.

F-statistics values showed model fitness at a significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Model 1 estimations suggest that at a significance level of 1%, crisis and size have a significant positive effect on liquidity. At a significance level of 5%, profitability has a significant positive effect on liquidity.

F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts the fixed effect estimates to explain the association between dependent and independent variables.

Model 2 results indicate that at a significance level of 1%, size has a significant positive effect on liquidity and deposits has a significant negative effect on liquidity. At a significance level of 5%, crisis, GDP and profitability (ROA) have a significant positive impact on liquidity and capital has a significant negative effect on liquidity.

F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect

estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, the present model accepts the fixed effect estimates to explain the relationship between dependent and independent variables.

Thus, empirical analysis of foreign banks operating in India highlights that NIM, CAR, deposits, cost of funding, bank size and profitability are significant factors impacting foreign banks' liquidity. Macroeconomic factors were also employed for liquidity analysis of foreign banks and results highlight that crisis, GDP and inflation are factors significantly influencing foreign banks' liquidity.

Crisis shows positive effect on foreign banks' liquidity; this reflects that foreign banks increased their liquidity during crisis (2007-2009).

Based on results, the study provides a pictorial representation of significant determinants of foreign banks' liquidity. It is given in Figure 5.3

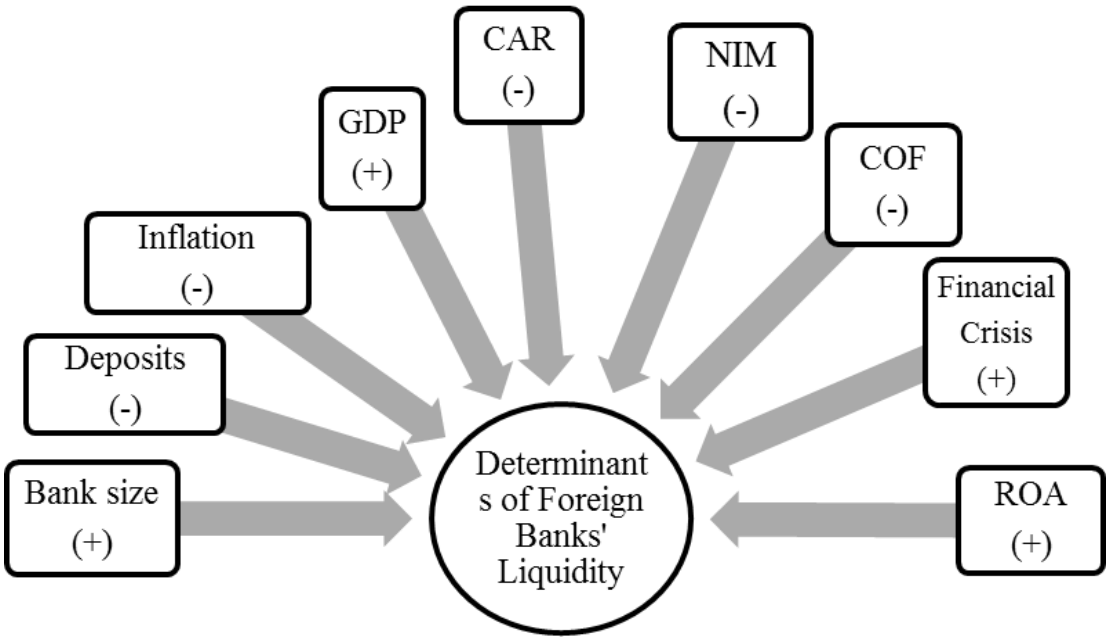



**Fig 5.3: Determinants of Foreign banks' liquidity**

**Table 5.12 Results of Regression Analysis of Panel Data (Foreign Banks) (Dependent Variable: Liquidity)**

| | **DCATA** | **LATA** | **LATD** |
|---|---|---|---|
| | Std. Err.<br>T Statistics | Std. Err.<br>T Statistics | Std. Err.<br>T Statistics |
| **Crisis** | **0.321***(5.18)** | **1.375***(3.16)** | **5.181** (2.12)** |
| **DSize** | 0.090 (-0.71) | **0.971***(4.89)** | **2.772***(5.51)** |
| **DCAR** | **0.008***(-4.95)** | 0.158 (-0.38) | **0.312** (-2.83)** |
| **Inflation** | **0.050** (-2.41)** | 0.386 (0.95) | 1.044 (0.25) |
| **GDP** | **0.069***(3.09)** | 0.382 (0.70) | **1.051** (2.45)** |
| **NPA** | 0.032 (-0.42) | 0.205 (-0.58) | 1.702 (1.33) |
| **COF** | **0.042* (-1.98)** | 0.547 (-1.03) | 1.964 (1.23) |
| **ROA** | 0.052 (0.69) | **0.544** (2.58)** | **1.912** (2.50)** |
| **NIM** | **0.074***(-4.09)** | 0.916 (-1.45) | 4.856 (0.83) |
| **Deposits** | **0.009* (-1.79)** | 0.103 (-0.19) | **0.348*** (-5.81)** |
| **Constant** | **1.494***(3.48)** | 13.878 (-2.15) | 47.800 (-1.45) |
| **R2 (within)** | **0.327** | **0.203** | **0.468** |
| **R2 (overall)** | **0.155** | **0.180** | **0.002** |
| **F-statistics** | **38.640** | **15.630** | **65.930** |
| **Robust-hausman test(p-value)** | **0.000** | **0.000** | **0.000** |
| **No. Obs.** | **320** | **320** | **320** |
| **No. Of groups** | **20** | **20** | **20** |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of t-statistics are presented in parentheses**].**

## 5.8 CONCLUSION

Chapter 5 analysed whether the influence of liquidity determinants on bank liquidity changed with change in ownership structure of banks. The time period considered was 2000 to 2018. The chapter explored how liquidity determinants influence liquidity of public, private and foreign banks operating in India. On the basis of Hausman test, if p-value is more than 5%, random effect estimates have been selected; otherwise, fixed effect estimates have been chosen for results estimations.

Empirical analysis of liquidity holding of public, private and foreign banks operating in India revealed that size, deposits, inflation, GDP, crisis and CAR had significant impact on public banks' liquidity. CAR, size, GDP, crisis, COF, profitability and inflation significantly impacted private banks' liquidity. Deposits, CAR, NIM, COF, inflation, GDP, crisis, profitability emerged as key determinants of foreign banks' liquidity.

For public and private banks, size showed a significant negative effect on CATA, LATA and LATD; this shows that as size of public and private banks increased, liquidity holding of these banks decreased. In case of foreign banks, bank size showed an insignificant negative impact on CATA, and positive impact on LATA and LATD. This highlights that bank size has different influence on banks as their ownership structure changes. Analysis also highlighted that crisis (2007-2009) had significant positive impact on banks' liquidity (public, private and foreign banks). This explains the fact that during financial crisis, all Indian banks of different ownership structures had increased their liquidity. This also shows that to combat crisis and its consequences and maintain stability, banks operating in India increased their liquidity holdings.

Inflation showed a positive effect on public banks' liquidity while it had a negative impact on private banks' liquidity. In case of foreign banks, liquidity measuring variables (LATA, CATA, LATD and LoansTA) were both positively and negatively influenced by inflation. CAR had a significant negative effect on public banks' liquidity (LATA, LoansTA and LATA). CAR showed mixed effect (positive and negative) on private banks' liquidity, and negative effect on foreign banks' liquidity (LATA, CATA and LATD). GDP had a negative impact on public banks' liquidity (LATA, CATA and LATD) and private banks' liquidity (LATA, CATA and LATD). On the other hand, GDP had a positive influence on the liquidity of foreign banks (LATA, CATA and LATD).

COF showed significant effect on private banks' liquidity (LoansTA, CATA and LATA) and foreign banks' liquidity. Profitability showed insignificant effect on public banks' liquidity while it had mixed effect (positive and negative) on liquidity of private banks' liquidity and foreign banks' liquidity. NIM had insignificant effect on public banks' liquidity and private banks' liquidity while it showed significant effect on liquidity of foreign banks.

On the basis of analysis, it can be concluded that crisis had a similar effect on all banks (private, public and foreign). Bank size had a significant negative effect on public banks' liquidity (LATA, CATA and LATD) and private banks' liquidity (CATA, LATA and LATD) while it showed mixed effect (negative and positive) on foreign banks' liquidity. Other liquidity determinants - capital, inflation, NIM, NPA, COF, GDP, deposits – showed mixed effect on liquidity of public, private and foreign banks.

Hence, we can state that crisis has a significant and homogeneous effect on all banks operating in India. Other studied variables exert varying levels of influence on liquidity of public, private and foreign banks operating in India.

# CHAPTER 6

# ASSOCIATION AMONG BANK SIZE, LIQUIDITY DETERMINANTS AND LIQUIDITY OF BANKS OPERATING IN INDIA

## 6.1 Introduction

Literature reviewed in chapter 2 emphasised the gap in literature with respect to the relationship between bank size and liquidity, especially in an Indian context. Past studies have highlighted the impact of bank size on liquidity and mentioned the size of the banks as small size banks and large size banks but had not defined the size. Additionally, the effect of size of banks on liquidity for medium size banks was also not given in the literature. So, to fill this gap of literature and to add significantly in the literature of Indian banks context, this chapter analyses how different bank sizes influences liquidity determinants and further the effect of determinants on liquidity of banks operating in India.

Results show that different bank sizes differently affect liquidity determinants and these determinants, in turn, differently impact liquidity of banks of different sizes. Liquidity determinants considered in this study are divided into bank-specific and macro-economic factors. Bank-specific factors include NPA, COF, bank size, deposits, CAR, and NIM, and macro-economic factors include inflations, crisis and GDP. Banks are categorized according to size into small, medium, large and largest banks. Banks having total assets upto Rs. 50 billion are classified as small banks; banks with total assets between Rs. 50 billion and Rs. 100 billion are considered medium sized banks; banks with total assets between Rs. 100 billion and Rs. 200 billion are classified as large banks; and banks having assets above Rs. 200 billion are considered largest banks. For the purpose of analysis, four panels have been made, namely small, medium size, large size and largest size. Further, developed hypotheses are tested on these panels. For this, fixed effect and random effect estimates are run and Hausman test performed to choose among fixed effect and random effect estimates.

Analysis section is divided into five sub-sections. First sub-section comprises analysis of small size panel data. Second sub-section describes analysis of medium size panel data. Third sub-section explains large size panel data estimations while fourth sub-section explains analysis of largest size panel data. The last sub-section presents the conclusion based on the analysis of small size, medium size, large size and largest size panel data.

## 6.2 Modelling of dependent variable (Liquidity) and independent variables (liquidity determinants) as size of banks operating in India changes

To set up a statistical association among liquidity determinants and liquidity as the ownership structure changes, this chapter uses panel regression models; the chapter regresses bank-specific (size, deposits, capital adequacy, profitability, non-performing assets, net interest margin and cost of funding) and macro-economic (crisis, GDP and inflation) factors over liquidity (LATA, CATA, LATD, LoansTA) by applying Panel data models

. Bank-specific variables and macro-economic variables are taken as independent variables while liquidity is considered the dependent variable.

Developed models are shown below:

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.1)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.2)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.3)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.4)}$$

Where, $LATA_{it}$ , $LATD_{it}$, $CATA_{it}$ and $LoansTA_{it}$represent annual liquidity of $i^{th}$ bank of different ownership at $t^{th}$ time period; $Deposits_{it}, ROA_{it}$ $NPA_{it}$ $NIM_{it}, Size_{it}, NIM_{it}$ *and* $COF_{it}$ denote deposits, profitability, non-performing assets, net interest margin, size and cost of funding of $i^{th}$ bank at the $t^{th}$ time period. $\varepsilon_{it}$ captures error terms for i = 1,2,……., N cross-sectional units (i.e. 22 banks) observed for dated period t= 1,2,……..,T (i.e. 16 financial years from 2000 to 2018).

### 6.2.1 Hypothesis

**H02: There is no significant influence of bank-specific and macro-economic factors on liquidity of banks of different sizes.**

## 6.3 Determinants of liquidity of banks of small size

This section of the study explains unit root test, descriptive statistics, correlation matrix and regression analysis of small size banks. First, stationarity of data set was checked; second, descriptive statistics were carried out for the data set; third, correlation analysis of small sized banks was performed; finally, regression analysis was conducted.

### 6.3.1 Test for Stationarity

Before applying panel regression analysis, stationarity test of data sets must be performed. Table 6.1 shows LLC panel unit root test results for regression variables. This study tests without time trend and time trend of data series and checks the presence of unit root. Results show through table (6.1) that non-stationarity is absent in the data series, i.e. data set is stationary. If non-stationarity is found in the nature of data series, it is differentiated and stationarity test is applied. In the data series of small banks, Size, Deposits, Inflation and COF were found to be non stationary. The data set was then differentiated to make it stationary. After differentiating Size, Deposits, Inflation and COF series at level, it became stationary. In regression models, differentiated Size, Deposits and COF were used. In case of independent variables, LoansTA and LATA were found to be non-stationary; to make them stationary, they were differentiated and differentiated LoansTA was used in analysis.

**Table 6.1: Results of Unit Root Test for Panel data Variables (Small Banks)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -0.205 | 0.419 | -2.431 | 0.008 |
| **D(Size)** | -12.313 | 0.000 | | |
| **Deposits** | -1.126 | 0.130 | -3.051 | 0.001 |
| **D(Deposits)** | -6.416 | 0.000 | | |
| **ROA** | -7.059 | 0.000 | -3.727 | 0.000 |
| **CAR** | -8.095 | 0.000 | -35.702 | 0.000 |
| **NIM** | -4.804 | 0.000 | -7.612 | 0.000 |
| **NPA** | -6.240 | 0.000 | -6.900 | 0.000 |
| **COF** | -6.588 | 0.000 | -1.556 | 0.060 |
| **DCOF** | | | -5.378 | 0.000 |
| **GDP** | -5.026 | 0.000 | -4.676 | 0.000 |
| **Inflation** | 0.869 | 0.808 | 3.588 | 1.000 |
| **D(Inflation)** | -3.656 | 0.000 | -4.136 | 0.000 |

| | | | | |
|---|---|---|---|---|
| **LATD** | -10.826 | 0.000 | -3.850 | 0.000 |
| **LATA** | -5.150 | 0.000 | -1.114 | 0.133 |
| **D(LATA)** | | | -3.647 | 0.000 |
| **CATA** | -4.540 | 0.000 | 1.179 | 0.881 |
| **LoansTA** | 0.925 | 0.823 | 2.900 | 0.998 |
| **D(LoansTA)** | 0.541 | 0.706 | -0.776 | 0.219 |
| **D(LoansTA,2)** | -6.399 | 0.000 | -4.708 | 0.000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 6.3.2 Descriptive Analysis

Table 6.2 shows descriptive analysis of variables associated with small sized banks. Data set pertaining to small banks from 2000 to 2015 has been considered. Statistics indicate that average liquidity held by small banks for this period was 24.536% (liquid assets over assets), 52.156% (liquid assets over deposits) and 4.458% (cash over assets). Maximum NPA reported by small banks was 36.040% and average NPA is 4.015%. Maximum profitability held by small banks was 10.230%, while minimum profitability reported was 0.000%. Maximum capital over assets maintained by small banks was 80.847% and average capital over assets was 15.418%. Average net interest margin was 3.359%, while minimum net interest margin was 0.609%.

**Table 6.2 Descriptive Analysis of Small Banks Liquidity and its Determinants**

| | **Mean** | **Maximum** | **Minimum** | **Standard Deviation** |
|---|---|---|---|---|
| **LATA** | 24.536 | 76.321 | 1.830 | 19.213 |
| **LATD** | 52.156 | 660.178 | 5.587 | 67.139 |
| **LoansTA** | 38.810 | 83.429 | 0.185 | 18.773 |
| **CATA** | 4.458 | 13.964 | 0.205 | 2.583 |
| **CAR** | 15.418 | 80.847 | 0.004 | 16.966 |
| **COF** | 5.540 | 12.678 | 0.325 | 2.553 |
| **Crisis** | 0.166 | 1.000 | 0.000 | 0.373 |
| **Deposits** | 61.152 | 92.911 | 6.481 | 21.989 |
| **GDP** | 6.847 | 10.260 | 3.804 | 2.154 |
| **Inflation** | 6.041 | 11.992 | 3.685 | 2.640 |
| **NIM** | 3.359 | 8.540 | 0.609 | 1.507 |
| **NPA** | 4.015 | 36.040 | 0.000 | 6.140 |
| **ROA** | 1.846 | 10.230 | 0.000 | 1.674 |
| **Size** | 11.086 | 13.106 | 8.009 | 1.421 |

### 6.3.3 Correlation Matrix

Table (6.3) presents correlation matrix of variables of small sized banks. It shows the correlation coefficient of independent and dependent variables.

High correlation between LATA and LoansTA, LATD and Deposits, Deposits and CAR is shown. As LATA and LoansTA are dependent variables and are used in different regression models, high correlation among them is not a problem. Deposits showed high correlation with other variables. To remove the high correlation between Deposits and other variables, Deposits were transformed by taking log. However, even after taking log of Deposits, it showed high correlation with LATD and CAR. Thus, this variable was dropped to remove multicollinearity of Deposits with other variables. Other independent variables have correlation coefficient values less than 0.5, which is an acceptable range. This makes our data set free from multicollinearity and fit for regression models.

**Table 6.3 Correlation Matrix of Small Banks Liquidity and its Determinants**

| | CATA | COF | DDLATA | DInflation | GDP | LCAR | LDeposits | LATD | Size | ROA | NPA | NIM | LoansTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1 | | | | | | | | | | | | |
| **COF** | 0.092 | 1 | | | | | | | | | | | |
| **DDLATA** | 0.208 | 0.349 | 1 | | | | | | | | | | |
| **DInflation** | -0.004 | 0.061 | -0.014 | 1 | | | | | | | | | |
| **GDP** | -0.090 | -0.412 | -0.131 | -0.005 | 1 | | | | | | | | |
| **Inflation** | -0.015 | -0.378 | -0.249 | -0.356 | 0.264 | | | | | | | | |
| **LCAR** | -0.433 | -0.304 | -0.121 | 0.072 | 0.138 | 1 | | | | | | | |
| **LDeposits** | 0.559 | 0.229 | 0.276 | -0.043 | -0.019 | -0.591 | 1 | | | | | | |
| **LATD** | -0.339 | -0.278 | -0.479 | 0.118 | -0.032 | 0.360 | -0.589 | 1 | | | | | |
| **Size** | 0.106 | 0.432 | 0.326 | -0.452 | -0.007 | -0.421 | 0.326 | -0.497 | 1 | | | | |
| **ROA** | -0.225 | -0.395 | -0.160 | 0.008 | 0.031 | 0.306 | -0.305 | 0.272 | -0.333 | 1 | | | |
| **NPA** | 0.013 | 0.310 | 0.094 | 0.186 | -0.204 | -0.119 | 0.035 | 0.099 | -0.017 | -0.197 | 1 | | |
| **NIM** | -0.130 | -0.229 | 0.054 | -0.050 | -0.097 | 0.440 | -0.287 | 0.368 | -0.298 | 0.327 | -0.172 | 1 | |
| **LoansTA** | 0.191 | 0.219 | 0.664 | -0.269 | -0.023 | 0.000 | 0.135 | -0.46 | 0.376 | -0.227 | 0.049 | 0.148 | 1 |

### 6.3.4 Hypothesis

**H01- There is no significant effect of liquidity determinants on liquidity of small sized banks.**

Hypothesis 01 analyses the impact of various factors (bank-specific and macro-economic) on liquidity of small sized banks.

For hypothesis testing, four regression models have been developed. On these models, fixed effect and random effect models have been run. Then, Hausman test has been used to choose among fixed effect estimates and random effect estimates. If p-value of Hausman test presents a value more than 0.05, then random effect estimates have been selected for result estimations; on the other hand, where the p-value is less than 0.05, fixed effect estimates have been chosen.

Four models have been developed and in these models, LATA (Liquid assets over assets), CATA (cash over assets), LoansTA (Loans over assets) and LATD (liquid assets over deposits) are dependent variables. Considered control variables (bank-specific) are size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital adequacy (CAR). Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are macroeconomic factors.

Developed four models for small size banks are presented below:

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.5)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.6)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.7)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.8)}$$

### 6.3.5 Empirical analysis

Table (6.4) explains the results obtained from the analysis of Model 1, Model 2, Model 3 and Model 4. In these models, liquidity is measured by four variables - liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) – which have been used as a proxy of liquidity of small sized banks operating in India. These variables are used as dependent variables in the models. All the models are regressed at the significance levels of 10%, 5% and 1%.

Results from analysis of Model 1 suggest that at a 1% of significance level, CAR has a significant negative effect on liquidity. At a 10% significance level, Inflation has a significant positive effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Hausman test has been conducted; as the p-value is less than 5%, fixed effect estimates are chosen over random effect estimates, and null hypothesis is rejected. Therefore, the present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Estimates from Model 2 indicate that at 10% significance level, CAR has a significant positive effect on liquidity. Bank size has a significant negative effect on liquidity at a significance level of 10%. F-statistics values showed model fitness at significance level of 1%. Robust standard error removed the heteroscedasticity of dataset. Hausman test was conducted; as the p-value is less than 5%, fixed effect estimates are chosen over random effect estimates, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Model 3 results highlight that at 5% significance level, crisis has a significant positive effect on liquidity and NIM has a significant negative effect on liquidity. At a significance level of 10%, bank size and COF have a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error eliminated the heteroscedasticityof dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Results obtained from analysis of Model 4 suggest that at 1% significance level, CAR has a significant positive effect on liquidity and profitability has a significant negative influence on liquidity. Results estimate that at 5% significance level, NIM has a significant positive effect on liquidity while inflation has a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticityof dataset. Hausman test was conducted as the p-value is less than 5%, fixed effect estimates are chosen over random effect estimates, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the association between dependent and independent variables.

Thus, empirical analysis on small banks suggests that CAR, bank size, profitability, NIM, cost of funding - which are bank-specific factors - determine liquidity of small sized banks. Macroeconomic factors - inflation and crisis - are significant factors influencing liquidity of banks with small size.

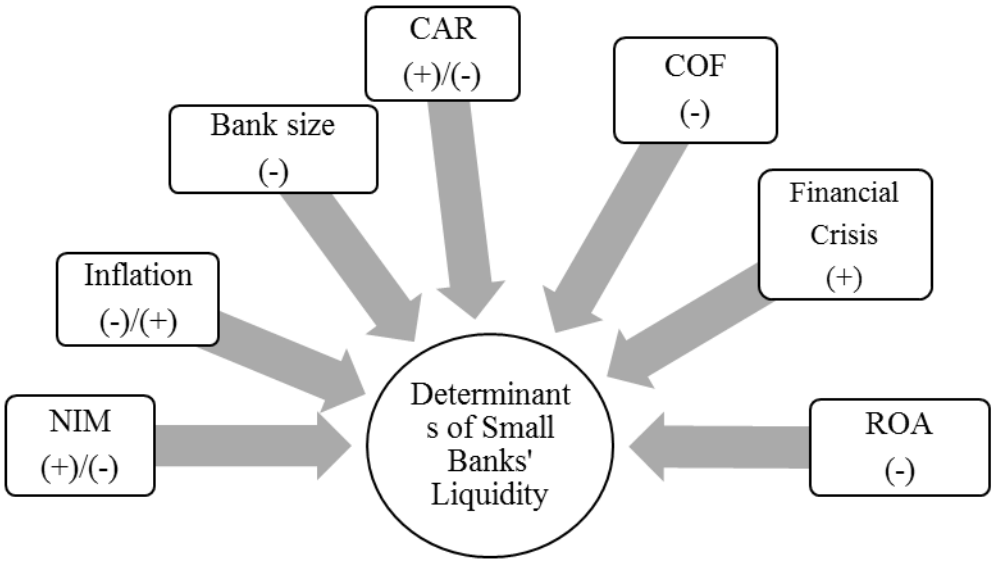



**Fig 6.1 Determinants of Small Banks' Liquidity**

**Table 6.4 Results of Regression Analysis of Panel Data (Small Banks)**

**(Dependent Variable: Liquidity)**

| | **FE** | **FE** | **FE** | **FE** |
|---|---|---|---|---|
| | **CATA**<br>**Coef.**<br>**Std. Err.** | **DDLATA**<br>**Coef.**<br>**Std. Err.** | **LoansTA**<br>**Coef.**<br>**Std. Err.** | **LATD**<br>**Coef.**<br>**Std. Err.** |
| **LCAR** | 0.097 (0.281) | **-4.264*** (1.124)** | **3.864*** (1.299)** | **19.158* (10.502)** |
| **Size** | **-0.703* (0.356)** | 1.870 (2.400) | 0.564 (2.323) | **-20.154* (11.021)** |
| **GDP** | -0.122 (0.080) | -0.492 (0.417) | -0.041 (0.287) | 0.554 (1.536) |
| **NIM** | **-0.359** (0.174)** | 1.290 (1.375) | **2.462** (0.924)** | 13.815 (10.895) |
| **COF** | **-0.140* (0.073)** | 0.629 (0.417) | -0.383 (0.449) | -0.317 (2.788) |
| **ROA** | -0.021 (0.089) | 0.374 (0.554) | **-1.496*** (0.532)** | 1.675 (3.439) |
| **NPA** | -0.013 (0.016) | -0.032 (0.227) | 0.186 (0.180) | 2.770 (2.058) |
| **Crisis** | **0.732** (0.289)** | -2.254 (2.374) | -2.074 (2.049) | 7.003 (5.865) |
| **DInflation** | 0.002 (0.072) | **0.912* (0.478)** | **-1.018** (0.390)** | -0.894 (1.256) |
| **Constant** | **14.961*** (4.492)** | 9.812 (29.369) | 31.566 (28.778) | 203.684 (123.743) |
| **R2 (within)** | 0.124 | 0.135 | 0.208 | 0.252 |
| **$R^2$ (overall)** | 0.002 | 0.131 | 0.102 | 0.333 |
| **F-statistics** | 2.67 | 20.82 | 31.69 | 3.67 |
| **Robust-hausman test(p-value)** | 0.000 | 0.020 | 0.019 | 0.022 |
| **No. Obs** | 265 | 270 | 270 | 270 |
| **No. Of grps** | 27 | 27 | 27 | 27 |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of standard error are presented in parentheses].

## 6.4 Association between Liquidity Determinants and Liquidity of Medium Sized Banks Operating in India

### 6.4.1 Introduction

This section presents the unit root test, descriptive statistics, correlation matrix and regression analysis of medium sized banks. Banks with assets worth (insert value) have been considered medium sized. First, we check the stationarity of data set; second, descriptive statistics of data set are carried out; third, correlation analysis of medium sized banks is performed; and fourth, regression analysis is conducted.

### 6.4.2 Descriptive Statistics

Table (6.5) displays descriptive statistics with respect to medium sized banks operating in India. Descriptive analysis associated with variables utilized in medium size model shows that average liquidity held by medium size banks during 2000-2015 was 11.675% (liquid assets over assets), 19.116% (liquid assets over deposits) and 5.038% (cash over assets). Minimum profitability held by medium size banks during the period was 0.020%, maximum profitability held was 3.760%. Maximum NPA of medium size banks was 15.850%, average NPA was 2.480%. Maximum cost of funding for medium size banks during 2000-2015 was 9.280% and average cost of funding was 6.254%. Maximum net interest margin of medium banks was 5.570% and minimum net interest margin was 1.010%. Maximum deposits held by medium sized banks were 70.435% and minimum deposits held were 23.797%.

**Table 6.5 Descriptive Analysis of Medium Size Banks Liquidity and its Determinants**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **LATA** | 11.675 | 57.373 | 2.839 | 8.089 |
| **LATD** | 19.116 | 127.974 | 6.228 | 18.481 |
| **CATA** | 5.038 | 9.469 | 1.434 | 1.724 |
| **LoansTA** | 51.657 | 75.767 | 20.255 | 10.666 |
| **CAR** | 3.770 | 34.404 | 0.000 | 6.413 |
| **COF** | 6.254 | 9.280 | 1.731 | 1.736 |
| **Deposits** | 70.435 | 90.994 | 23.797 | 21.619 |
| **GDP** | 6.761 | 10.260 | 3.804 | 2.268 |
| **Inflation** | 6.591 | 11.992 | 3.685 | 2.866 |
| **NIM** | 2.989 | 5.570 | 1.010 | 0.922 |
| **NPA** | 2.480 | 15.850 | 0.000 | 3.099 |
| **ROA** | 1.361 | 3.760 | 0.020 | 0.854 |
| **Size** | 13.460 | 13.806 | 13.140 | 0.210 |

### 6.4.3 Correlation analysis of medium sized banks operating in India

Table (6.6) illustrates the correlation matrix of independent and dependent variables of panel data set of medium size banks. LATA and LoansTA show a high degree of correlation between each other.

In the data set, CAR, deposits and COF show high correlation with other variables. We transformed the data series by taking log or difference at level, but found that log of capital removed the high correlation between CAR and other variables. However, transformation of COF and Deposits didn't remove the high correlation. So, to remove the problem of multicollinearity, we removed the two variables - COF and Deposits. LATD showed a high

correlation with LoansTA and LATA. But as these three variables are dependent and we developed four different regression models – each model with one dependent variable - the data series of these variables are free from multicollinearity. Table (6.6) shows that all the independent variables - Size, ROA, NPA, NIM,COF, GDP, inflation, CAR and deposits – show coefficient values of less than 0.5. This indicates that all the variables are free from the problem of multicollinearity.

**Table 6.6: Correlation Matrix for all Regression Variables of Medium Size Banks**

| | Size | ROA | NPA | NIM | LoansTA | LATA | LATD | LCAR | Inflation | GDP | CATA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | 1.000 | | | | | | | | | | |
| **ROA** | -0.048 | 1.000 | | | | | | | | | |
| **NPA** | 0.079 | -0.373 | 1.000 | | | | | | | | |
| **NIM** | -0.103 | 0.488 | -0.238 | 1.000 | | | | | | | |
| **LoansTA** | -0.025 | -0.240 | -0.164 | -0.119 | 1.000 | | | | | | |
| **LATA** | -0.110 | 0.219 | -0.091 | -0.053 | -0.668 | 1.000 | | | | | |
| **LATD** | -0.069 | 0.471 | -0.275 | -0.020 | -0.631 | 0.826 | 1.000 | | | | |
| **LCAR** | 0.173 | 0.214 | -0.255 | -0.059 | -0.205 | 0.202 | 0.289 | 1.000 | | | |
| **Inflation** | 0.223 | 0.070 | -0.494 | 0.064 | 0.325 | -0.164 | -0.131 | 0.358 | 1.000 | | |
| **GDP** | -0.023 | 0.131 | -0.329 | 0.063 | 0.119 | -0.075 | 0.000 | 0.130 | 0.361 | 1.000 | |
| **CATA** | 0.137 | -0.397 | 0.212 | -0.216 | 0.245 | -0.170 | -0.357 | -0.241 | 0.175 | -0.127 | 1.000 |

### 6.4.4 Hypothesis

**H02: There is no significant effect of liquidity determinants on liquidity of medium sized banks.**

Hypothesis 02 analyzes the impact of various factors (bank-specific and macro-economic) on liquidity of medium sized banks.

For hypothesis testing, four regression models have been developed. On these models, fixed effect and random effect models have been run. Then, Hausman test has been used to choose among fixed effect estimates and random effect estimates. If p-value of Hausman test presents a value more than 0.05, then random effect estimates have been selected for result estimations; on the other hand, where the p-value is less than 0.05, fixed effect estimates have been chosen.

Four models have been developed and in these models, LATA (Liquid assets over assets), CATA (cash over assets), LoansTA (Loans over assets) and LATD (liquid assets over deposits) are dependent variables. Considered control variables (bank-specific) are size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital (CAR). Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are macroeconomic factors.

Developed four models for medium sized banks are presented below:

**Model**

Models shown below-

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.9)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.10)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.11)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.12)}$$

### 6.4.5 Empirical Analysis

Table (6.7) presents the results from regression estimations of Models 1, 2, 3 and 4. Dependent variables used in these models are - liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA); these variables have been used as a proxy of liquidity for medium sized banks operating in India. All four models are regressed at significance levels of 10%, 5% and 1%.

From estimations of Model 1, profitability was found to have a statistically significant positive influence on liquidity while NIM showed a significant negative impact on liquidity at a significance level of 1%. At 5% significance level, crisis showed a significant positive effect on liquidity.

Model 2 results suggest that at 1% significance level, profitability has a significant positive effect on liquidity and NIM has a significant negative effect on liquidity. At a 10% significance level, inflation has a significant negative effect on liquidity.

Model 3 estimation results indicate that at 1% significance level, GDP has a significant negative effect on liquidity. At 5% significance level, capital has a significant positive effect on liquidity while NIM has a significant negative effect on liquidity.

Model 4 results suggest that at 1% significance level, profitability has a significant negative effect on liquidity. At 5% f significance level, NPA was found to have a significant negative effect on liquidity.

Thus, analysis of medium sized banks operating in India reveals that among considered bank-specific factors, profitability, NIM, capital and NPA are key significant factors influencing liquidity of medium sized banks. Selected macroeconomic factors - GDP, crisis and inflation - have significant effect on medium sized banks' liquidity.

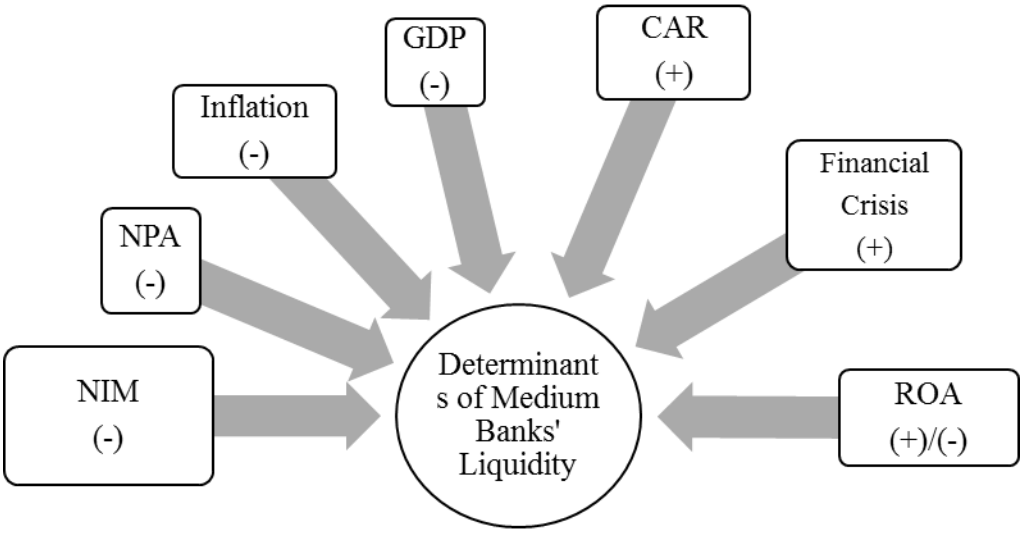



**Fig 6.2 Determinants of Medium Banks' Liquidity**

**Table 6.7 Results of Regression Analysis of Panel Data (Medium Banks)**
**(Dependent Variable: Liquidity)**

| **FE** | **FE** | **RE** | **RE** | **RE** |
|---|---|---|---|---|
| **CATA** | **Coef.**<br>**Std. Err.** | **LATA**<br>**Coef.**<br>**Std. Err.** | **LATD**<br>**Coef.**<br>**Std. Err.** | **LoansTA**<br>**Coef.**<br>**Std. Err.** |
| **Size** | -0.976 (1.183) | -4.007 (4.503) | 1.894 (8.496) | -1.347 (4.235) |
| **Inflation** | 0.094<br>(0.102) | -0.381 (0.339) | **-1.508* (0.835)** | 0.640 (0.636) |
| **GDP** | **-0.174***(0.060)** | -0.032 (0.359) | 0.248 (0.560) | -0.297 (0.268) |
| **LCAR** | **0.269** 0.128)** | 0.176 (0.560) | -0.124 (1.832) | -1.527 (1.060) |
| **NPA** | -0.169 (0.170) | -0.047 (0.292) | -0.556 (0.668) | **-0.952** (0.453)** |
| **ROA** | -0.058 (0.331) | **5.098***(1.292)** | **15.126***(4.644)** | **-6.015***(1.465)** |
| **Crisis** | 0.346 (0.478) | **2.215** (1.035)** | 2.820 (2.267) | -1.549 (2.118) |
| **NIM** | **-0.319** (0.135)** | **-2.614***(0.781)** | **-9.042***<br>**(3.0175)** | 0.479 (0.945) |
| **Constant** | 20.096<br>(15.847) | 70.038<br>(61.320) | 10.525<br>(109.989) | 75.987<br>(59.417) |
| **R2 (within)** | 0.192 | 0.377 | 0.551 | 0.490 |
| **R2 (overall)** | 0.000 | 0.136 | 0.353 | 0.210 |
| **F-statistics** | 3.75 | 57.63 | 42.11 | 203.34 |
| **Robust-hausman test(p-value)** | 0.007 | 0.530 | 0.089 | 0.294 |
| **No. Obs** | 77 | 77 | 77 | 77 |
| **No. Of grps** | 23 | 23 | 23 | 23 |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of t-statistics are presented in parentheses.

## 6.5 Association between Liquidity Determinants and Liquidity of Large Sized Banks Operating in India.

### 6.5.1 Introduction

This section presents the unit root test, descriptive statistics, and correlation matrix and regression analysis of large size banks operating in India. Banks with assets worth (insert value) have been considered large sized banks. First, we check stationarity of data set; second, descriptive statistics of data set are carried out; third, correlation analysis of large sized banks is conducted; fourth, regression analysis is performed.

### 6.5.2 Descriptive analysis

Table (6.8) explains descriptive statistics of large size banks. The analysis reveals that during 2000-2015, average liquidity of large banks was 10.968% (liquid assets over assets), 16.572% (liquid assets over deposits) and 5.583 %( cash over assets). Maximum NPA held by large banks was 18.370% and average NPA held was 3.287%. Maximum profitability held was 3.770% and average profitability held was 1.131%. Maximum cost of funding of large banks was 8.940% and minimum cost of funding was 1.848%. Maximum capital over assets was 35.603% and average capital over assets was 2.507%.

**Table 6.8 Descriptive Statistics of Large Size Banks Liquidity and its Determinants**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **LATA** | 10.968 | 45.900 | 2.764 | 6.192 |
| **LATD** | 16.572 | 138.648 | 5.517 | 17.039 |
| **CATA** | 5.583 | 13.276 | 2.244 | 2.032 |
| **LoansTA** | 47.538 | 66.752 | 21.423 | 11.172 |
| **CAR** | 2.507 | 35.603 | 0.000 | 4.905 |
| **COF** | 6.433 | 8.940 | 1.848 | 1.614 |
| **Crisis** | 0.094 | 1.000 | 0.000 | 0.293 |
| **Deposits** | 75.535 | 91.845 | 29.059 | 17.994 |
| **GDP** | 6.327 | 10.260 | 3.804 | 2.081 |
| **Inflation** | 6.039 | 11.992 | 3.685 | 2.688 |
| **NIM** | 2.993 | 4.859 | 0.884 | 0.748 |
| **NPA** | 3.287 | 18.370 | 0.000 | 3.759 |
| **ROA** | 1.131 | 3.770 | 0.000 | 0.789 |
| **Size** | 14.183 | 14.495 | 13.830 | 0.192 |

### 6.5.3 Correlation analysis

Table (6.9) presents correlation coefficients of independent and dependent variables of large sized banks.

The matrix shows that dependent variables - LATD, LATA and LoansTA –share a high degree of correlation. We developed four regression models for this study; LATA, LATD, CATA and LoansTA are dependent variables – one each considered in each of the four models. As high correlation is not among independent variables or among dependent and independent variables, we can state that data series of dependent variables are free from multicollinearity. Deposits have shown high correlation with other variables even after transformation, so we removed it from the regression models while keeping all other independent variables. All independent variables - COF, CAR, GDP, inflation, NIM, NPA, size and ROA - show correlation coefficients within the acceptable range, so we emphasise that all are free from multicollinearity and can be used in regression models for estimation.

Table (6.9) presents correlation coefficients of independent and dependent variables of large sized banks.

**Table 6.9: Correlation Matrix for all Regression Variables of Large Size Banks**

| | CAR | CATA | COF | GDP | Inflation | LATD | LATA | LoansTA | NIM | NPA | ROA | Size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAR** | 1.000 | | | | | | | | | | | |
| **CATA** | -0.177 | 1.000 | | | | | | | | | | |
| **COF** | -0.479 | 0.391 | 1.000 | | | | | | | | | |
| **GDP** | 0.021 | -0.375 | -0.500 | 1.000 | | | | | | | | |
| **Inflation** | 0.275 | -0.335 | -0.278 | 0.348 | 1.000 | | | | | | | |
| **LATD** | 0.321 | -0.041 | -0.293 | 0.087 | -0.111 | 1.000 | | | | | | |
| **LATA** | 0.086 | 0.252 | -0.028 | -0.104 | -0.367 | 0.875 | 1.000 | | | | | |
| **LoansTA** | -0.119 | -0.269 | 0.091 | 0.246 | 0.435 | -0.498 | -0.591 | 1.000 | | | | |
| **NIM** | 0.267 | -0.058 | -0.349 | -0.098 | 0.034 | -0.146 | -0.234 | -0.054 | 1.000 | | | |
| **NPA** | -0.205 | 0.431 | 0.453 | -0.390 | -0.500 | -0.141 | 0.042 | -0.334 | -0.152 | 1.000 | | |
| **ROA** | 0.168 | -0.298 | -0.462 | 0.079 | 0.278 | 0.057 | -0.116 | -0.052 | 0.493 | -0.515 | 1.000 | |
| **Size** | -0.120 | 0.000 | 0.003 | 0.003 | -0.115 | -0.155 | -0.132 | -0.054 | 0.151 | 0.058 | -0.040 | 1.000 |

### 6.5.4 Hypothesis

**H03: There is no significant effect of liquidity determinants on liquidity of large sized banks operating in India.**

Hypothesis 03 analyses the impact of various factors (bank-specific and macro-economic) on liquidity of large sized banks.

Four regression models have been developed for hypothesis testing. Fixed effect and random effect models have been run on the regression models. Hausman test has been utilized to select among fixed effect estimates and random effect estimates. If p-value of Hausman test presents a value greater than 0.05, then random effect estimates have been chosen for result estimations; on the other hand, where the p-value is less than 0.05, fixed effect estimates have been selected.

Four models have been developed and in these models, LATA (Liquid assets over assets), CATA (cash over assets), LoansTA (Loans over assets) and LATD (liquid assets over deposits) are dependent variables. Considered control variables (bank-specific) are size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital adequacy (CAR). Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are macroeconomic factors.

Developed four models for large sized banks () are presented below:

Models shown below-

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.13)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.14)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.15)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.16)}$$

### 6.5.5 Empirical Analysis

Table (6.10) indicates the results of estimations of Models 1, 2, 3 and 4. Liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) are taken as a proxy of liquidity of large sized banks operating in India. The four models are regressed at significance levels of 10%, 5% and 1%.

Model 1 estimation results suggest that at a significance level of 5%, inflation has a significant negative effect on liquidity. At a 10% significance level, bank size and NIM have a significant negative effect on liquidity.

Model 2 analysis results illustrate that at a significance level of 1%, inflation has a significant negative effect on liquidity and CAR has a significant positive effect on liquidity. At 10% significance level, NIM has a significant negative effect on liquidity.

Results from analysis of Model 3 show that at a 5% significance level, crisis has a significant positive effect on liquidity. At a 10% significance level, GDP and profitability have a significant negative effect on liquidity.

Estimations from Model 4 suggest that at a significance level of 1%, GDP has a significant negative effect on liquidity. At a 10% significance level, COF has a significant negative effect on liquidity and bank size has a significant positive effect on liquidity.

Thus, large banks' regression analysis suggests that among selected bank-specific factors, profitability, NIM, CAR and NPA are significant factors influencing liquidity of large size banks. All the selected macroeconomic factors - GDP, crisis and inflation - are key factors affecting liquidity of medium sized banks operating in India.

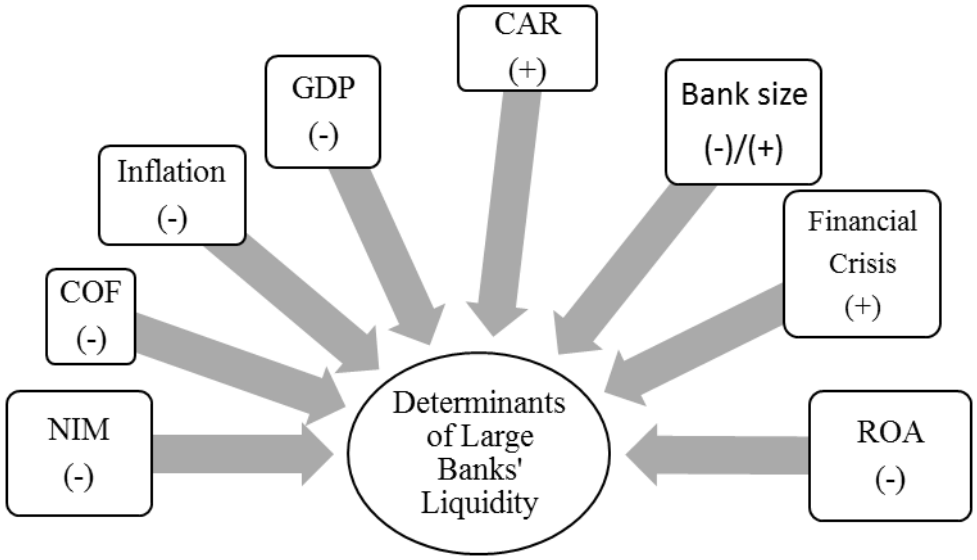



**Fig. 6.3 Determinants of Large Banks' Liquidity**

**Table 6.10 Results of Regression Analysis of Panel Data (Large Banks)**
**(Dependent Variable: Liquidity)**

| | **RE** | **RE** | **FE** | **FE** |
|---|---|---|---|---|
| | **CATA**<br>**Coef.**<br>**Std. Err.** | **LATD**<br>**Coef.**<br>**Std. Err.** | **LATA**<br>**Coef.**<br>**Std. Err.** | **LoansTA**<br>**Coef.**<br>**Std. Err.** |
| **Size** | -1.342 (1.090) | -7.791 (4.872) | **-4.750* (2.454)** | **5.968* (3.223)** |
| **Inflation** | -0.097 (0.076) | **-1.562***(0.564)** | **-0.519** (0.243)** | 0.580 (0.451) |
| **GDP** | **-0.186* (0.112)** | -0.168 (0.369) | 0.023 (0.176) | **-0.888***(0.320)** |
| **CAR** | -0.061 (0.041) | **0.814*** (0.306)** | 0.078 (0.455) | 0.603 (0.783) |
| **NPA** | 0.110 (0.085) | -0.602 (0.543) | -0.187 (0.340) | -0.335 (0.388) |
| **COF** | -0.022 (0.145) | -1.483 (1.736) | 0.343 (0.615) | **-1.778* (0.886)** |
| **ROA** | **-0.581* (0.336)** | -0.115 (2.108) | -0.777 (1.155) | 0.091 (1.515) |
| **NIM** | 0.327 (0.308) | **-10.020* (5.271)** | **-2.520* (1.247)** | 2.056 (1.512) |
| **Crisis** | **0.864**(0.375)** | -2.111 (2.484) | -0.308 (1.265) | 1.255 (2.031) |
| **Constant** | **26.036*(15.643)** | **178.393* (93.936)** | **87.999**(37.506)** | -30.332 (48.442) |
| **$R^2$ (within)** | 0.146 | 0.363 | 0.306 | 0.439 |
| **$R^2$ (overall)** | 0.272 | 0.241 | 0.154 | 0.000 |
| **F-Statistics** | 30.64 | 24.98 | 3.25 | 7.25 |
| **Robust-hausman test(p-value)** | 0.159 | 0.163 | 0.009 | 0.000 |
| **No. Obs.** | 128 | 128 | 128 | 128 |
| **No. Of Grps.** | 40 | 40 | 40 | 40 |

**[Note:** ***, ** and * statistically significant at the 1, 5 and 10% levels, respectively; values of t-statistics are presented in parentheses.

## 6.6 Association between Liquidity Determinants and Liquidity of Largest Size Banks Operating in India.

### 6.6.1 Introduction

This section presents the unit root test, descriptive statistics, correlation matrix and regression analysis of largest size banks operating in India. First, stationarity of data set is checked; second; descriptive statistics of data set are carried out; third, correlation analysis of largest size banks is performed; finally, regression analysis is conducted.

### 6.6.2 Test for Stationarity of Data Set of Largest Size Banks

Before applying panel regression analysis, it is necessary to perform stationarity test of data sets. Table (6.11) shows the LLC panel unit root test results for regression variables. This study tests without time trend and time trend of data series and checks the presence of unit root. Results presented in table (6.11) clearly show that non-stationarity is absent in the data series, i.e. data set is stationary. If non-stationarity is found in data series, then it is differentiated and stationarity test is applied. In no trend stationary test, a few variables were found to be non-stationary; they were made stationary by differentiating them at level. In this data set, all independent and dependent variables were found to be stationary. Thus, in regression models, these variables have been employed for further analysis.

**Table 6.11: Results of Unit Root Test for Panel data Variables (Largest Size Banks)**

| **Individual Effects (No Trend)** | | | **Individual and Individual Linear effects (With Trend)** | |
|---|---|---|---|---|
| **Variables** | **Statistics** | **p-value** | **Statistics** | **p-value** |
| **Size** | -7.393 | 0.000 | -0.426 | 0.335 |
| **D(Size)** | | | -6.210 | 0.000 |
| **Deposits** | -3.665 | 0.000 | -5.442 | 0.000 |
| **ROA** | -3.529 | 0.000 | -5.050 | 0.000 |
| **CAR** | -13.512 | 0.000 | -35.867 | 0.000 |
| **NIM** | -15.046 | 0.000 | -3.955 | 0.000 |
| **NPA** | -75.805 | 0.000 | -35.722 | 0.000 |
| **COF** | -6.226 | 0.000 | -13.905 | 0.000 |
| **GDP** | -28.923 | 0.000 | -20.381 | 0.000 |
| **Inflation** | -2.681 | 0.004 | 4.113 | 1.000 |
| **D(Inflation)** | | | -11.290 | 0.000 |
| **LATA** | -6.011 | 0.000 | -7.211 | 0.000 |
| **LATD** | -6.143 | 0.000 | -7.511 | 0.000 |
| **CATA** | -7.059 | 0.000 | -7.826 | 0.000 |
| **LoansTA** | -8.106 | 0.000 | -4.999 | 0.000 |

**[Note:** p-values less than 0.05 and 0.01 rejects the null hypothesis that the series is not a non-stationary at 5% and 1 % level of significance respectively.]

### 6.6.3 Descriptive Analysis

Table (6.12) demonstrates descriptive analysis of various variables used in this study to analyse the association between liquidity determinants and liquidity of largest size banks operating in India. The duration considered is 2000 to 2015. Descriptive statistics reveal that average liquidity held by largest banks operating in India was 8.709% (liquid assets over assets), 11.219% (liquid assets over deposits) and 5.582% (cash over assets). Maximum liquidity held by largest banks was 23.450%(liquid assets over assets), 39.851%(liquid assets over deposits) and 16.104%(cash over assets) maximum profitability held by largest size banks was 3.730% and minimum profitability held by largest size banks was 1.064%. Maximum cost of funding borne by largest banks was 9.880% and average cost of funding for largest banks was 5.791%. Maximum NPA held by largest size banks was 11.830% and average NPA of largest banks was 1.926%.

**Table 6.12 Descriptive Statistics of Largest Size Banks**

| | Mean | Maximum | Minimum | Standard Deviation |
|---|---|---|---|---|
| **LATA** | 8.709 | 23.450 | 1.415 | 3.248 |
| **LATD** | 11.219 | 39.851 | 4.235 | 4.890 |
| **CATA** | 5.582 | 16.104 | 0.823 | 1.936 |
| **LoansTA** | 54.499 | 70.614 | 24.267 | 9.947 |
| **CAR** | 1.455 | 24.649 | 0.001 | 3.147 |
| **COF** | 5.791 | 9.880 | 1.604 | 1.288 |
| **Crisis** | 0.205 | 1.000 | 0.000 | 0.404 |
| **Deposits** | 79.785 | 103.052 | 20.597 | 12.752 |
| **GDP** | 7.245 | 10.260 | 3.804 | 1.835 |
| **Inflation** | 7.396 | 11.992 | 3.685 | 2.715 |
| **NIM** | 2.926 | 6.312 | 0.960 | 0.746 |
| **NPA** | 1.936 | 11.830 | 0.000 | 2.045 |
| **ROA** | 1.064 | 3.730 | 0.000 | 0.583 |
| **Size** | 15.895 | 19.138 | 14.517 | 0.944 |

### 6.6.4 Correlation Analysis

Table (6.13) illustrates correlation matrix for largest size banks. It shows the correlation coefficients of independent variables and dependent variables of largest size banks. CAR shows high correlation with other variables. After taking the log of capital, data series of capital becomes free from multicollinearity, but it still shows high correlation with LoansTA, so in the regression model where LoansTA is a dependent variable, we would not take capital (we would drop the variable). We can observe that NIM also has high correlation with ROA

and inflation. We tried to transform this variable (NIM) but as it still showed high correlation with other variables, we dropped NIM. The variables - CATA, COF, Deposits, GDP, Inflation, NPA, LATA, Size, ROA, and LATD - are free from multicollinearity.

**Table 6.13: Correlation Matrix for all Regression Variables of Largest Size Banks**

| | CATA | COF | Deposits | GDP | Inflation | LCAR | LATA | LoansTA | Size | ROA | NPA | NIM | LATD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CATA** | 1.000 | | | | | | | | | | | | |
| **COF** | 0.050 | 1.000 | | | | | | | | | | | |
| **Deposits** | 0.362 | 0.482 | 1.000 | | | | | | | | | | |
| **GDP** | -0.164 | -0.389 | -0.001 | 1.000 | | | | | | | | | |
| **Inflation** | -0.084 | -0.010 | -0.086 | 0.139 | 1.000 | | | | | | | | |
| **LCAR** | -0.004 | -0.253 | -0.394 | -0.057 | -0.171 | 1.000 | | | | | | | |
| **LATA** | 0.506 | -0.186 | 0.094 | -0.146 | -0.195 | 0.077 | 1.000 | | | | | | |
| **LoansTA** | -0.056 | 0.270 | 0.430 | 0.094 | 0.446 | -0.612 | -0.315 | 1.000 | | | | | |
| **Size** | -0.180 | -0.057 | 0.017 | 0.002 | 0.285 | -0.405 | 0.002 | 0.424 | 1.000 | | | | |
| **ROA** | -0.043 | -0.449 | -0.456 | 0.119 | 0.078 | 0.067 | 0.070 | -0.163 | -0.109 | 1.000 | | | |
| **NPA** | 0.063 | 0.359 | 0.154 | -0.302 | -0.457 | 0.232 | 0.130 | -0.379 | -0.111 | -0.463 | 1.000 | | |
| **NIM** | 0.000 | -0.384 | -0.323 | 0.070 | -0.151 | 0.206 | 0.126 | -0.310 | -0.219 | 0.633 | -0.140 | 1.000 | |
| **LATD** | 0.254 | -0.410 | -0.390 | -0.131 | -0.108 | 0.255 | 0.849 | -0.469 | -0.001 | 0.273 | 0.042 | 0.267 | 1.000 |

### 6.6.5 Hypothesis

**H04: There is no significant effect of liquidity determinants on liquidity of largest sized banks operating in India.**

Hypothesis 04 analyses the impact of various factors (bank-specific and macro-economic) on liquidity of largest size banks.

Four regression models have been developed for hypothesis testing. Fixed effect and random effect models have been run on the regression models. Hausman test has been utilized to select among fixed effect estimates and random effect estimates. If p-value of Hausman test presents a value greater than 0.05, then random effect estimates have been chosen for result estimations; on the other hand, where the p-value is less than 0.05, fixed effect estimates have been selected.

Four models have been developed and in these models, LATA (Liquid assets over assets), CATA (cash over assets), LoansTA (Loans over assets) and LATD (liquid assets over deposits) are dependent variables. Considered control variables (bank-specific) are size (Size), profitability (ROA), deposits (Deposits), cost of funding (COF), non-performing assets (NPA), net-interest margin (NIM) and capital adequacy (CAR). Crisis (Crisis), Gross domestic product (GDP) and inflation (Inflation) are macroeconomic factors.

Developed four models for largest sized banks are presented below:

Model (1)

$$LATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.17)}$$

Model (2)

$$LATD_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.18)}$$

Model (3)

$$CATA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.19)}$$

Model (4)

$$LoansTA_{it} = \alpha + \beta_1 Deposits_{it} + \beta_2 COF_{it} + \beta_3 NPA_{it} + + \beta_4 ROA_{it} + \beta_5 CAR_{it} + \beta_6 NIM_{it} + \beta_7 Size_{it} + \beta_8 Inflation_{it} + \beta_9 GDP + \beta_{10} Crisis_{it} + \varepsilon_{it} \quad \textbf{(6.20)}$$

(6.6.5.4)

### 6.6.6 Regression Analysis

Table (6.14) signifies the results of regression estimation of Model 1, Model 2, Model 3 and Model 4. In these models, liquidity is the dependent variable. Liquid assets over assets (LATA), liquid assets over deposits (LATD), cash over assets (CATA) and loans over assets (LoansTA) are used as a proxy for liquidity of largest size banks. These models are regressed at significance levels 10%, 5% and 1%.

Estimations of Model 1 reveal that at 1% of significance level, crisis has a significant positive effect on liquidity and GDP has a significant negative effect on liquidity. At a significance level of 10%, size has a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Results of Model 2 indicate that at a significance level of 1%, crisis has a positive effect on liquidity and GDP has a significant negative effect on liquidity. At a significance level of 10%, COF and deposits have a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates because the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the relationship between dependent and independent variables.

Model 3 results suggest that at a significance level of 1%, deposits, inflation and crisis have a significant positive effect on liquidity. At significance level of 1%, GDP and size have a significant negative effect on liquidity. At 5% significance level, COF has a negative effect on liquidity. At 10% significance level, profitability has a significant positive effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error eliminated heteroscedasticity of dataset. On the basis of Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the association between dependent and independent variables.

Model 4 estimation results suggest that at a significance level of 1%, deposits, crisis and size have a significant positive effect on liquidity. At a 5% significance level, NPA has a significant negative effect on liquidity. F-statistics values showed model fitness at significance level of 1%. Robust standard error has removed the heteroscedasticity of dataset. Based on Hausman test, fixed effect estimates are chosen over random effect estimates as the p-value is less than 5%, and null hypothesis is rejected. Therefore, present model accepts fixed effect estimates to explain the association between dependent and independent variables.

Thus, this section of the chapter shows that banks size, cost of funding, deposits, profitability, and NPA are significant bank-specific factors that determine liquidity of largest bank size. Analysed macroeconomic factors - crisis, GDP and inflation - were found to be key influencers of liquidity of largest size banks operating in India.

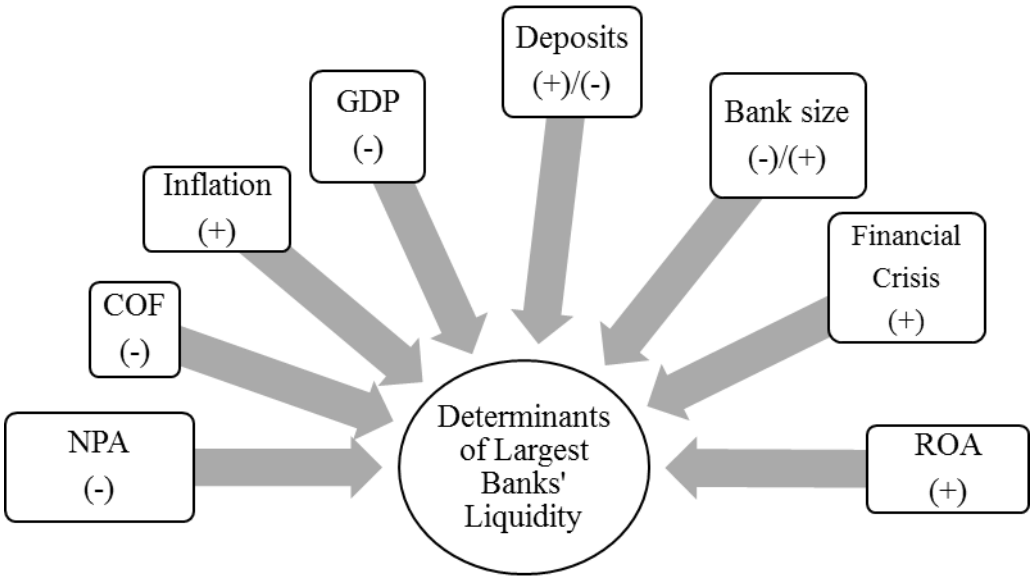



**Fig 6.4 Determinants of Largest Banks' Liquidity**

**Table 6.14 Results of Regression Analysis of Panel Data (Largest Banks)**
**(Dependent Variable: Liquidity)**

| | CATA (FE) | LATA (FE) | LATD (FE) | LoansTA (FE) |
|---|---|---|---|---|
| **COF** | **-0.200** (0.087)** | -0.314 (0.218) | **-0.585* (0.301)** | -0.429 (0.573) |
| **Deposits** | **0.075*** (0.021)** | 0.062 (0.041) | **-0.165 * (0.088)** | **0.443*** (0.146)** |
| **GDP** | **-0.226*** (0.030)** | **-0.218*** (0.062)** | **-0.312*** (0.080)** | -0.079 (0.103) |
| **Inflation** | **0.100*** (0.025)** | 0.058 (0.053) | 0.115 (0.079) | 0.172 (0.128) |
| **LCAR** | 0.131 (0.543) | 0.742 (0.891) | 0.782 (1.472) | |
| **NPA** | 0.015 (0.059) | 0.172 (0.110) | 0.291 (0.173) | **-0.832** (0.315)** |
| **ROA** | **0.366* (0.195)** | -0.021 (0.399) | -0.358 (0.675) | -0.144 (1.427) |
| **Size** | **-0.908*** (0.234)** | **-1.083* (0.565)** | -1.381 (0.884) | **8.391*** (0.764)** |
| **Crisis** | **0.820*** (0.186)** | **1.285*** (0.314)** | **1.763*** (0.482)** | **1.972*** (0.582)** |
| **Constant** | **15.572***(4.350)** | **23.604** (10.123)** | **50.841***(18.30)** | **-111.076***(17.246)** |
| **$R^2$ (within)** | 0.287 | 0.234 | 0.227 | 0.711 |
| **$R^2$(overall)** | 0.242 | 0.052 | 0.190 | 0.427 |
| **F-statistics** | 37.69 | 22.73 | 16.62 | 51.15 |
| **Robust-hausman test(p-value)** | 0 | 0 | 0 | 0 |
| **No. Obs** | 532 | 532 | 532 | 532 |
| **No. Of grps** | 47 | 47 | 47 | 47 |
| | | | | |

**[Note:** 'z' statistics are presented in the parentheses, *** indicates significant coefficients under 1% level of significance, ** indicates significant coefficients under 5% level of significance, * indicates significant coefficients under 10% level of significance]

## 6.7 CONCLUSION

This chapter explored the association between liquidity determinants and liquidity of banks of different sizes operating in India.

Results showed that bank size significantly impacted bank liquidity. Crisis showed significant influence on liquidity of all bank sizes. On the other hand, COF, Deposits, GDP, Inflation, NPA, ROA, Size did not show significant influence on liquidity of banks across different sizes.

# CHAPTER 7

# SUMMARY, CONCLUSION AND SUGGESTIONS

## 7.1 Introduction

This chapter presents the findings of the current study and lays down suggestions and recommendations for the Indian banking sector. Findings are presented with respect to research objectives given in chapter 3.

Limitations of study and directions for future research are given towards the end of the chapter.

## 7.2 Summary and Conclusion

This section provides an objective-wise (see chapter 3) summary of the significant findings of the study. Objectives 1 and 4 have been addressed in chapter 4, objective 2 in chapter 5, and objective 4 has been addressed in chapter 6 of this study.

### 7.2.1 Impact of bank-specific and macroeconomic factors on liquidity of banks operating in India

The first objective of the study was to determine the impact of bank-specific and macroeconomic factors (determinants) on liquidity of banks in India. For this objective, banks were not segregated on the basis of size or ownership structure. The impact of bank-specific and macroeconomic factors was assessed on all types of banks considered in the study. This was done to determine how the factors under study influenced the Indian banking system as a whole. Panel data models were employed to examine the impact of determinants on liquidity. The time considered for the study was 2000 - 2015.

**Significant findings with respect to objective 1 of the present study are given below.**

1. Bank-specific factors - NPA, CAR, COF, ROA, and NIM – were found to significantly affect liquidity of the selected 63 Indian banks.
2. Macroeconomic factors - crisis, GDP and inflation - were found to significantly affect liquidity of Indian banks.
3. Crisis showed a significant positive effect on liquidity.

   Results reveal that the financial crisis (2007 to 2009) had a positive effect on bank liquidity. In other words, the financial crisis stimulated liquidity of banks at an increasing rate. The reason behind this may be found in the explanation given by

Vodová (2013) and Fadare (2011); they state that during a crisis, banks get more skeptical and display greater degrees of doubt when it comes to giving out loans which results in banks holding back liquidity and not giving out loans. It is this hoarding of liquidity during crisis that increases liquidity levels of banks.

4. GDP had a significant negative effect on CATA (cash over assets).

   An increase in GDP indicates an increase in the production of goods and services in a country, which further suggests an increase in industrial and economic activity. This means that there has been economic growth and also that people now spend greater amounts of money on goods and services. As a result, demand for loan increases which reduces the liquidity holding of banks (Koray Alper, Timur, Hulagu, and Gursu Keles (2012).

5. NPA had a significant positive effect on liquidity.

   An increase in NPA affects the capital level and profitability of banks which further reduces liquidity. Capital has a risk absorbing capacity. As NPA levels rise, banks begins to hold greater amounts of liquidity. Growing NPA levels may also lead to banking crisis. To avoid such a situation, banks maintain higher levels of liquidity.

6. CAR showed a significant positive effect on liquidity, and a significant negative effect on LoansTA (loans over assets).

   High capital levels of banks boost their risk absorbing capacity. They also help banks to create liquidity from other sources such as deposits and loans. High capital levels also indicate greater efficiency of banks and their readiness to face testing situations. High capital levels attract bank deposits and lead to greater levels of liquidity. When banks maintain high capital levels, they give a positive signal to the market and attract more deposits than loans. This results in more liquid assets over total assets than loans over total assets.

7. COF had a significant negative effect on liquidity.

   Studies have observed the influence of funding cost and funding sources on bank liquidity (Bunda and Desquilbet, 2008; Munteanu, 2012 and Alger and Alger, 1999). Alger and Alger (1999) and Munteanu (2012) explained that if funding cost increased, banks tended to invest more in liquid assets. In other words, if liability cost increased, then banks, instead of relying on interbank market, relied more on liquid assets as a source of liquidity. Our study reports similar results. It was found that as funding cost of banks operating in India increased, banks began holding more liquid assets. Hence, as COF increases, liquid asset holding of banks increases. When COF is low, banks

prefer to rely more on market for liquidity rather than maintaining high levels of liquidity.

8. ROA had a significant positive effect on liquidity and a significant negative effect on LoansTA.

Highly profitable banks showed a positive effect on liquidity and a negative impact on LoansTA. This possibly suggests that profitable banks depend less on interest earnings from loans. In other words, banks with high profits decrease the amount of loans they give out. This may be because they choose to invest surplus liquidity in other assets which give rates of return higher than the interest that would have been earned by disbursing loans. The finding that greater profitability leads to lesser loans being disbursed is a rather unique finding that has not been mentioned in literature before. Further research is suggested to establish the relationship (along with underlying reasons behind the association) between the two variables in different contexts.

9. NIM showed a significant positive effect on liquidity.

In context of banks operating in India, NIM displayed a significant positive effect on liquidity. Net interest margin is a ratio that measures how successful a firm is at investing its funds in comparison to the expenses on the same investments. A positive net interest margin means the adopted investment strategy pays more interest than it costs. Conversely, if net interest margin is negative, it means that the investment strategy costs more than it makes. Thus, this finding indicates that banks operating in India adopted sound investment strategies during the period under study.

Several studies have examined the association between liquidity of banks and net interest margin. Drakos (2003) and Hesse (2007) revealed a negative link between bank liquidity and net interest margin. Maudos and Solis (2009) indicated an insignificant association between market liquidity and net interest margin. Hamadi and Awdeh (2012) observed Lebanese banks from 1996 to 2009 and found that liquidity had a negative effect on net interest margin. It is clear that the finding of our study regarding the association between MIM and bank liquidity is not in line with existing literature. This discrepancy between results forms an area for further study.

10. Inflation exhibited a significant negative effect on LATA (liquid assets over assets), and a significant positive effect on LoansTA.

Our study shows that inflation negatively affects LATA and positively impacts LoansTA. A possible explanation behind this is as follows: Inflation essentially means too much money chasing too few goods. This means that available money in circulation

is not able to purchase enough goods. In such a scenario, more people either seek to set up new manufacturing units, or expand existing capacity of firms. Thus, demand for loans increases. Due to greater loans disbursed by banks, their liquidity holdings decline. Existing literature largely corroborates the finding of our study regarding the association between inflation and bank liquidity.

Moussa (2015) revealed that increase in inflation rates negatively affected bank liquidity in Tunisia. Bhati et al. (2015) found in the context of Indian banks that higher inflation negatively impacted bank liquidity. However, Tesfay (2012) found that inflation positively impacted bank liquidity while Horvath et al. (2014) found an insignificant effect of inflation on liquid assets of banks.

It is noteworthy that the studies mentioned above examine only the association between inflation and bank liquidity. The link between inflation and LoansTA has been largely neglected, especially in an Indian context. Our study makes a valuable and unique contribution to existing literature by examining this relationship in context of banks operating in India.

### 7.2.2 Change in Influence of Determinants on Liquidity of Banks Operating in India with Change in Bank Ownership (significant findings with respect to objective 2).

This study analysed whether the impact of determinants on banks' liquidity changed with change in bank ownership; in other words, whether ownership structure influenced the effect of liquidity determinants in the context of banks operating in India. The types of ownership considered were – public, private and foreign. Key findings are given below.

#### 7.2.2.1 Influence of determinants on liquidity of public sector banks

**1. Size showed a significant negative impact on liquidity, and significant positive effect on LoansTA.**

Bank size showed a negative relationship with bank liquidity. This implies that the greater the bank size, the lower the liquidity it holds. This is consistent with studies conducted by Deléchat, Henao, Muthoora, and Vtyurina (2011). An explanation to this finding is that large banks have easy access to capital markets and can arrange funds in times of necessity. Thus, they do not need to hold large amounts of liquidity. Instead, they give out more loans which decreases their liquidity holding but increases the number of LoansTA.

2. **Inflation had a significant positive effect on liquidity, and significant positive effect on LoansTA.**

This finding suggests that in case of public sector banks operating in India, inflation positively affects liquidity and LoansTA. A possible explanation is that public sector banks in India enjoy greater trust of people. Thus, more people go to public sector banks to deposit money and take loans (generally, interest rates charged by public sector banks are lower than those by private sector banks). This makes both the amount of deposits in and loans disbursed by public sector banks more as compared to private sector banks. Due to higher loans disbursed, public sector banks hold greater amounts of liquidity so as to be able to deal with a sudden liquidity crunch.

3. **GDP showed a significant negative effect on liquidity, and a significant positive effect on LoansTA.**

Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. During economic boom or times when GDP is on the rise, demand for loan increases. Thus, banks give away more loans, reducing their liquidity holdings. This explains the finding that GDP negatively affects liquidity but positively impacts LoansTA.

4. **Deposits had a significant positive effect on CATA, and significant negative effect on LATD (liquid assets over total deposits).**

This finding proves inconclusive in determining how deposits impact bank liquidity. Deposits show a positive effect on one measure of liquidity (CATA) while simultaneously exhibiting a negative impact on another measure of liquidity (LATD).

5. **Crisis showed a significant positive effect on liquidity.**

This finding is indicative of the fact that during crisis, banks began holding liquidity and decreased the amount of loans disbursed. This finding is supported by Vodová (2013) and Fadare (2011)) who argued that during crisis, banks become more doubtful of borrowers' capability of repaying the loan and start holding liquidity instead of granting loans to customers.

6. **CAR showed a significant negative effect on liquidity.**

In India, public sector banks with high capital levels don't need to hold large levels of liquidity. They enjoy the trust of people and other institutions. Thus, deposits in such banks are naturally higher. Further, public sector banks with high capital levels are in a position to arrange funds if a sudden need arises. Thus, these banks do not hold higher levels of liquidity and either invest surplus funds or grant loans.

### 7.2.2.2 Influence of determinants on liquidity of private banks.

1. Size had a significant negative effect on liquidity, and a significant positive effect on LoansTA.

   In context of private sector banks operating in India, larger banks hold less liquidity and are able to grant more loans because larger banks are in a position to access funds from the market in case of need. The opposite holds true for smaller banks in the private sector. Smaller banks need to hold greater amounts of liquidity due to which their capability to disburse loans becomes limited.

2. CAR had a significant positive effect on LATD, and a significant negative effect on CATA.

   In case of private sector banks operating in India, the relationship between capital adequacy ratio and liquidity remained inconclusive. CAR showed a positive effect on one measure of liquidity (LATD) while a negative impact on another (CATA).

3. Inflation showed a significant negative effect on CATA.

   For private sector banks operating in India, inflation negatively affected bank liquidity.

4. GDP had a significant negative effect on LATD.

   Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. Our study corroborates these findings in the context of private sector banks operating in India. Increase in GDP may indicate economic boom wherein demand for loans increases. Banks grant more loans due to which their liquidity holdings decrease.

5. COF showed a significant negative effect on liquidity, and a significant positive effect on LoansTA.

   Increased COF showed a negative effect on private banks' liquidity but a positive impact on LoansTA. This may be due to the fact that banks give out more loans and hold less liquidity to compensate for higher cost of funds. The interest that banks pay on deposits is the cost of funds. In order to earn, banks have to charge greater rates of interest on the loans they disburse than the rates at which they pay interest for deposits. Thus, when COF rises, banks seek to increase the number of loans they give out at greater rates of interest.

7. ROA showed a significant positive effect on liquidity.

   Results reveal that as profitability levels of private banks increase, their levels of liquidity also rise.

6. Crisis had a significant positive effect on liquidity.

   Crisis had a positive effect on liquidity of private banks operating in India. This may be due to the fact that during crisis, banks start holding liquidity and reduce the amount of loans granted.

#### 7.2.2.3 Influence of determinants on liquidity of foreign banks

1. Crisis has a significant positive effect on CATA, LATA and LATD.

   As expected, crisis showed a positive effect on liquidity of foreign banks operating in India.

2. CAR had a significant negative effect on CATA and LATD.

   Higher CAR signifies efficiency and risk bearing ability of a bank. In case of foreign banks operating in India, CAR showed negative impact on both measures of liquidity – CATA and LATD. This seems logical as foreign banks have access to their parent banks in times of need. Therefore, they do not need to hold large liquidity reserves; they seek to invest surplus funds in more profitable activities.

7. Inflation has a significant negative effect on CATA.

   Inflation showed a negative effect on liquidity for foreign banks operating in India.

8. GDP had a significant positive effect on CATA and LATD.

9. COF has a negative effect on CATA.

   In case of foreign banks operating in India, COF negatively impacted liquidity

10. NIM has a negative effect on CATA.

    Greater NIM represents higher profitability and successful investment strategies in context of banks. When banks generate more income, they may decide to reinvest majority of surplus funds, holding lesser liquidity themselves.

11. Deposits have a significant negative effect on CATA and LATD.

    The negative effect of deposits on liquidity may be indicative of the strategy of foreign banks operating in India to hold lower levels of liquidity and invest surplus funds in other profitable activities.

12. ROA has a significant positive effect on LATA and LATD.

    According to Delechat et al. (2012), profitability of banks indicates financial soundness and risk bearing ability. Highly profitable banks have less liquidity constraints, and can arrange funds with relative ease in times of need. The findings of our study corroborate the above in context of foreign banks operating in India.

13. Size has a significant positive effect on LATA and LATD.

Banks having large number of total assets can arrange funds from market as they have easy access to the capital markets whereas smaller banks prioritize on intermediation processes and transformation activities hence have a smaller amount of liquidity. Public banks of India having large total assets shows positive association with LoansTA, it means that large public banks provides more loans to customer than small public banks, it may be due to the reason that large banks can bear more risk or losses than small banks due to their size advantage. As the banks gives loans, it depends on customers for their income but when customers do not pay back the loans, banks bear the losses and it reduces the income of banks and also affect the profitability level. Large banks have risk absorbing capacity due to large size hence are involve in providing loans to customers but small banks are risk averse and hence shows negative association with LoansTA.

Bank's size can have a negative effect on liquidity holdings given that large banks can be expected to have less volatile cash flows (due to offsetting flows) and better access to different funding sources. On the other hand, given their special role in the economy, large banks might be particularly prone to peer and supervisory monitoring.

### 7.2.3 Effect of determinants on bank liquidity with change in bank size (significant findings with respect to objective 3)

The study analysed change in effect of determinants on bank liquidity with change in bank size; in other words, whether bank size influenced the effect of liquidity determinants in the context of banks operating in India. The types of size considered were – small, medium, large, and largest. Key findings are given below.

#### 7.2.3.1 Effect of determinants on liquidity of small sized banks

1. Crisis showed a significant positive effect on liquidity.

   As seen above, crisis positively impacted liquidity of small sized banks operating in India.

2. Inflation showed a significant positive effect on LATA, and a significant negative effect on LoansTA.

   Inflation showed mixed effect on liquidity of small sized banks operating in India.

3. CAR had a significant positive effect on LATD and LoansTA, and a significant negative effect on LATA.

   For small sized banks, the association between CAR and liquidity remained inconclusive while LoansTA was positively impacted by CAR. Banks with higher CAR have greater risk bearing capacity and are in a better position to grant more loans.

4. Size showed a significant negative effect on liquidity.

   In our study, banks having assets upto Rs. 50 billion have been considered small sized. Within this range, it is seen that as banks' asset worth increases, their liquidity holdings decrease.

5. NIM (net interest margin) showed a significant negative effect on liquidity, and a significant positive effect on liquidity.

   For small sized banks, NIM showed mixed effect on liquidity.

6. COF showed a significant negative effect on liquidity.

   For small sized banks, COF showed a negative impact on bank liquidity.

7. ROA had a significant negative effect on LoansTA.

   Greater profitability negatively affected LoansTA in context of small sized banks. This may be due to the fact that small banks don't grant loans easily owing to their limited size and risk bearing capacity. Thus, they refrain from activities that are inherently risky, and prefer to make safer investments.

#### 7.2.3.2 Effect of determinants on liquidity of medium sized banks

1. Inflation showed a significant negative effect on liquidity.

   For medium sized banks, inflation negatively impacted liquidity.

2. GDP showed a significant negative effect on liquidity.
3. Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. Our results in context of medium sized banks are in line with these studies.
4. CAR had a significant positive effect on liquidity.

   CAR showed a positive impact on liquidity of medium sized banks operating in India.

5. NPA had a significant negative effect on LoansTA.

   It is only logical that if non-performing assets of a bank increase, the bank will lose its ability to grant loans, and its capital as well as profitability will decrease.

6. ROA showed a significant positive effect on liquidity, and a significant negative effect on LoansTA.

In case of medium sized banks, profitability positively affected liquidity while negatively impacting LoansTA. This may be representative of banks' strategy to hold funds and restrict disbursement of loans.

7. Crisis showed a significant positive effect on liquidity.
   Similar to findings in contexts mentioned above, crisis positively affected liquidity of medium sized banks.

8. NIM showed a significant negative effect on liquidity.
   For medium sized banks, NIM displayed a negative effect on liquidity.

#### 7.2.3.3 Effect of determinants on liquidity of large sized banks

1. Size showed a significant negative effect on liquidity, and a significant positive effect on LoansTA.
   As expected, large sized banks do not hold large levels of liquidity, and grant more loans as compared to smaller banks.
2. Inflation showed a significant negative effect on liquidity.
   Inflation negatively impacted liquidity of large sized banks.
3. GDP had a significant negative effect on liquidity.
4. As discussed earlier, GDP has been seen to negatively influence liquidity. This holds true in context of large sized banks also.
5. CAR showed a significant positive effect on liquidity.
   This is an interesting finding as large sized banks with higher CAR are expected to hold lower levels of liquidity. However, results in this case show otherwise.
6. COF showed a significant negative effect on liquidity.
   In context of large sized banks, COF negatively influenced liquidity.
7. ROA had a significant negative effect on liquidity.
   Profitability negatively affected liquidity of large banks. This seems logical as large banks would seek to lend and invest more and hold less liquidity.
8. NIM had a significant negative effect on liquidity.
   For large sized banks operating in India, NIM negatively impacted liquidity. This result is also according to expectations.
9. Crisis showed a significant positive effect on liquidity.

For large sized banks, crisis positively impacted liquidity.

#### 7.2.3.4 Effect of determinants on liquidity of largest sized banks

1. COF showed a significant negative effect on liquidity.
   For largest sized banks, COF negatively impacted liquidity. This finding is consistent with the findings above in context of most other categories of banks.
2. Deposits had a significant positive effect on liquidity, and a significant negative effect on LATD.
   In context of largest sized banks, results regarding the association between deposits and liquidity remain inconclusive.
3. GDP had a significant negative effect on liquidity.
   For largest sized banks, GDP showed a negative effect on liquidity.
4. Inflation had a significant positive effect on liquidity.
   Inflation showed a significant negative effect on liquidity of largest sized banks.
5. NPA had a significant negative effect on LoansTA.
   NPA showed a negative impact on LoansTA in context of largest sized banks. This is as expected.
6. ROA showed a significant positive effect on CATA.
   For largest sized banks, ROA exhibited a positive effect on liquidity.
7. Size had a significant negative effect on liquidity, and a significant positive effect on LoansTA.
   Size affected liquidity negatively, and impacted LoansTA positively in context of largest sized banks. The rationale has been discussed earlier in similar contexts.
8. Crisis showed a significant positive effect on liquidity.
   Crisis positively affected liquidity of largest sized banks.

### 7.2.4 Behaviour of determinants of bank liquidity in pre-crisis, crisis and post crisis periods (significant findings with respect to objective 4).

The study analysed the behaviour of determinants of bank liquidity in pre-crisis (2000-2006), crisis (2007-2009) and post crisis (2010-2015) periods. Key findings are given below.

#### 7.2.4.1 Behaviour of determinants of bank liquidity pre-crisis (2000-2006)

1. GDP has a significant negative effect on liquidity (LATA).
   Pre-crisis, GDP showed a negative effect on liquidity.
2. Profitability has a significant positive effect on liquidity (LATA).
   Profitability positively affected bank liquidity pre-crisis.

3. Deposits have a significant negative effect on liquidity (LATD).
   Deposits negatively affected liquidity pre-crisis.
4. Bank size has a significant negative effect on liquidity (CATA).
   Bank size negatively affected liquidity pre-crisis.
5. GDP have a significant negative effect on liquidity (CATA).
6. Deposits found to have a significant positive effect on liquidity (CATA).
7. CAR has a significant positive effect on liquidity (CATA).
   Pre-crisis, capital positively impacted liquidity.
8. Inflation has a significant positive effect on liquidity and LoansTA.
   Pre-crisis, inflation showed positive influence on liquidity and LoansTA.
9. NIM has a significant positive effect on liquidity (LoansTA).
   Pre-crisis, NIM positively affected liquidity.
10. CAR has a significant negative effect on liquidity (LoansTA).
    Banks having high CAR shows negative impact on loans over assets. It means that during pre-crisis period, banks having increasing CAR decrease the loans over assets ratio. It also suggests that high CAR of banks discourages banks to facilitate the loans to customers.
11. Profitability has a significant negative effect on liquidity (LoansTA).
    It is found that during pre-crisis period profitable banks are less indulges in loan giving to customers. So as the profitability of banks increases, it decreases the ratio of loans over assets. It also indicates that as the providing loans to customers is risky due to risk of non-payment of principle and interest amount. Profitable banks avoid giving loans and get involve in other profitable investments.

#### 7.2.4.2 Behaviour of determinants of bank liquidity during crisis (2007-2009)

1. GDP has a significant positive impact on liquidity (LATA).
2. CAR has a significant positive impact on liquidity (LATA).
   High CAR of banks, boost the risk absorbing capacity of banks and it helps the banks to create liquidity from other sources such as deposits and loans. High CAR also indicates the high efficiency of banks to face the severe situation. It attracts the deposits in banks and lead to high liquidity of the banks. When banks maintain high capital level it can create positive signal to the market and attracts more deposits rather than loans. It results in more liquid assets over assets rather loans over assets.

3. Size has a significant negative impact on liquidity (LATA) and LATD.

   Banks having large number of total assets can arrange funds from market as they have easy access to the capital markets whereas smaller banks prioritize on intermediation processes and transformation activities hence have a smaller amount of liquidity. Public banks of India having large total assets shows positive association with LoansTA, it means that large public banks provides more loans to customer than small public banks, it may be due to the reason that large banks can bear more risk or losses than small banks due to their size advantage. As the banks gives loans, it depends on customers for their income but when customers do not pay back the loans, banks bear the losses and it reduces the income of banks and also affect the profitability level. Large banks have risk absorbing capacity due to large size hence are involve in providing loans to customers but small banks are risk averse and hence shows negative association with LoansTA.

4. Inflation and NIM have a significant negative effect on liquidity (LATD).
5. COF and profitability have a significant positive effect on liquidity (LATD).
6. GDP has a significant negative effect on liquidity (CATA).

   Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. During economic boom it is likely for an increase in the number of loan and hence reducing the liquidity buffer for a bank meaning a positive relationship with bank liquidity ratio.

7. Profitability found to has a significant negative effect on liquidity (CATA)
8. Crisis period found to have a significant positive effect on liquidity (CATA).

   During this period Indian banks have increased its liquidity. It has result into positive effect of 2007 to 2009 period on CATA. Indian banks have increased its liquidity to face the crisis situation. As during this period there is usually uncertain cash demand by depositors and high rate of cost of funding in the market. So, Indian banks have increased its liquidity so that it can avoid bank run situation and other critical situation if happens.

9. Inflation has a significant negative effect on liquidity (LoansTA)
10. Deposits has a significant positive effect on liquidity (LoansTA)
11. GDP has a significant negative effect on liquidity (LoansTA).

    Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. During economic boom it is likely for an increase in the number of loan and hence reducing the liquidity buffer for a bank. But in Indian context.

### 7.2.4.3 Behaviour of determinants of bank liquidity Post-crisis (2010-2015)

1. GDP has a significant positive effect on liquidity (LATA).
   During post crisis period, increase in GDP of the economy, has the positive signal for the banks which increases liquidity of the banks.
2. Deposits have a significant positive effect on liquidity (LATA).
   During post-crisis period increase in deposits increases the liquidity of the banks. As the deposits
3. Post crisis period has a significant negative effect on liquidity (LATA).
   As holding liquidity doesn't generate any profit or income to the bank, banks avoid holding high liquidity. During the post crisis period (2010 to 2015), Indian banks show the negative effect on liquidity. It indicates that during this period Indian banks got involved into investment or other activities which can generate income or profit for the banks instead of holding high level of liquidity.
4. Deposits have a significant positive effect on liquidity (LATD).
   During post-crisis period increase in deposits increases the liquidity of the banks. As the deposits
5. Post crisis period have a significant negative effect on liquidity (LATD).
   As holding liquidity doesn't generate any profit or income to the bank, banks avoid holding high liquidity. During the post crisis period (2010 to 2015), Indian banks show the negative effect on liquidity. It indicates that during this period Indian banks got involved into investment or other activities which can generate income or profit for the banks instead of holding high level of liquidity.
6. Size has a significant negative effect on liquidity (LATD).
   Banks having large number of total assets can arrange funds from market as they have easy access to the capital markets whereas smaller banks prioritize on intermediation processes and transformation activities hence have a smaller amount of liquidity. Public banks of India having large total assets shows positive association with LoansTA, it means that large public banks provides more loans to customer than small public banks, it may be due to the reason that large banks can bear more risk or losses than small banks due to their size advantage. As the banks gives loans, it depends on customers for their income but when customers do not pay back the loans, banks bear the losses and it reduces the income of banks and also affect the profitability level. Large banks have risk absorbing capacity due to large size hence are involve in providing loans to

customers but small banks are risk averse and hence shows negative association with LoansTA.

7. GDP has a significant positive effect on banks' liquidity (LATD)

   During post crisis period, increase in GDP of the economy, has the positive signal for the banks which increases liquidity of the banks.

8. Post crisis period has a significant negative effect on liquidity (CATA).

   As holding liquidity doesn't generate any profit or income to the bank, banks avoid holding high liquidity. During the post crisis period (2010 to 2015), Indian banks show the negative effect on liquidity. It indicates that during this period Indian banks got involved into investment or other activities which can generate income or profit for the banks instead of holding high level of liquidity.

9. GDP has a significant positive effect on liquidity (CATA) during post crisis period.

   During post crisis period, increase in GDP of the economy, has the positive signal for the banks which increases liquidity of the banks.

10. Size has a significant positive effect on liquidity (CATA).

    During post crisis period, result reveals that as the bank size increases, it increases the liquidity of the banks.

11. COF has a significant negative effect on liquidity (CATA).

    Increased COF has a negative effect on private banks' liquidity. It means that private banks depends on market as source of funding. And when COF increases, private banks increases proportion of loans over assets, and decreases the banks' liquidity.

12. NPA has a significant negative effect on liquidity (CATA).

    When NPA of bank increases, to combat the situation, as the NPA increases it affects the income level and profitability level of a banks. In such situation, banks gives less loans to customers to curb the NPA level. It leads to negative effect on LoansTA.

13. Post crisis period analysis shows that, inflation has a significant negative impact on liquidity (LoansTA).

    During the post crisis period, when inflation increases, it increases the demand for loans. But during this period as a result of crisis effect banks gives less loans to the customers, it result into less LoansTA.

14. Deposits have a significant positive effect on liquidity (LoansTA).

    During post-crisis period when deposits increases, banks also increases the loans for the customers which result in positive effect on LoansTA.

15. GDP found to has a significant negative impact on liquidity (LoansTA).

Koray Alper, Timur, Hulagu, and Gursu Keles (2012) suggest a negative relationship between GDP and liquidity. During economic boom it is likely for an increase in the number of loan and hence reducing the liquidity buffer for a bank. But in Indian context,

## 7.3 Implications and Recommendations

The present study examines the influence of macroeconomic [gross domestic product (GDP), inflation (Inflation), and crisis (Crisis)] and bank-specific [return on assets (ROA), bank size (Size), deposits (Deposits), cost of funding (COF), capital adequacy ratio (CAR), net interest margin (NIM), non-performing assets (NPAs)] factors on liquidity of banks (public, private and foreign) in India. Further, the study examines how the influence of aforementioned determinants changes with change in bank size and ownership, and in normal (non-crisis) and abnormal (crisis) situations. It is important to study the relationship among bank liquidity, determinants of liquidity, and the external environment to understand how a change in any one variable affects others. It is necessary to examine how determinants act in normal (non-crisis) and unusual (crisis) situations as this would shed light on the mechanism by way of which situations wield influence on liquidity of banks.

This study takes into account the time period 2000-2015 (including the crisis of 2007-2009) and divides it into pre-crisis (2000-2006), crisis (2007-2009) and post-crisis (2010-2015) to ascertain the change in the effect of determinants on liquidity in the considered time frames. The contribution and originality value of the study lie in the fact that no effort has been made hitherto to study the influence of determinants on liquidity of banks in three distinct time periods (pre, crisis and post-crisis) to determine the difference in determinants' behaviour, especially in the context of India. This study provides deeper insights into how determinants affect bank liquidity in normal and abnormal situations.

Indian banks faced the crisis period very well. The Indian economy was able to sustain due to the conservative approach of Indian banks. In line with findings, it can be said that Indian banks maintained high levels of liquidity during the crisis period which resulted in less credit availability but security of the banking system. While implications of several findings have been explained above when listing down findings themselves, a few managerial implications and suggestions have been given below:

- In times without crisis, banks may maintain moderate levels of liquidity and increase loan disbursement.

- NPAs in public sector banks have been a serious concern for banks operating in India. Increasing NPAs erode capital and depositor confidence and trust. This encourages private banks to grant loans at higher interest rates. Steps must be taken by RBI to curb the NPA problem to check loss of money and rates charged by private sector banks.
- Smaller banks face more liquidity problems in times of crisis due to their smaller asset base. It is suggested that smaller banks be merged with larger banks so that their capacity to face crisis and absorb bad loans increases along with their asset base.
- To consolidate the banking system, policy makers may consider creating more large sized banks and financial institutions with greater capital bases to reinforce public trust and better deal with crisis situations.
- Banks may consider increasing interest rates to encourage deposits.

### 7.4 Limitations and future research direction

This study and its empirical analysis are limited to certain factors. The limitations are due to the scope of the study and to control the business of the explanatory factors in this study. The broad limitations of the study are explained below.

- The study is limited to scheduled commercial banks operating throughout the analysis period. This limitation restricted the number of banks to be included in the sample of the study and therefore the sample size was limited and small.
- The study considered balanced panel data only and therefore, an equal number of banks are included in each year of analysis. This balancing excluded several new private and foreign banks from the study which started their operations in the later years of 2003-04.
- The study includes four parameters of bank liquidity – liquid assets over total deposits, liquid assets over total assets, cash over total assets, and loans over total assets. Future studies may include other parameters for measuring bank liquidity.

The study is limited to schedule commercial banks only. Future studies may include co-operative and regional rural banks also.

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# ANNEXURE

## Determinants of Liquidity in Indian Commercial banks: An empirical evaluation

This questionnaire is circulated for research purpose and undertaken by a research scholar of IIT Roorkee. Details of the respondent would be confidential and without their permission, details of their identity would not be revealed. Thanks for encouraging research

*Required

1. **Name and designation of respondent**

_____

2. **Is (2007-2009) financial crisis affected Indian banks' liquidity** *Mark only one oval.*

- ◯ yes
- ◯ No
- ◯ Other: _____

3. **Liquidity measures are** *

*Tick all that apply.*

| Liquid assets/total assets | Cash/Total assets | Liquid assets/total deposits | Loans/Total assets | All of the above | None of the above |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

4. **Smaller banks maintains lower liquidity than larger banks.** *Mark only one oval.*

- ◯ YES
- ◯ NO
- ◯ Other: _____

5. **Public Sector banks maintains lower liquidity than foreign and private sector banks.** * *Mark only one oval.*

- ◯ YES
- ◯ No
- ◯ Other: _____

6. **Significant macro-economic variables influencing banks' liquidity are:-** * *Tick all that apply.*

| | GDP | Inflation | Crisis | All of the above | None of the above |
|---|---|---|---|---|---|
| 7. | ☐ | ☐ | ☐ | ☐ | ☐ |

7. **Bank-specific factors affecting liquidity are** * *Tick all that apply.*

| Deposits | ROA | Size | NIM | NPA | CAR | Cost of Funding | All of the above | None of the above |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

8. **Public banks' liquidity (Cash over assets) is influenced by** * *Tick all that apply.*

| Bank Size negatively (-) | Inflation positively (+) | GDP negatively (-) | Crisis positively (+) | DEPOSITS positively (+) | All of the above | None of the above |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

9. **Public banks' liquidity (Loans over assets) is influenced by** * *Tick all that apply.*

| Bank Size positively (+) | Inflation positively (+) | GDP positively (+) | Crisis positively (+) | Capital negatively (-) | All of the above | None of the above |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

10. **Public banks' liquidity (Liquid assets over DEPOSITS) is influenced by** * *Tick all that apply.*

| Bank Size negatively (-) | GDP negatively (-) | Crisis positively (+) | Capital negatively (-) | DEPOSITS negatively (-) | All of the above | None of the above |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

11. **Public banks' liquidity (Liquid assets over assets) is influenced by** * *Tick all that apply.*

| Bank Size negatively (-) | GDP negatively (-) | Crisis positively (+) | Capital negatively (-) | All of the above | None of the above |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

12. **Private banks' liquidity (Liquid assets over assets) is influenced by** * *Tick all that apply.*

| Bank Size negatively (-) | Cost of funding positively (+) | Return over assets positively (+) | Crisis (+) | All of the above | None of the above |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

13. **Private banks' liquidity (Loans over assets) is influenced by** * *Tick all that apply.*

| Size (+) | Cost of funding (-) | Crisis (+) | All of the above | None of the above |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

14. **Private banks' liquidity (Liquid assets over DEPOSITS ) is influenced by** * *Tick all that apply.*

| Capital(+) | Bank Size(-) | GDP (-) | Crisis (+) | All of the above | None of the above |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

15. **Private banks' liquidity (Cash over assets) is influenced by** * *Tick all that apply.*

| Capital negatively (-) | Inflation negatively (-) | Bank Size negatively (-) | Cost of funding negatively (-) | Crisis positively (+) | All of the above | None of the above |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

16. **Foreign banks' liquidity (Cash over assets) is influenced by** * *Tick all that apply.*

| Crisis positively (+) | Capital negatively (-) | Inflation negatively (-) | GDP positively (+) | Cost of funding negatively (-) | Net interest margin negatively (-) | DEPOSITS negatively (-) | All of the above | None of the above |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

17. **Foreign banks' liquidity (Liquid assets over assets) is influenced by** * *Tick all that apply.*

| | Crisis positively (+) | Bank Size positively (+) | Return over assets positively (+) | All of the above | None of the above |
|---|---|---|---|---|---|
| | ☐ | ☐ | ☐ | ☐ | ☐ |

18. **Foreign banks' liquidity (Liquid assets over deposits) is influenced by** * *Tick all that apply.*

| | Crisis positively(+) | Bank Size positively (+) | Capital negatively (-) | GDP positively (+) | Return over assets positively (+) | DEPOSITS negatively (-) | All of the other | None of the above |
|---|---|---|---|---|---|---|---|---|
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

19. **Write your opinion on Indian banking liquidity w.r.t. ownership (Public banks, private banks and foreign banks); bank size (Small size, medium size, large size and largest size); different time period(Pre-crisis (2000 to 2006), crisis period(2007 to 2009) and post crisis period (2010 to 2015))**