



COLLEGE OF LAW AND MANAGEMENT STUDIES

SCHOOL OF ECONOMICS, ACCOUNTING & FINANCE

**LIQUIDITY MANAGEMENT PRACTICES OF BANKS IN
EMERGING MARKET ECONOMIES UNDER BASEL III
LIQUIDITY REGULATIONS**

By

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ABSTRACT

During the 2007 to 2009 global financial crisis, several banks experienced liquidity problems, largely as a result of liquidity management practices they pursued prior to the crisis. In an effort to strengthen banks' liquidity management practices, the Basel Committee on Banking Supervision announced harmonized and binding liquidity requirements for banks in December 2010 under the Basel III framework in the form of the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR). The LCR aims to enhance banks' short term resilience to liquidity stress lasting 30 calendar days by requiring them to maintain sufficient stock of high quality liquid assets. The NSFR seeks to limit banks' asset and liability mismatch by demanding them to maintain a balanced funding mix that is commensurate with their asset base and off-balance sheet activities. Thus, liquidity standards are deliberately aimed at affecting banks' liquidity management practices. However, the new liquidity regulations introduced by the Basel Committee on Banking Supervision may bring a new source of intertemporal assets and liabilities choices that are currently absent in banks' decision making processes. Moreover, as with all regulations, liquidity standards may or may not produce their expected goals. Accordingly, this study sought to examine the impact of the Basel III liquidity standards, in particular, the LCR which is now binding on liquidity management practices of banks operating in emerging market economies. Employing the two-step system Generalised Method of Moments estimation technique on a panel dataset of forty commercial banks operating in eleven emerging market economies over the period 1 January 2011 to 31 December 2016, the results obtained revealed that banks in emerging market economies have target liquidity ratios they pursue and partially adjust their liquidity due to financial frictions. Furthermore, the study established that the Basel III LCR liquidity regulation complemented liquidity management practices of banks in emerging markets. In terms of the behavioral response of banks in emerging markets to liquidity standards, the study found that, on the asset side, banks in emerging markets appear to have elevated their stock of high quality liquid assets and on the liability side, it seems banks in emerging markets increased retail deposits, equity and long term funding. Moreover, empirical results demonstrated that the LCR charge did not adversely affect the profitability of banks in

emerging markets. Among other things, these findings suggest that the LCR liquidity regulation is less effective in jurisdictions with high liquidity reserves. In addition, changes in banks' funding mix caused by regulatory pressure stemming from the LCR rule may lead to stiff competition for retail deposits among banks. The study therefore recommends that regulators and policy makers should monitor competition for retail deposits to prevent reversal of financial sector stability gains achieved by the liquidity regulations. The study also advocates for the adoption of the Basel III liquidity standards in jurisdictions with commercial banks that depend more on capital markets for funding.

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DEDICATION

To my wife, Blissful and daughter, Kirsten.

DECLARATION

I, **Tafirei Mashamba**, declare that:

This thesis has been completed by myself and that, except where otherwise indicated, the research document is entirely my own.

This thesis has never been submitted for the award of any degree or examination at any other university.

All data, graphs, tables and pictures used have not been copied from any other person or the internet unless fully and specifically acknowledged wherever from other sources.

This thesis contains my initiative and writing, and is devoid of other persons' writings unless fully and specifically acknowledged wherever referenced from other sources. Any time a quotation is made:

- (1) In a situation of a verbatim quotation, these writings are referenced and quotation marks used to indicate that they belong to the acknowledged author.
- (2) The words of the author(s) have been paraphrased but at the same time the whole information ascribed to them has been duly referenced.

Name of student: Tafirei Mashamba

Signature

Date / / / 2017

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LIST OF ACRONYMS

ASF	Available stable funding
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CAP	Bank capital
CAR	Capital adequacy ratio
CBR	Central bank rate
COST_INC	Cost to income ratio
DEPINS	Deposit insurance
DEPOSITS	Retail deposits
DEP/TL	Retail Deposits to Total Liabilities
DLS	Deposit loan synergy
EQ/TL	Equity Funding to Total Liabilities
FSD	Financial sector development
GDP	Real gross domestic product
HQLA	High quality liquid assets
HQLA/TA	High Quality Liquid Assets to Total Assets
ID	Income diversification
IMF	International Monetary Fund
LaR	Liquid asset ratio
LCR	Liquidity coverage ratio
LG	Loan growth
LIQ	Bank liquidity

LLOSS	Loan loss
LTWF/TL	Long Term Wholesale Funding to Total Liabilities
MP	Monetary policy
NIM	Net interest margin
NPL	Non-performing loans
NSFR	Net stable funding ratio
TNCO	Total net cash outflows
OPENNESS	Financial sector openness
REGPRESS	Regulatory pressure
ROA	Return on assets
ROE	Return on equity
RSF	Required stable funding
SIZE	Bank size
SPEC	Specialization
SR	Savings ratio
TD	Transaction / demand deposits

CHAPTER I

INTRODUCTION

1.0. INTRODUCTION

The old saying, “*shortage in liquidity will kill you instantly and excess liquidity will kill you over time*” (SunGard 2012:1), highlights the importance of sound liquidity management in banking institutions. The liquidity position of banks is also of significant concern to bank regulators, policy makers and bank creditors because most failures of banking institutions emanate from insufficient liquidity (Goldman Sachs, 2017). The importance of prudent liquidity management in banks was rekindled following havoc that rocked global financial markets between 2007 and 2009. During the global financial crisis, several banks experienced acute liquidity challenges. Banks’ liquidity challenges reached a climax at the end of 2008, following the failure of Lehman Brothers in September 2008. The liquidity challenges experienced by banks during the period can be attributed to imprudent liquidity management practices (Cucinelli, 2013a; Farag *et al.*, 2013; Vodova, 2013). Banks’ complacency was motivated, to some extent, by easy access to cheap and readily available liquidity in capital markets (Basel Committee on Banking Supervision, 2010b).

Due to the interconnectedness of the financial system, liquidity challenges that were experienced by banks in the United States of America and Europe rapidly spread into other markets leading to a worldwide liquidity crisis. In an effort to strengthen banks’ liquidity management practices and to prevent future liquidity crisis, the Basel Committee on Banking Supervision (BCBS) proposed new binding liquidity requirements in December 2010 in the form of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). Although the new Basel III liquidity regulations are intended to persuade banks to change their liquidity management practices, banks may not react to regulations as expected by regulators for two reasons. First, if the regulations are not deterrent enough to induce behavioral change in banks, that is to say, if the penalties/sanctions are not deterrent enough to provoke non-compliant banks

to act, banks may not respond as expected (Calem and Rob, 1996; Berben, 2010). Second, considering that the goal of bank managers is to maximize value for common stock holders, if regulatory costs far outweigh the benefits of complying with the regulations banks may be complacent to implement the regulatory reforms (Wall and Peterson, 1996). Therefore, as regulators phase in the new Basel III liquidity standards, it is important to investigate the interplay between liquidity regulations and banks' liquidity management behavior. This is because liquidity standards are likely to bring a new source of intertemporal assets and liabilities choices that are currently absent in banks' decision making processes. Accordingly, this study seeks to shed some light on possible impact of harmonized liquidity regulations on liquidity management practices of banks in emerging markets.

1.1. BACKGROUND TO THE STUDY

Bank liquidity can be described as the ability of a bank to meet its contractual obligations timeously at minimal cost (Vento and La Ganga, 2009). Lack of liquidity can be detrimental even to banks that are highly capitalized as revealed by events that transpired during the recent global financial crisis. A bank may be well-capitalized and profitable, but a loss of creditors' confidence in the institution's ability to settle obligations upon request may lead to sudden large cash withdrawals which may bring down an otherwise solvent institution (Subhanij, 2010). In light of this, Le Lesle (2012) and the Basel Committee on Banking Supervision (2013) observed that although most banks entered the financial crisis with favorable capital ratios, liquidity shortages ignited and catalyzed failure of a number of banks. Banks' liquidity problems reached a climax in late 2008 following the failure of Lehman Brothers in September 2008. Cucinelli (2013b), Farag *et al.*, (2013) and Vodova (2013) attributed liquidity problems faced by banks to imprudent liquidity management practices. The fact that liquidity was easily, cheaply and readily available made banks to be complacent in their liquidity management as they thought they would continuously get funding from capital markets (Caballero and Krishnamurthy, 2008; Tian, 2009; Basel Committee on Banking Supervision, 2010a). However, the sudden reversal in market conditions led to rapid evaporation of liquidity in funding markets igniting liquidity challenges at individual banks (Marozva, 2015). Similarly, Accenture (2015) observed that banks did not develop proper liquidity projection models and they over relied on volatile short term wholesale funding such as Repurchase Agreements (Repos) and Asset Backed Commercial Paper (ABCP)

to finance their activities. At the same time, banks invested heavily in structured products such as Asset Backed Securities (ABS), which are vulnerable to illiquidity in times of severe financial stress such as the 2007/2009 financial turmoil (Kowalik, 2013).

Concerns about bank liquidity emanate from their maturity transformation function in the economy. Typically, banks accept short term demand deposits and loan them out on a long term basis. In the process of providing this vital social service to the economy, banks expose themselves to liquidity risk, both of firm-specific and market wide nature. Liquidity risk can be described as the probability that a bank fails to pay off maturing liabilities timeously (Drehmann and Nikolaou, 2013). It arises from the fact that maturity transformation relies on the probabilistic stability of demand deposits (Hartlage, 2012). If depositors simultaneously lose confidence in an institution due to solvency concerns or irrational behavior caused by asymmetric information, they are likely to rush to the bank to withdraw their money (Diamond and Dybvig, 1983). This sudden “enmasse” cash withdrawal is called a bank run (Casu *et al.*, 2006). Due to fractional reserve banking¹, sudden massive cash withdrawals can cause an individual bank to default on its obligations and in worst cases, totally fail. Therefore, effective liquidity risk management enhances a bank’s ability to meet maturing obligations which are random since they are influenced by external events and other agents’ behavior (Basel Committee on Banking Supervision, 2008a).

Besides determining the ongoing existence of a bank, ample liquidity has several merits from both a macro and micro perspective. From a macro perspective, a large stock of liquid assets/liquidity buffers can reduce systemic risk in four ways. First, large liquidity buffers make banks less prone to runs because liquidity buffers instill confidence to creditors that the bank is able to meet its demand withdrawals (Carney, 2013; Elliott, 2014). Second, substantial liquid assets stock minimize banks’ dependence on asset sales as a source of liquidity in a crisis or sudden withdrawal of liquidity supply to other institutions (liquidity hoarding). Both asset sales and liquidity hoarding engender negative externalities which can jeopardize the financial sector’s stability (Kowalik, 2013). Third, in the event of liquidity crisis, liquidity buffers give management and supervisors ample time to solve troubled bank(s) challenges while appropriate

¹ Fractional reserve banking is a concept in banking whereby banks keeps only a fraction of deposits in cash and near cash assets to satisfy customer withdrawals.

remedial action is being worked out (Carlson *et al.*, 2015). Fourth, a large pool of liquid securities minimizes banks' dependency on the central bank's funding which may create moral hazard challenges. From a micro perspective, the liquidity position of a bank is one of the fundamental factors that determine its ability to perform its intermediation roles (Raeisi *et al.*, 2014; Olarewaju and Adeyemi, 2015). Generally, illiquid banks manage their liquidity positions by cutting credit supply which can hurt the real economy (Berrospide, 2011). On the other hand, liquid banks are able to meet daily customer withdrawals even in times of adverse market conditions (Bank of Jamaica, 2005; Davis, 2014). In support of this assertion, Garcia-Herrero (2004) highlights that Argentinian banks were able to cope up with massive withdrawals during the 1997 crisis because they held significant liquidity buffers.

The significance of liquidity falls beyond an individual bank because liquidity challenges at an individual bank can quickly spill over to other banks and financial institutions as well as the real economy due to the interconnectedness of financial markets and institutions (Van Rixtel and Gasperini, 2013). This occasion was witnessed during the 2007/2009 global financial turmoil. Negative news of rising defaults from the United States of America subprime market caused the values of Mortgage Backed Securities (MBS) to fall drastically resulting in huge losses to banks (Brunnermeier, 2009). Furthermore, uncertainty from the subprime mortgage market caused institutional investors to shun banks' debt instruments such as Asset Backed Commercial Paper (ABCP) thereby effectively cutting liquidity supply to banks (Caballero and Krishnamurthy, 2008; Caruana and Kodres, 2008; Fisher, 2008). In the end, problems that started in the United States of America's subprime mortgage market spilled over to banking institutions and later transcended to other financial institutions and markets and eventually infected the whole United States of America's economy and the global economy at large.

The role of liquidity risk in igniting and prolonging the 2007/2009 global financial crisis prompted the Basel Committee on Banking Supervision (herein, the Basel Committee) to release a new set of global banking regulations known as the *International regulatory framework for banks – (Basel III)* in December 2010 under the auspices of the Bank for International Settlements (BIS). For the first time, the Basel Committee introduced harmonized liquidity regulations, in the form of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). According to the Basel Committee on Banking Supervision (2010b), the two metrics

have different but complementary objectives. The LCR is aimed at enhancing banks short term resilience to liquidity shocks by requiring them to maintain ample stock of unencumbered² high quality liquid assets (HQLA) that can be sold easily and quickly to pay off the bank's obligations over a 30-day liquidity stress situation. The LCR is given as the stock of high quality liquid assets to total net cash outflows over 30 calendar days. The ratio is expected to be equal to or above 100% (1) on an ongoing basis starting 1 January 2019, but implemented gradually – 60% in January 2015, then grow at a constant 10% to reach 100% in January 2019. On the other hand, the NSFR requires banks to maintain a balanced funding mix that is commensurate with their asset base and off-balance sheet activities. The NSFR is defined as the ratio of available stable funding to the amount of required stable funding. Similar to the LCR, the NSFR is expected to be at least 100% (1) at all the times. The standard was revised in 2014 following concerns from bankers and it is expected to become binding in January 2018 (Basel Committee on Banking Supervision, 2014). In spite of the fact that the implementation of liquidity regulations is transitional, events that transpired during the global financial crisis and the Eurozone debt crisis provoked market participants to call for the immediate implementation of the Accord (Gassmann *et al.*, 2011; Kok and Schepens, 2013).

Although liquidity regulations appear to be noble from a theoretical view, they may produce perverse effects if improperly designed or implemented. Early studies on the impact of capital regulations such as Kahane (1977), Koehn and Santomero (1980) and Kim and Santomero (1988) observed that capital requirements actually triggered excessive risk taking instead of constraining banks' risk behavior. Likewise, Hartlage (2012) argues that the Basel III liquidity standards may weaken the financial sector's stability instead of fostering it. Concomitantly, Duijm and Wiertz (2016) concluded that Dutch liquidity regulations worked from a microprudential perspective instead of a macroprudential perspective, suggesting that liquidity regulations may produce unexpected results. Besides, the effects of liquidity standards on bank behavior may have far-reaching consequences on financial markets and the economy. Therefore, an inquiry into the relationship between liquidity regulations and banks' strategic decisions is useful as it enables regulators to evaluate the effectiveness of the new liquidity standards. Accordingly, the present research is important in that it attempts to shed light on the

² Elliot (2014) defines an unencumbered asset as that asset that is free of legal, regulatory, contractual or other restrictions on the ability of the bank to liquidate, sell, transfer or assign it.

impact of the Basel III liquidity rules, in particular, the LCR rule which is now mandatory, on liquidity management strategies of banks operating in emerging market economies.

1.2. PROBLEM STATEMENT

Following disturbances that wreaked havoc in banks during the global financial crisis, the Basel Committee on Banking Supervision realized that there was need to strengthen existing bank regulations. For this reason, the Basel Committee on Banking Supervision introduced the LCR charge in December 2010 under the Basel III framework. The LCR regulation is aimed at strengthening banks' ability to withstand short term liquidity shocks emanating from either a financial or economic crisis. Although the LCR appears to be noble from a theoretical perspective, as with all regulations, the standard may not produce the expected outcomes. For instance, if the regulations are not deterrent enough to induce behavioral change in banks, that is to say, if the penalties/sanctions are not deterrent enough to motivate non-compliant banks to act, banks may not react as expected. In addition, considering that the goal of bank managers is to maximize value for common stock holders, if regulatory costs far outweigh the benefits of complying with the regulations, banks may be complacent to implement the regulatory reforms. Besides, the new LCR liquidity regulation brings a new source of intertemporal assets and liabilities choices that are currently absent in banks' decision making processes which may affect their liquidity management strategies. For example, from a tactical viewpoint, bank managers need to adjust their balance sheets to fulfill the new rule. At the same time, from a strategic perspective, bank executives need to modify their business models to accommodate the LCR specification and also to establish new funding sources. By and large, the LCR liquidity regulation is likely to affect the liquidity management strategies of banks. Thus, this study attempts to examine the interplay between Basel III LCR regulation and liquidity dynamics of banks operating in emerging market economies. This investigation is important because regulators need insights into the behavioral response of banks to the LCR rule which is necessary for policy evaluation. This study also examines the behavioral response of banks in emerging markets to the LCR charge. The study goes on to evaluate the effects of the LCR rule on the profitability of banks in emerging market economies.

1.3. AIM AND OBJECTIVES OF THE STUDY

The purpose of this study is to make contributions to ongoing discussions on the impact of Basel III liquidity rules on banks. To achieve this main aim, the study examines the interplay between the Basel III liquidity regulations, precisely, the LCR rule which is now binding, and liquidity management behaviors of banks operating in emerging market economies.

This aim was achieved by looking into the following specific objectives:

- ❖ To ascertain liquidity management practices pursued by banks in emerging market economies.
- ❖ To investigate the impact of the LCR charge on liquidity management practices of banks in emerging markets.
- ❖ To assess the behavioral response of banks in emerging markets to the LCR liquidity standard.
- ❖ To evaluate the impact of the LCR regulation on funding structures of banks in emerging markets.
- ❖ To examine the effects of LCR charge on the profitability of banks in emerging market economies.

1.4. RESEARCH QUESTIONS

In light of the objectives highlighted above, the following research questions were set out:

1. Do banks in emerging markets have optimal liquidity target they pursue?
2. What factors drive liquidity adjustment dynamics of banks in emerging market economies?
3. To what extent has the Basel III LCR affected liquidity dynamics of banks in emerging markets?
4. Which balance sheet items have banks in emerging markets adjusted to satisfy the Basel III LCR standard?
5. To what extent has the Basel III LCR rule modified funding structures of banks in emerging market economies?
6. To what extent has the Basel III LCR charge impacted profitability of banks in emerging markets?

1.5. SIGNIFICANCE OF THE STUDY

This study is important in that it makes the following contributions to the body of knowledge. First, despite the significance of liquidity management to banks' ongoing existence, empirical work on banks' liquidity management practices is still very scanty, largely because there were no harmonised mandatory liquidity regulations before Basel III (Moore, 2010; Bonner, 2012; DeYoung and Jang, 2016; Rezende *et al.*, 2016). Therefore, this study seeks to make contributions to the limited body of knowledge in this area.

Second, the behavioral response of banks to harmonized liquidity requirements matters to policy makers who are the watchdogs of the financial sector's stability. For instance, if banks are to meet the new binding LCR requirement by garnering more retail deposits, a herd towards retail deposits may create excessive competition for retail deposits which may lead to banking sector instability (Hartlage, 2012). Similarly, if banks fulfill liquidity rules by increasing government securities holdings, a huge demand of government securities to meet liquidity requirements may lead to crowding out of private lending or entice governments to run large budget deficits (Blundell-Wignall and Atkinson, 2010b; Li, 2017), which have dire consequences on the real economy. On the same note, banks may simply shift liquidity risk from regulated entities to the unregulated or less regulated sectors of the economy via off-balance sheet constructs (Smaghi, 2010). An examination of the impact of bank regulation on bank activities is therefore imperative to regulators and economic policy makers to assess whether liquidity standards are producing desired or undesired effects. Similarly, from a microprudential perspective, forcing banks to hold a large stock of high grade securities which generally earn low returns may weigh down their profitability. This may in turn force banks to increase their lending rates to remain profitable. Indeed, the study by Macro Assessment Group (2010) revealed that liquidity standards are likely to trigger a rise in lending rates by 27 basis points. The adverse effect of this behavior is that credit demand may decrease due to high borrowing rates. Moreover, banks may reduce credit supply to make way for liquid assets. This behavior may have negative repercussions on credit supply which subsequently affects investment and economic activity. Therefore, banks' responses to liquidity regulations have policy implications that warrant investigation.

Third, the response of banks to binding liquidity requirements may also affect central banks' operations. Given that central bank funds qualify as liquid assets, the period they are repaid (either before or after the LCR 30 day period) matters for fulfillment of the LCR rule. Smaghi (2010) points out that banks are likely to find long term central bank refinancing more attractive relative to short term. For instance, a three-month refinancing would be excluded from liquidity outflows for two months compared to a two week facility. This may motivate banks to switch from very short term to relatively long term central bank funding liquidity. In addition, banks may choose to improve their liquidity ratios by pledging non-high quality liquid assets as collateral to obtain central bank funding (Van den End, 2012). What this implies is that banks may attempt to circumvent the new liquidity regulations by transferring liquidity and credit risk to central banks resulting in moral hazard (perverse effects). Added to that, the fulfillment of minimum liquidity requirements by borrowing from the central bank by pledging illiquid assets at the expense of the interbank market could cause a reduction in unsecured money market activity which may disturb the smooth functioning of money markets (Coeure, 2013). Besides, money markets play a pivotal role in monetary policy transmission and disturbances in their operations may have dire effects on bank-based economies. Thus, an analysis of strategies that banks in emerging markets are employing to satisfy the LCR rule is imperative for effective monetary policy operations.

Fourth, most empirical studies on the impact of regulations on banks are drawn from advanced economies experiences. Nevertheless, Ediz *et al.* (1998) advise that it is important to assess the implications of regulatory requirements on banks operating in other markets. Since the effects of liquidity charges is likely to vary between bank-based (emerging market economies) and market-based (developed) economies due to differences in their market structures, this study seeks to provide empirical evidence on the impact of Basel III liquidity rules on the strategic behavior of banks functioning in emerging markets.

Fifth, given that regulatory intervention is not assigned randomly but invoked when a bank falls below the minimum regulatory threshold and such conditions are not directly observable, simple regressions may produce biased coefficients. This study contributes to bank liquidity management discourse by employing a dynamic approach and instrument variable

approach, in particular system Generalized Methods of Moments, which controls identification problems.

1.6. CHARACTERISTICS OF BANKING SYSTEMS OF EMERGING MARKETS

This sub-section provides an overview of the architecture and structure of banking systems of selected countries under investigation. This analysis of stylized facts about the markets under study may help to explain empirical results. The selected countries are Cambodia, Malaysia, South Africa, South Korea and Thailand.

1.6.1. Cambodia

The Cambodian financial sector is in its infancy stage of development. Domestic conflicts that lasted close to thirty years (ended in 1998) ravaged fundamental economic and social infrastructure as well as the financial system. The economy severely regressed during the conflict period to the extent that economic agents went back to traditional barter trade (Sarat, 2010). Presently, the economy is going through a slow but unpleasant rehabilitation. The intermediation function of banks was gradually re-established and financial institutions have managed to reclaim public confidence, as evidenced by rapid growth in credit and deposits (International Monetary Fund, 2017). In spite of these recent developments, the Cambodian banking sector is still focused on traditional intermediation, that is, deposit taking and loan extension. Lending constituted about 53% of total banks' assets as of June 2009 (Sarat, 2010). Banks dominate the financial system since the insurance industry, money and capital markets are still in infancy development level. In fact, commercial banks held about 98.60% of total banking sector assets as at the end of June 2009 (Sarat, 2010). This has made Cambodia to be a predominantly cash-based economy. Banks keep about 7% of total assets in cash reserves. Domestic credit supply as a proportion of GDP stood at 69.66 at the end of 2016 (World Bank, 2016). Although a framework has been established to spearhead the operation of the money market, its operation has been impeded by the fact that Cambodian banks have excess liquidity hence there are no incentives to borrow from the interbank market. The securities market came into existence only recently (in 2012). The development of the capital market has been hampered by limited tradable assets and undeveloped trading platform and framework (Royal Government of Cambodia, 2012).

The banking sector is made up of commercial banks, specialized banks and microfinance institutions. As of May 2016, there were 49 banking institutions consisting of 36 commercial banks and 13 specialized banks (National Bank of Cambodia, 2016). In addition, there are six deposit taking microfinance institutions and eight representative offices of foreign banks. The number of banks in Cambodia has been growing at a phenomenal rate. The number of banks in Cambodia grew by 53 percent from 32 banks in June 2009 to 49 banks in May 2016 (National Bank of Cambodia, 2016). This phenomenal growth can be attributed to rapid economic growth, limited entry barriers and previous low capital requirements for new comers (Sarat, 2010). Over the past six years, Cambodia has been registering significant economic growth, its GDP growth averaged 7% between 2011 and 2016 (World Bank, 2016). This trend is expected to continue into the foreseeable future. The minimum capital required for a new bank to enter the Cambodian market was previously set at US\$13 million, which was very low compared to neighboring countries. This low capital required attracted multinational investors to set up their own banks to support their activities in Cambodia. However, the minimum capital has since been revised to US\$ 38 million. Banks in Cambodia are largely funded by deposits since deposits account for 65% of total banks' funding as at the end of June 2009 (Sarat, 2010).

1.6.2. Malaysia

The Malaysian banking sector comprises conventional and Islamic commercial banks and merchant banks. As of May 2016, there were 54 banks operating in Malaysia, made up of 27 conventional commercial banks (8 local and 19 foreign), 16 Islamic banks (10 local and 6 foreign) and 11 local investment banks (Bank Negara Malaysia, 2016). There are no significant variations in liquidity management practices between local and foreign conventional commercial banks save for the fact that foreign banks rely on parent company for liquidity support (Sabri, 2010). Nevertheless, local banks with branches overseas can also make use of their foreign affiliates for liquidity support. Because of the Sharia Law, Islamic banks differ from conventional commercial banks in the way they manage their liquidity (Sabri, 2010). Sharia law forbids Islamic banks to charge interest on loans. As such Islamic banks cannot make use of interest bearing instruments. Furthermore, Islamic interbank market is still rudimentary, the secondary market for short term assets is illiquid and they cannot access the central bank

discount window (Sobol, 2013). This leaves Islamic commercial banks with limited tools for liquidity management.

In terms of credit supply, the ratio of domestic credit to the private sector to GDP was 123.98% in 2016 (World Bank, 2016). This suggests that banks in Malaysia significantly fund the real economy. As for financial sector development, stock market capitalization and stocks traded total value as a proportion of GDP were 121.40% and 33.16% respectively (World Bank, 2016). This evidence suggests that the Malaysian financial sector is developed though it is low when compared to mature economies. Banks are a significant player in debt markets as subscribers and not as issuers. Between May 2008 and June 2009, they held about 34% of the total amount of outstanding debt securities (Sabri, 2010). The major issuer of debt securities is the Malaysian government. As at the end of 2009, the Malaysian government issued about 43% of total debt securities. Banks are largely funded by deposits since 41% of their total funding was obtained from retail depositors. In terms of funds usage, 66% of total funds were invested in loans and 19% of total funds were invested in government securities for liquidity management purposes as at the end of 2009. Liquidity has remained relatively high in Malaysia in the period before and after the global financial crisis. Ample liquidity is envisaged in considerable liquidity surplus, stable loan to deposit ratios which average 80%, significant bank deposits and minimal dependency on wholesale funding (off shore and interbank borrowing has been maintained at 5.5% and 15% respectively) (Sabri, 2010).

1.6.3. South Africa

The South African banking sector is large, complex, well-developed and regulated and compares with advanced economies. Domestic credit supplied by banks in South Africa was 144.71% of total GDP in 2016 (World Bank, 2016). The sector is dominated by five big banks that hold about 91% of total banking sector assets (South African Reserve Bank, 2017). The dominance of a few large banks makes South Africa's banking sector to be highly concentrated. The concentrated nature of the South African banking sector provides considerable pricing power to the mega banks which enables them to reap high returns on equity and assets relative to other competitive markets (International Monetary Fund, 2014). Although domestic deposits are the largest source of funding for banks in South Africa, most liabilities of banks in South Africa are short term and wholesale in nature. According to the South African Banker magazine (2012)

around 60% of deposits in South Africa mature in one month. This makes banks in South Africa to be susceptible to liquidity risk. Notwithstanding this, it seems the liquidity position of South African banks is very sound. As of January 2017, the aggregate LCR for banks in South Africa was 100% and the liquid assets to total assets ratio stood at 9.86% (South African Reserve Bank, 2017). These ratios suggest that banks operating in South Africa have ample high quality liquid assets to withstand short term liquidity shocks. Pertaining to financial sector development, stocks traded total value to GDP ratio and market capitalization as a fraction of GDP were 136.49% and 322.66% respectively (World Bank, 2016). These ratios compare with those of developed economies. For example, the ratio of stocks traded total value to GDP in the United Kingdom and Japan were 78.60% and 105.89% respectively in 2014 (World Bank, 2014).

1.6.4. South Korea

The development of the South Korean financial system can be traced back to the early 1950s when the central bank and commercial banking models were set up following the ratification of the Bank of Korea Act and Banking Act (Kim, 2010). From that time, the Korean government has instituted several types of financial institutions that include securities and insurance firms. Subsequent to these developments, today South Korea has a well-diversified financial system in the world. Likewise, the Korean securities market is well developed considering that the stocks traded turnover ratio and the ratio of market capitalization to GDP were 126.08 and 88.90% respectively (World Bank, 2016). The vibrant securities market has enabled firms to obtain funding for their business growth, no wonder South Korea still remains one of the most promising economies in the world. The banking sector is made up of commercial and specialized banks. Commercial banks consist of nationwide and local banks and branches of foreign banks. Specialized banks are those banking institutions established on a special legislation that is different from the Banking Act. Specialized banks are mainly development oriented banks such as Korea Development Bank, Export-Import Bank of Korea, Industrial Bank of Korea and others.

As of 31 May 2016, there were 57 banks in South Korea comprising seven nationwide banks, six local banks, 39 branches and foreign banks and five specialized banks (Bank of Korea, 2016). By and large, commercial banks and specialized banks are the dominating players in the Korean banking sector as they hold a large share of total financial sector assets. Commercial

banks operate under the branch banking system and they are split into three categories, namely nationwide banks, local banks and branches and foreign banks, depending on their activities (Kim, 2010). A nationwide bank is described as a bank that operates countrywide while a local bank is a commercial bank that operates within a specific confined province. Pertaining to the nature of activities, there is no significant variation between nationwide commercial banks and local banks. In other words, the nature of activities between nationwide commercial banks and local banks is identical. Similarly, foreign bank branches operate more or less similar to Korean banks since the preferential treatment they used to enjoy has diminished and inequitable business regulations have been tightened. The non-banking sector is made up of merchant banks, mutual savings banks, credit institutions, insurance companies and securities firms.

Domestic commercial banks in South Korea are largely funded by wholesale instruments. Wholesale funding can be described as other sources of funding besides core retail deposits that banks use to finance their operations, for example, repurchase agreements, interbank loans and negotiable certificate of deposits. Wholesale funding reached a peak of about 25% of total funding at the end of June 2008, and then reversed during the global financial crisis (Kim, 2010). On the other hand, foreign banks' branches obtain most of their funding from foreign debt markets and most of their funds are channeled towards derivatives. Specialized banks were set up to fund long term capital intensive projects that could not access funding from commercial banks due to the nature of their business. Specialized banks obtain their funding from the public deposits similar to commercial banks; therefore, they directly compete for deposits with commercial banks. Besides public deposits, they also obtain their funding from debenture issues and borrowings from the government. As of the end of December 2009, commercial and specialized banks in South Korea held about 57% of total financial sector assets. Most of the banks' funds were channeled towards loans. The ratio of loans to total assets ratio was about 70% (Kim, 2010). Moreover, domestic credit to private sector scaled by GDP was 143.34% at the end of 2016 (World Bank, 2016). This suggests that banks in South Korea are more focused on traditional financial intermediation.

1.6.5. Thailand

Thailand's financial sector is comparatively large, with assets above 200% of gross domestic product (Rattanapintha, 2010). The financial system is predominantly bank based,

notwithstanding the growing importance of capital markets. The ratio of domestic credit to the private sector to GDP stood at 147.38% as at the end of 2016 (World Bank, 2016). Thailand's banking system comprises several forms of banks that consist of domestic commercial banks, foreign bank branches, finance companies and credit foncier companies. Domestic banks dominate the system with a share of approximately 87% of total assets. Moreover, banks in Thailand are primarily funded by retail deposits. Deposits accounted for about 70% of total funds while equity; borrowings and other liabilities accounted for 11%; 11% and 5% of total banks' funding as of June 2009 (Rattanapintha, 2010). Foreign banks play a significant role in Thailand's banking system, but their role is restricted as they can only operate one single branch.

The bond market is dominated by public debt securities and the issuance of corporate bonds remains limited. Government bonds account for the largest chunk of bond issuance. As of June 2009, government securities accounted for 36.52% total bonds issued (Rattanapintha, 2010). In response to lessons learnt from the global financial crisis, banks in Thailand have been building their liquidity buffers to cushion themselves against liquidity shocks. Turning to financial sector development, the stocks traded turnover ratio, stock traded total value scaled by GDP and market capitalization as a proportion of GDP stood at 80.92%, 79.88% and 106.38% respectively (World Bank, 2016). These ratios are quite high; this suggests that Thailand's financial system is well-developed.

1.6.6. Stylized facts summary

In general, the banking and financial sectors of emerging market economies are characterized by the following features. First, most financial systems of emerging market economies are bank-based because banks provide a large fraction of funding to non-financial firms compared to other financial intermediaries. Furthermore, commercial banks maintain a greater fraction of total financial sector assets. Second, the banking sector is concentrated since the top few (mostly top five) banks usually hold a large share of total banking sector assets. Third, most banks in emerging markets are largely funded by retail deposits since retail deposits account for a large share of total banks' funding. For example, deposit funding constitutes about 80% of funding for banks in Malaysia, Philippines and Saudi Arabia (Basel Consultative Group, 2014). Fourth, liquidity ratios of banks in emerging markets economies are very high. This can be explained by revision of their liquidity management strategies as a result of past lessons they

learnt from the 1997 Asian financial crisis and large government borrowings from domestic markets which causes banks to hold significant volumes of government securities. Fifth, the structure of the banking sector remains traditionally oriented. Banks are still focused on traditional financial intermediation function of deposits acceptance and loan extension. Sixth, financial sector development is still low compared to mature economies. The level of stock market capitalization to GDP and bond market size of mature economies is about 4 times and $2\frac{1}{2}$ times greater than that of emerging market economies respectively (Ernst and Young, 2013b). The low levels of financial sector development largely explain why banks dominate in emerging markets' financial systems. However, some of the emerging market economies have become advanced and sophisticated markets that compare favourably with those of mature economies, for example China, South Africa and South Korea.

1.7. CONTEXT OF THE STUDY

The impetus to focus on emerging market economies is based on four reasons. First, financial systems of emerging markets are bank-oriented because banks are the main providers of long term funding and they play a key role in financial intermediation (Santos-Paulino, 2003; Ito and Park, 2014; International Council of Securities Associations, 2015). Therefore, any disturbances to banks' asset allocation can be detrimental to the real economy; hence, there is need to investigate whether the new liquidity regulations have significant impact on emerging markets banks' tactical and strategic decisions. Second, most quantitative impact studies carried out by the Basel Committee have been confined to a small sample of member countries which restrict informed decision making on the possible effects of liquidity standards on economies with less developed capital markets and more concentrated financial systems like emerging market economies (Gobat *et al.*, 2014). Hence, this study seeks to fill this knowledge gap by carrying out an empirical assessment of the impact of Basel III liquidity regulations on banks operating in emerging market economies.

Third, for banks in Western economies that over-relied on volatile wholesale funding before the financial crisis, the imposition of liquidity standards to these economies may have merit. However, the relevance of these standards to emerging markets is debatable given that banks in emerging economies already fund their activities with stable sources, that is, retail

deposits (Financial Stability Board, 2011; Oura *et al.*, 2013). In the same vein, emerging market economies are presumed to have simpler, perhaps strong, asset and liability management techniques as evidenced by their ability to withstand liquidity disturbances that caused havoc in developed economies (Davis, 2014). In addition, Ly (2015) states that the impact of liquidity regulations may differ between bank-based and market-based economies due to differences in their market structures. Therefore, what remains to be known is the extent to which the Basel III liquidity requirements alter liquidity management strategies of banks operating in emerging market economies. This study attempts to fill this knowledge gap. Fourth, banks in emerging market economies are likely to face significant challenges in the process of abiding with binding liquidity requirements. For instance, most emerging market economies tend to have limited stock of qualifying high quality liquid assets to satisfy banks' demands as well as less liquid and less sophisticated markets (Caballero *et al.*, 2008). These challenges will probably hamper balance sheet adjustment of banks in emerging markets relative to developed markets. Added to that, emerging market banks are subject to divergent liquidity regimes which make it quite challenging for the banks to homogenously adopt the standards (Bruno *et al.*, 2016). Hence, there is motivation to examine how emerging market banks are responding to liquidity regulations given these challenges.

1.8. THESIS STRUCTURE

The thesis is organized as follows. The first chapter outlined the background to the study, problem statement, study objectives, research questions, and the significance of the study, as well as the scope of the study. Moreover, the characteristics and stylized facts of banks in emerging markets were also discussed in the first chapter.

The second chapter reviews literature related to bank liquidity and bank liquidity management. It starts by introducing the concept of bank liquidity, clearly highlighting what bank liquidity entails and sources of liquidity to banks. It proceeds to examine the notion of bank liquidity management by outlining theories behind the concept, and how the concept has evolved over time. It also discusses tools for measuring, monitoring and managing liquidity risk and lastly presents a review of liquidity management practices for banks in selected emerging market economies.

The third chapter discusses bank regulation and the behavioral response of banks to new regulations. It first of all highlights the meaning of bank regulation and proceeds to examine theories behind bank regulation, the rationale for bank regulation. Still, instruments and forms of bank regulation as well as the evolution and development of the Basel Accords are outlined in this chapter. Lastly, an analysis of behavioral response of banks to liquidity regulations is covered in this chapter.

The fourth chapter attends to study methodology. It spells out how each objective will be measured, the data to be used in the study, study sample and also the estimation approach employed. Post estimation techniques as well as data analysis procedures are also presented in this chapter.

The fifth to seventh chapters present, analyse and discuss empirical results. Chapter five presents, analyses and discusses empirical results on the first and second study objectives which are centered on ascertaining banks' liquidity management practices and analyzing the effect of liquidity regulations on banks' liquidity management practices. Results, analysis and discussion of the reaction of banks to binding liquidity rules as well as the implications of liquidity requirements on banks' funding models are presented in Chapter six. Chapter seven presents, analyses and discusses findings on the impact of liquidity regulations on the performance of banks in emerging market economies.

The eighth and last chapter of the study presents a summary of the study and key results, draws conclusions based on key findings and spells out key contributions of the study as well as recommending areas of further study.

CHAPTER II

THE CONCEPT OF BANK LIQUIDITY AND LIQUIDITY MANAGEMENT

2.0. INTRODUCTION

Liquidity is of significant importance for smooth operation of banks. Banks' growth and survival relies on liquidity (Sekoni, 2015). Given the importance of liquidity to banks, bank managers need to prudently manage their liquidity positions. In light of this, this chapter seeks to explain the concept of bank liquidity and liquidity management. The chapter is organized as follows: firstly, it describes the notion of bank liquidity, and then analyzes the interactions between the various forms of bank liquidity. Thereafter the chapter traces the evolution, development and organization of liquidity management in banks. Measures that can be adopted by bank managers to measure, monitor and prevent liquidity shortfalls are also highlighted in this chapter. Lastly, the chapter explores the key determinants of liquidity in banks and reviews liquidity management practices of banks in selected jurisdictions.

2.1. THE NOTION OF BANK LIQUIDITY

2.1.1. Bank Liquidity

Broadly, bank liquidity can be defined as the ability of a bank to pay off maturing on and off-balance sheet obligations timeously and at a minimal cost while continuing to lend (Basel Committee on Banking Supervision, 2008a). The concept of bank liquidity has many facets since it can be described from both sides of the bank's balance sheet. From an asset side perspective, bank liquidity can be described as the ability of a market participant to convert assets into cash immediately at minimal or no cost, risk or inconvenience (Tian, 2009). This definition implies that the liquidity of a bank is determined by its liquid asset holdings. From a liability side perspective, bank liquidity can be described as the ability of the bank to finance assets growth (mainly loans) and cover maturing obligations as they fall due (Basel Committee on Banking Supervision, 2000). This study is mainly interested in asset side liquidity, therefore it defines bank liquidity as the extent to which a bank maintains assets, relative to its volume and characteristics of liabilities, in the form of cash and marketable securities that can be converted

to cash within a short timeframe without significant loss of value to cover unexpected cash demands (Drehmann and Nikolaou, 2013).

The liquidity position of a depository institution is primarily determined by its stock of cash (which include vault cash, central bank reserves and balances at other banks), stock of short term marketable money market securities (such as government securities and high quality corporate bonds) and the structure of its liabilities (Gomes and Khan, 2011). Thus, bank liquidity is connected to both sides of the bank's balance sheet since it relates to the combination of assets that the bank holds and liabilities used to fund assets. The pool of marketable securities that the bank maintains as a liquidity buffer is particularly significant in the event that a bank fails to roll over or renew its debts or if other assets (such as loans) are difficult to sell immediately. Assets that make up the buffer can be sold quickly at market or close to market prices to improve the bank's liquidity position (Diamond and Kashyap, 2016).

On the other hand, it is imperative to note that the value of liquid assets held as a buffer depends on market conditions. For example, structured products may be liquid in normal times, but suffer significant haircuts³ or valuation uncertainty under stress (Brunnermeier, 2009). Therefore, as outlined by the Basel Committee on Banking Supervision (2013) assets that make up the buffer must be resilient, that is able to generate liquidity consistently, in both times of idiosyncratic and market wide stress. Furthermore, the liquidity position of a bank, especially in a crisis situation, is not just dependent upon its cash and highly liquid asset holdings: the tenor of its other less liquid assets also matters (Elliott, 2014). Elliot (2014) went on to highlight that these other less liquid assets may provide additional liquidity to the bank since a fraction of these assets may mature before the liquidity crises thereby providing additional liquidity to the bank. Likewise, these other less liquid assets may be liquidated, though at forced sale values, to offer additional liquidity to the bank (Rochet, 2008).

The nature of banks' business – intermediation function – suggests that banks hold illiquid assets that are funded by liquid liabilities. The fact that banks invest liquid liabilities in illiquid assets implies that there are several issues to consider when analyzing the liquidity position of the bank (Vento and La Ganga, 2009). From one point of view, traditional financial

³ A haircut refers to the difference between the loan amount and market value of an asset pledged as collateral (European Central Bank, 2016).

intermediation is based on the belief that depositors will not withdraw all their money simultaneously hence banks can take a large part of the deposits to supply credit (Diamond and Dybvig, 1983). Thus, the timing of withdrawals also matters for bank liquidity. Nevertheless, contemporary banking is based on financial innovation. Loan securitization⁴ and banks' access to debt markets also significantly influence their liquidity position (Saayman, 2003).

The liquidity position of a bank is also connected to its solvency (Gongol and Vodova, 2014). A solvent institution experiencing liquidity problems can quickly become insolvent if it is absorbing losses by selling illiquid assets at depressed prices due to its inability to obtain funding from debt markets (Basel Committee on Banking Supervision, 2015a). Moreover, when investors and the public begin to question the solvency of a bank they usually run on the institution which creates additional liquidity pressure on the bank. Likewise, liquidity pressure can develop from either side of the bank's balance sheet. On the liability side, large unexpected outflows can cause solvent banks to experience liquidity challenges. On the asset side, large loan defaults and unanticipated significant credit line drawdowns can lead to liquidity pressures (Rattanapintha, 2010). Furthermore, Casu *et al.* (2006) state that a bank's liquidity problems can also emanate from its off-balance sheet activities since trade losses will eventually be transferred to on-balance sheet thereby amplifying a bank's liquidity problems.

Praet and Herzberg (2008), assert that there are some market frictions that can hinder a solvent bank to manage liquidity shortfalls. These market frictions include asymmetric information, imperfect competition and systemic effects. Asymmetric information affects a bank's liquidity management since inadequate information about the bank's financial position can cause investors and depositors to run on the institution thereby worsening its problems (Holod and Peek, 2004; Allen and Carletti, 2013). When the market is characterized by imperfect competition some banks may restrict their support to an ailing bank to capitalize on its failure (Kaufman, 2006). Likewise, aggregate liquidity shocks in the market can lead to increased uncertainty which makes it difficult for troubled banks to source external funding. Broadly, bank liquidity has three main forms: funding liquidity, market liquidity and central bank liquidity.

⁴ Loan securitization is a financial practice whereby banks pool, repack and sell loans and other receivables to investors in the form of "asset backed securities" (Hu, 2011).

2.1.2. Types of bank liquidity

Nikolaou (2009) identified three main types of liquidity in the financial system, namely funding, market and central bank liquidity. This sub-section attempts to describe these liquidity facets by identifying the properties and behavior of each liquidity facet.

2.1.2.1. Funding liquidity

Brunnermeier (2009) describes funding liquidity as the easiness with which banks can raise money from private debt markets by collateralizing their assets. However, the ability of the bank to secure funds from private debt markets depends upon its debt overhang: the more debt it has the harder it is for the bank to source external funds (Kalemli-Ozcan *et al.*, 2015). It follows that banks that rely on short term wholesale market for funding should be able to continuously roll over their debt to remain liquid. Banks fund their activities with a multiplicity of funding instruments that are relatively sticky (slow to change). These instruments are presented in Figure 2.1 below.

Figure 2.1: Banks' funding structures

By investor type	By instrument		By seniority	
Customer deposits	Stable deposits, including insured deposits		Secured debt	
	Less stable deposits, including uninsured, foreign currency, internet, high net worth individual deposits.		Long term: Repo, Swap, ABCP	Short term: Covered bond, MBS
Wholesale funding	Short-term (ST)	Unsecured: Interbank deposit, Commercial Paper, Certificate of deposit. Secured: Repo (including Central bank), Swap, Asset backed commercial paper (ABCP).	Senior unsecured debt ▪ Deposits ▪ Short term: interbank deposits, Commercial paper, Certificate of deposit ▪ Long term: bonds	
	Long term (LT)	Secured: covered bonds, Asset Backed Securities (ABS), Mortgage Backed Securities		
Regulatory capital (Retail/Wholesale)	Subordinated debt, including preferred share, Contingent convertible, Perpetual bond		Junior debt	
	Common equity		Equity	

Source: Oura *et al* (2013: 108)

As shown in Figure 2.1 above, banks funding instruments can be categorized by investor type, instrument type and seniority ranking, and the main forms of liability funding are customer deposits, wholesale funds and regulatory capital. These funding instruments are described below.

i. Retail customer deposits

The Basel Committee on Banking Supervision (2013) defines retail deposits as money which is placed at a bank by a natural person. Retail deposits are considered to be the traditional source of liquidity to banks and generally stable, particularly if they are secured by an effective deposit protection scheme (Basel Committee on Banking Supervision, 2010b). In spite of their relative stability, retail deposits are susceptible to liquidity risk as they are liable to runs (Diamond and Rajan, 1983), therefore, banks should not completely depend on them (Le Lesle, 2012).

ii. Wholesale funds

Besides sourcing funding from retail depositors, banks can also obtain funding from the wholesale/capital market. Wholesale funds are made up of short term instruments (that can either be secured such as Repos and ABCP or unsecured such as interbank loans, commercial paper and certificates of deposits) and long term securities (that can also be either secured such as covered bonds, asset backed securities, mortgage backed securities or unsecured such as senior unsecured bonds) (Oura *et al.*, 2013; Truno *et al.*, 2017). They are relatively volatile compared to retail deposits, although they are stable in normal times (Craig and Dinger, 2013). Wholesale deposits are very sensitive to market conditions. Once wholesale depositors sense some changes in market conditions, they move with haste to withdraw their money which can leave the bank with serious liquidity shortfalls (Federal Reserve Board, 2001). Therefore, over-reliance on this funding source poses a significant liquidity risk to banking institutions. This argument can be validated by examining the impact of wholesale funding to the 2007/9 global financial crisis. Several banks that over-relied on short term wholesale funding in the period preceding the crisis experienced serious liquidity challenges during the crisis (Kowalik, 2013; Babihuga and Spaltro, 2014). In contrast, banks that depended on stable retail deposits fared better during the crisis than banks that over-relied on wholesale funding (Vazquez and Frederico, 2012; Ritz and Walther, 2015). Thus, although wholesale funding can provide banks with a cheap source of funding in

normal times, this funding source is very volatile (especially in times of crisis) hence banks should depend on this funding source to a lesser extent.

iii. Bank Capital

Like any other business, banks also finance their activities with equity capital. In general, bank capital is meant to absorb losses (Hugonnier and Morellec, 2017). Capital is made up of common equity, subordinated debt, preferred stock, contingent convertible debt (CoCos) and perpetual debt (Basel Committee on Banking Supervision, 2010b). The highest quality capital is Tier 1 capital which is made up of common equity and it is the first to be used to cover losses. It is supplemented by Tier 2 capital that is made up of securities stated above and retained earnings. Since capital is irredeemable it provides a stable funding source to banks (Basel Committee on Banking Supervision, 2010b). This explains why Basel III liquidity regulations encourage banks to fund their activities with core equity capital.

iv. Asset Securitization

Banks can also obtain liquidity using off-balance sheet instruments, particularly asset securitization. Under the ‘originate-to-distribute’ business model, banks are no longer keeping illiquid assets such as loans on their balance sheets; rather they repackage and sell these illiquid assets to other investors (Saayman, 2003). This process is referred to as asset securitization. Prior to the 2007/9 global financial crisis securitization was a significant source of liquidity to banks (Brunnermeier, 2009). However, liquidity from securitization suddenly evaporated in 2008 when investors perceived securitized products to be too risky leading to severe liquidity pressure on banks (Szablowska, 2010). This suggests that although asset securitization can enhance banks’ liquidity, it can be unreliable in times stressed market conditions. This argument is validated by the European Central Bank (2008) finding that banks experienced severe challenges in accessing secured funding in securitization markets during the global financial crisis.

2.1.2.2. Market liquidity

Market liquidity can be defined as the easiness with which an asset is traded in financial markets (Brunnermeier and Pedersen, 2009). According to Kyle (1985) and Lybek and Sarr (2002) market liquidity is characterized by five attributes: tightness, immediacy, depth, breadth and resiliency. Tightness relates to the cost of selling an asset and immediately buying it back, as

measured by the bid-ask spread. Immediacy refers to the time it takes to execute a trade and is dependent on the efficiency of the trading, clearing and settlement systems. Market depth relates to the presence of abundant orders in a market. Market breadth describes the ability of traders to sell or buy assets at the ruling bid-offer price with no significant movement in prices. Resiliency refers to the time it takes for prices in disequilibrium to revert to their intrinsic values.

Market liquidity is of great concern to investors because it has a bearing on their returns (Fontaine *et al.*, 2015). Elliot (2015) states that investors' returns tend to fall in times of market illiquidity due to high transaction costs (high bid/offer spread) and falling asset values. Additionally, illiquid markets are very fragile in that they cannot withstand shocks in extreme cases which may trigger or amplify a financial crisis while buoyant market liquidity promotes financial stability because it makes financial institutions resilient to sharp price decreases (Goldstein *et al.*, 2017). Likewise, low market liquidity has a high probability of fragility, but what may appear to be abundant market liquidity may suddenly plunge (Basel Committee on Banking Supervision, 2010b). This means that market liquidity is prone to abrupt evaporation and is greatly compromised in stress conditions. Sudden evaporation of market liquidity occurs when speculators' capital is reduced significantly in a crisis which forces the market to adjust to a low liquidity/high margin equilibrium (Brunnermeier and Pedersen, 2009). Therefore, bank managers need to monitor day-to-day liquidity developments and put in place contingent plans to deal with unanticipated market illiquidity.

2.1.2.3. Central bank liquidity

Central bank liquidity refers to the ability of the reserve bank to provide liquidity support to the banking sector when needed (Cecchetti and Disyatat, 2010). It is measured by the flow of the monetary base to the financial system from the reserve bank. The central bank supplies liquidity to the financial markets either through its open market operations or lender of last resort functions (Bindseil, 2000). Through open market operations the central bank can control the amount of liquidity in the market. The lender of last resort function exists to enhance financial sector stability. When banks are short of liquidity, they can borrow from the central bank via this window to manage their shortfalls (Johnson and Santor, 2013). The importance of central bank funding was observed during the global financial crisis. During the crisis central banks injected large amounts of liquidity to both individual institutions and the whole market to restore stability

(Armstrong and Caldwell, 2008; Moe, 2012). However, the provision of central bank liquidity has been critiqued on the grounds that it engenders moral hazard (Li *et al.*, 2013; Domanski and Sushko, 2014; Hassdorf, 2014). Moral hazard arises when managers invest more in risky assets and less in liquid securities on the belief that they will be bailed out in times of crisis (McCoy, 2006). In order to minimize moral hazard central banks do not usually disclose “ex-ante” how they will react to individual firm and system wide liquidity shortages (Domanski *et al.*, 2014).

2.2. LIQUIDITY NEXUS

2.2.1. Loop between funding and market liquidity

The interrelationship between market, funding and central bank liquidity demonstrates how liquidity works in the financial sector. This loop can be analyzed under two scenarios: normal and turbulent times as explained by Nikolaou (2009). In normal times, liquidity smoothly flows among the three liquidity forms, creating a vicious liquidity cycle that fosters financial sector stability. The role of each is unique and significant in the system; therefore, each should play its roles and depend on the other two for the system to remain liquid. Under normal market conditions, the central bank would supply ‘neutral/equilibrium’ amount of liquidity to the financial system via banks through its normal instruments of monetary policy. The neutral amount of liquidity supplied by the reserve bank flows smoothly assuming market liquidity efficiently recycles it and funding liquidity efficiently allocates it within the system (Nikolaou, 2009). Markets would remain liquid as long as there is ample aggregate liquidity in the financial system and agents demand liquidity based on their unique needs. On the other hand, funding liquidity relies on the continuous supply of funding liquidity from the market and the central bank.

However, in stressed market conditions, when liquidity risk rises, the interdependencies described above are also strong, but the strong relationships act together as conduits of liquidity risk which can destabilize the market (Subhanij, 2010). These linkages can be discussed by considering a bank facing idiosyncratic liquidity risk emanating from imperfect competition and asymmetric information. By their design, banks provide intermediation services to the society by transforming liquid liabilities into illiquid assets through accepting short term deposits and issuing long term loans. Although this service is vital to the society, it exposes banks to funding liquidity risk. Funding liquidity risk is defined as the probability that a bank will fail to meet

demand withdrawals with immediacy (Drehmann and Nikolaou, 2013). This risk arises when depositors, out of fear that the institution is no longer solvent, make ‘en-masse’ panic withdrawals (Elliott, 2014). Asymmetric information and imperfect competition can combine to bring the bank down. In a market characterized by asymmetric information, the bank can suffer huge liquidity drains even though it may be solvent. Depositors reacting to bad news, which may not be true after all, about the bank can make a run on the institution leading to massive cash outflows (Diamond and Dybvig, 1983). Similarly, when markets exhibit imperfect competition other banks not experiencing funding difficulties can withdraw their support to the ailing institution in order to benefit from its failure (Kaufman, 2006). Due to the contagious nature of liquidity risk, funding liquidity problems at an individual institution can transcend to market liquidity risk via the interbank market and asset markets (Cifuentes *et al.*, 2005; Estrada and Osorio, 2006).

a) Interbank Market link

Banks are connected via the interbank market. As such, idiosyncratic funding difficulties at individual banks can cascade to other banks via the interbank market. The interbank market provides a pool of liquidity that banks can tap into to manage their positions; however, in times of crisis, this pool can be depleted by an ailing bank leading to liquidity pressure at other banks (Nikolaou, 2009). In this case, idiosyncratic liquidity problems at individual banks can transcend to market illiquidity.

b) Asset Market link

Asset markets can also be another channel through which funding liquidity risk transmit to market liquidity risk. Once the interbank market is impaired as a result of funding distress, banks move to the asset market in search of alternative liquidity through fire sales (Hurd, 2017). Forced fire sales depress asset prices, which causes market liquidity to dry up (European Central Bank, 2002; Elliot, 2015).

2.2.2. Loop between market and funding liquidity

So far, this discussion has revealed how funding illiquidity transcends to market illiquidity. Nikolaou (2009) further illustrates how a loop between market and funding liquidity

can cause a downward liquidity spiral. The strong inter linkage between funding and market liquidity can lead to second round effects, whereby market liquidity risk is transmitted back to funding liquidity risk (Nikolaou, 2009). This loop occurs in markets where assets and balance sheets are marked to market on a daily basis. Decreases in asset prices are instantly captured by changes in the bank's net worth. The loss in asset values coupled with funding illiquidity can lead to another round of asset sales which further depress asset prices. To cover up for funding gaps, more sales are needed which further reduce asset prices and the cycle continuous (Brunnermeier and Pedersen, 2009). In the end, funding liquidity risk is amplified. In light of this, it is clear that the inter-linkages between funding and market liquidity can lead to a vicious downward liquidity spiral.

2.2.3. The role of the Central Bank

The role of the central bank is to restrain panic-induced bank failures. When the market is distressed, the central bank should calm markets by providing additional liquidity (Johnson and Santor, 2013). Central bank intervention can either be directed to specific struggling banks or the market as a whole through open market operations. During the course of the global financial crisis, central banks throughout the world had to bail a number of institutions to prevent systemic risk (Bindseil and Jablecki, 2013). Central bank support is aimed at breaking feedback loops between funding and market liquidity to prevent total collapse of the financial sector (Bindseil, 2000). Though significant, central bank support is not a panacea to the underlying liquidity problems confronting banks. This support can sometimes fail because its intervention is aimed at shock absorption (stabilizing function) which does not attend to the fundamental problems confronting banks (Bertsch and Molin, 2016). Thus, the root causes of liquidity risk can limit the stabilizing effect of central bank intervention. In that case, central bank intervention not only fails to break the vicious loop between funding and market liquidity, but can cause a full vicious cycle to be created in the system that emanates from central bank liquidity (Li and Ma, 2017).

2.3. BANKS' LIQUIDITY MANAGEMENT

2.3.1. Evolution and development of the concept of bank liquidity management

The evolution and development of the concept of bank liquidity management can be traced to the following theories: Commercial Loan theory/Real bills doctrine; Shiftability/Asset

Conversion theory; Anticipated Income theory; Liability Management theory, Asset and Liability Management and Asset Securitization and Risk Management. The evolution and development of liquidity management in banks is summarized in Table 2.1 below.

Table 2.1: Evolution and development of bank liquidity management

Theory/Concept	Period in operation
1) Commercial Loan theory/Real Bills doctrine	Late 1700s to 1920s
2) Shiftability/Asset Conversion theory	1940s
3) Anticipated Income theory	1950s to early 1960s
4) Liability Management theory	Late 1960s to early 1970s
5) Asset and Liability Management (ALM) and Asset Securitization	Mid 1970s to mid-1990s
6) Risk Management	Mid-1990s to date

Source: Own construction

As shown in Table 2.1 above, the present day concept of bank liquidity management (asset and liability management) has evolved through six different stages. Initially, Adam Smith Real Bills doctrine influenced the way banks managed their liquidity from the late 1700s to 1920s. As time passed by, the Commercial Loan theory became irrelevant because banks realized that they could obtain liquidity from non-loan assets, thus banks believed in holding liquid assets they could sell to manage shortfalls. Thereafter, as commerce grew, the Anticipated Income theory gained popularity, but waned with the emergence of Negotiable Certificate of Deposits and the inception of the liability management theory. The Liability Management theory can be hailed for permitting banks to source funding liquidity from both sides of their balance sheets. Next, Asset and Liability management and Asset Securitization grew out of the need for banks to effectively manage their mortgage loan portfolios. Nowadays, liquidity management is incorporated in the overall Risk Management strategy for the bank. These theories and concepts are discussed in detail below.

2.3.1.1. Commercial Loan theory

The theory can be traced back to Adam Smith's 1779 '*Real Bills Doctrine*.' The theory asserts that banks exist to provide only short term credit to businesses involved in the production of goods (Merris, 1979). The role of banks in commerce would be to provide loans over the life span of a project which was presumed to be relatively short term. In other words, banks were expected to finance the movement of goods through successive stages of production to consumption by providing working capital to businesses (Chawla, 2013). Based on the nature of businesses funded by banks, banks were expected to remain liquid as long as they matched their cash needs to the repayment schedule of their loans (Alshatti, 2015). Thus, according to this theory, bank liquidity is generated automatically through self-liquidation of loans. The loans were self-liquidating in the sense that the loans would result in significant sales and profits to cover repayments. Under this theory banks were prohibited to invest in immovable assets such as plant and equipment, mortgage loans and land because such loans would take a long time to reap returns to retire the debt (Merris, 1979).

The theory is supported by Onoh (2002) finding that effective liquidity management requires banks to match the maturity of their liabilities with the maturity of their assets. Notwithstanding this, the main drawback of this theory is that it assumes that banks are able to recover their loans in the normal course of their business activities (Bhattacharya, 2011). In a financial crisis or economic recession this theory may fail to hold because banks may not be able to collect all their loans. Furthermore, the theory ignored the relative stability of retail deposits as a key source of funding to banks since it emphasized on self-liquidation of loans. The other weakness of the theory is that it is inconsistent with the requirements of economic development especially in emerging markets because it disregards long term loans which are vital for economic development (Ibe, 2013).

Merris (1979) notes that in the 1920s the commercial loan theory was challenged on three grounds: First, monetary authorities realized that the theory did not offer monetary policy advantages as claimed by its proponents because monetary policy could not expand and contract in line with business credit needs as claimed by proponents of the theory. Second, bankers established that the requirement that borrowers get a new loan upon payment of the old loan actually encouraged multiple borrowings (sequential financing across banks) as businesses

sought long term credit to fund fixed capital investments. Moreover, bankers realized that loans are illiquid; hence, loans could not provide liquidity as suggested by the theory. These factors debased the commercial loan theory and the shiftability theory emerged.

2.3.1.2. Shiftability theory

This theory was enunciated by Harold Glenn Moulton in 1918 (Chawla, 2013). The theory was based on the view that business loans are not liquid hence they cannot provide liquidity cushions against unexpected deposit withdrawals (Merris, 1979). In place of short term loans the theory assumes that bank liquidity is determined by holding assets that can be sold to investors or shifted to the central bank via the discount window. This means that the liquidity position of a bank is influenced by the shiftability, marketability and transferability of its assets. In this context, Moulton (1918) assumed that a bank can solve its liquidity problems by shifting (selling) assets to other banks or the central bank.

In light of this theory, banks recognized that they could obtain liquidity by borrowing from the central bank discount window and interbank market through repurchase agreements (Repos) (Merris, 1979). Thus, banks began to buy securities of high creditworthy firms with a high degree of shiftability to provide collateral for lending. In other words, the theory prompted banks to hold liquid assets for liquidity management. In fact, the popularity of the theory led to the rising prominence of the central bank lender of last resort function, whereby banks use their assets as collateral to obtain liquidity from the central bank (Koulischer and Struyven, 2014). The intuition behind this theory is consistent with the aim of Basel III LCR regulation. The LCR encourages banks to hold ample stock of liquid assets which they can sell to withstand short term liquidity shocks. The main contribution of the theory is that nowadays banks hold short term securities such as Treasury bills that can be easily sold to cover unexpected large liquidity demands. The theory is regarded as a forerunner to modern day liability management (Merris, 1979). However, the main weakness of this theory is that during a depression, the whole economy falls into a crisis. Therefore, liquid assets such as shares and debentures of blue chip companies would also fall in value thereby raising the cost of shifting significantly (Elliot, 2015).

2.3.1.3. Anticipated Income theory

The theory was postulated by Herbert Victor Prochnow in 1945 (Chawla, 2013). Based on the concept of anticipated income, the theory maintains that banks consider their loan portfolios to be a source of liquidity. In this context, long term assets (such as mortgages) that are paid over a considerable period of time, are assumed to provide a continuous flow of liquidity to banks through interest and principal repayments (Alshatti, 2015). Thus, banks were encouraged to base their loan repayment schedules on the borrower's anticipated future income, rather than collateral, so that there would be a continuous flow of liquidity to the bank. That way, liquidity was assured as long as scheduled loan repayments were tied to the borrower's future income. Put differently, as long as the borrower is able to satisfy the planned principal plus interest repayment schedule, the bank would remain liquid. Based on this theory, banks adopted the ladder effect concept in managing their investment portfolios (Ibe, 2013). Despite its novelty, the theory fails to hold in episodes of financial crisis. For instance, during the 2007/9 financial crisis, massive loan delinquencies dragged banks into serious liquidity challenges. In other words, borrowers can fail to meet their scheduled payments in times of a crisis (Agarwal, 2015), which compromises banks' liquidity positions.

2.3.1.4. Liability Management theory

Luckett (1980) states that liquidity management theory was born in the 1960s when banks in the United States of America began to source liquidity from the liability side of their balance sheet following the introduction of the negotiable certificate of deposit (NCD) instrument. The theory maintains that banks can source liquidity from the liability side of their balance sheet by issuing more liabilities such as negotiable certificate of deposits, interbank loans, central bank loans or raising more capital through rights issues or retained earnings. Based on the theory, it is not necessary for banks to pursue traditional liquidity management practices such as holding liquid assets and liquid investments. Liability management relies on the bank's creditworthiness and provides managers with flexibility in managing their balance sheets (Luckett, 1980).

Nevertheless, to be able to actively manage its liabilities, the bank must have and be able to maintain a sound reputation because the market disciplines bad behavior (Camba-Mendez *et*

al., 2014). In cases where the bank fails to preserve its creditworthiness, it pays for it dearly either through increased cost of borrowing or withdrawal of funding in extreme cases (Casu *et al.*, 2006). This theory led to the concept of asset and liability management (ALM) whereby banks seek a coordinated approach to balance sheet (risk) management. The main contribution of the theory is the ability of banks to generate liquidity on both sides of their balance sheets (Alshatti, 2015). Asset and liability management, asset securitization as well as risk management are the current practices employed by banks in managing their day-to-day liquidity positions.

2.3.2. Definition of bank liquidity management

Archer and Karim (2014) define bank liquidity management as methods used by a bank to manage its assets and liabilities such that it remains liquid while at the same time maintaining an optimal cost-return tradeoff. It encapsulates the management of the bank's funding sources and investments (assets) to ensure that the bank has sufficient cash and liquid assets to meet contractual outflows (Gongol and Vodova, 2014). Archer and Karim (2014) further highlight that a key aspect in banks' liquidity management is the manner in which they adjust their assets and liabilities to remain liquid.

It follows that prudent liquidity management is indicated by the bank's ability to meet depositors' withdrawals while providing for unforeseen liquidity contingencies and making investments that guarantee security and liquidity at the same time. In order to efficiently manage its liquidity position, an individual bank has to select and make use of the most relevant tools. Moreover, a bank has to project its future cash needs under both normal and abnormal conditions and ensure that there are plans put in place to meet these liquidity needs at minimal costs (Basel Committee on Banking Supervision, 2008a). This task is quite involving even under normal conditions since it requires banks to be able to consolidate information from its various activities and evaluate the effects of external events on funding availability. This challenge, however, increases under stressed market conditions when assumptions made in liquidity projections change as a result of changes in counterparties behavior and market conditions that affect the liquidity of financial assets and funding availability (European Central Bank, 2002). These factors make both liquidity management and liquidity regulation tasks demanding for both bankers and regulators. Since banks can obtain liquidity from either side of the balance sheet, a manager who manages liquidity by solely adjusting the asset side could be ignorant of other less

expensive sources of liquidity that can be obtained from the liability side (ALCO Partners, 2001).

Likewise, over reliance on debt funding makes the bank to be susceptible to market conditions and exogenous disturbances. Therefore, prudent bank managers should scan all the available liquidity sources when setting up their liquidity plans. Additionally, bank managers should be cognizant of funds providers' behavior as well as regulatory and market conditions changes that can affect their funding. To do that, they should be aware of the volume, mix, pricing, cash flows and risks embedded in their assets and liabilities (Swift, 2016). From this discussion, one can note that there are many aspects involved in the management of liquidity in banking institutions. These aspects include the unit/department responsible for liquidity management, liquidity measuring and monitoring tools and strategies put in place to manage liquidity shortfalls. These aspects are discussed in the succeeding sub-sections.

2.3.3. Organization of liquidity management in a bank

The way liquidity is managed in banks depends in part on the size, scope and sophistication of the bank's operations (European Central Bank, 2002). At large internationally active banks, liquidity management may be confined to lower levels in the bank but coordinated at the parent organization (Committee on the Global Financial System, 2010). Other banks may go for the simple unit approach. Furthermore, liquidity management in a bank can either be centralized or decentralized. A centralized structure manages liquidity at group level while a decentralized structure gives branches and subsidiaries autonomy to manage their own liquidity (Cangiano, 2017). As such, liquidity management in a bank is done by various parties as discussed herein.

2.3.3.1. Board of Directors

Typically, the Board of Directors establishes the bank's liquidity management policies and succinctly communicates them to management (Basel Committee on Banking Supervision, 2015c). The policies should clearly spell out specific goals of liquidity management. Furthermore, the policies should outline the roles and responsibilities of the different parties involved in liquidity management. In the course of making and formulating liquidity management policies, the Board may take into consideration recommendations from the

authorities involved in risk management such as the Asset and Liability Committee (ALCO), Chief Executive Officer (CEO) and bank risk managers (Kimathi *et al.*, 2015). Consultations help the Board to better understand its operating environment (internal and external), thus it will be able to come up with effective liquidity management policies. For the liquidity management policies to remain relevant, the Board must routinely review, approve and update its policies, procedures and limits in line with obtaining internal and external conditions (Basel Committee on Banking Supervision, 2015c).

2.3.3.2. Senior Management

Management is responsible for executing policies, procedures and strategies approved by the Board (European Central Bank, 2002). This task involves managing the development and application of relevant risk measurement and reporting systems, contingency funding plans and internal controls (ALCO Partners, 2001). Additionally, management is responsible for periodically reporting the bank's liquidity profile to the Board.

2.3.3.3. Asset and Liability Committee (ALCO)

The ALCO is made up of senior heads from each unit of the bank that considerably influences the liquidity position of the bank. The ALCO's task in liquidity management is to ensure that liquidity management systems sufficiently recognize and measure the bank's liquidity vulnerabilities and at the same time ensure that reporting systems accurately report the level and causes of that exposure (Basel Committee on Banking Supervision, 2015c). In order to fulfill its tasks, ALCO members ought to constantly interact with those people involved in the daily management of the bank's risks (Kimathi *et al.*, 2015). ALCO generally delegates the day to day liquidity management task to the bank's treasury department (Nordic Investment Bank, 2017).

2.3.3.4. Risk Management department

The risk management department ensures compliance to established policies and procedures as well as regulatory requirements. This department is also responsible for compiling, evaluating and reporting liquidity risk developments to the CEO and the Board (Basel Committee on Banking Supervision, 2015c). In short, the risk management unit is responsible for

managing liquidity risk of the bank using various techniques such as gap analysis (Rattanapintha, 2010).

2.4. MEASURING AND MONITORING LIQUIDITY

2.4.1. Liquidity Indicators

Bank liquidity can be measured from two perspectives, namely the stock approach and flow-based approach. This subsection discusses the two approaches in detail.

2.4.1.1. The Stock Approach

This technique views liquidity as a stock. The approach aims to establish the bank's liquidity by examining its ability to settle short term obligations based on liquid assets that it has. These liquid assets can either be liquidated or collateralized to obtain funding. Stock approaches make use of a number of balance sheet ratios to analyze liquidity trends. The following balance sheet ratios are commonly used to measure the bank's liquidity: the liquid asset ratio (LAR), loan to deposit ratio (LDR) and cash capital ratio (CCR) (Moody's, 2001; Saayman, 2003; Vento and La Ganga, 2009; Moore, 2010).

❖ Liquid asset ratio (LAR)

The liquid asset ratio is given as the proportion of liquid assets to total assets. It measures the ability of the bank to absorb liquidity shocks (Vodova, 2013). In general, when the ratio is high, that is equal to or above 100%, the greater the ability of the bank to absorb liquidity shocks assuming that market liquidity is uniform across banks (Kim, 1998). Nevertheless, a high liquid asset ratio can be taken as a sign of inefficiency because liquid assets earn very low returns, thus they represent an opportunity cost to the bank (Bordeleau and Graham, 2010; Hull, 2012). Thus managers ought to strike a balance between liquidity and profitability in order to maximize shareholder value. The main weakness of this metric is that it does not take into consideration inflows from loan repayments that can improve the bank's liquidity position (Vodova, 2013).

❖ **Loan to Deposit ratio (LDR)**

The loan to deposit ratio (LDR) is given as the ratio of total loans to total assets. It indicates the proportion of the bank's assets that are locked up in illiquid loans and determine the extent to which loans are funded by retail deposits. A loan to deposit ratio below 100% indicates that loans are primarily funded by retail deposits, while a loan to deposit ratio above 100% reflects a funding gap that is usually covered by wholesale funds (Satria *et al.*, 2016). High dependency on debt financing can be detrimental especially if market conditions suddenly change. By and large, the higher this ratio is, the lower the liquidity position of the bank. The shortcomings of the loan to deposit ratio is that it ignores other assets that can be sold to provide additional liquidity to the bank and it does not take into consideration inflows from loan repayments, growth in liabilities and loan demand (Moore, 2010).

❖ **Net Cash Capital ratio (NCCR)**

The net cash capital ratio was developed by Moody's in 2001. It was initially designed to assess the liquidity position for security companies, but nowadays it is widely employed in assessing bank liquidity standing (Yan *et al.*, 2012). It indicates whether a bank's long term funding is exceeding its illiquid assets, presupposing that the bank will face difficulties to roll over its short term debt (Matz and Neu, 2006). The cash capital ratio is given as the difference between long term funding and sum of illiquid assets and illiquid financial securities (Moody, 2001). A positive cash capital ratio shows that the bank is able to continue operating on its own resources, even if there are temporary disturbances in the wholesale funding market. Simply put, the bank is liquid. On the other hand, a negative value implies that the bank is in bad liquidity state that requires it to sell its liquid assets or borrow from the central bank to remain afloat (Moody, 2001).

2.4.1.2. Critique of liquidity ratios

Notwithstanding the significance of liquidity ratios in assessing the liquidity standing of a bank, Poorman Jr and Blake (2005) argue that liquidity ratios are inadequate measures of bank liquidity given that banks with positive liquidity ratios can fail. They cited a case of South East Bank of Miami which went bankrupt in 1991 due to its failure to repay maturing liabilities in spite of showing a favorable liquidity ratio of 30%. Furthermore, Shen and Chen (2014) assert

that liquidity ratios failed to predict liquidity distress for banks before the 2007/2009 financial crisis, hence liquidity ratios are weak measures of a bank's liquidity position. They cited the case of Northern Rock which reported a liquidity ratio that was 25% above the minimum requirement before 2007, but went on to suffer a massive bank run. Consequently, Poorman Jr and Blake (2005) maintain that a good liquidity indicator should be sensitive to liquidity conditions as they evolve in the market, which liquidity ratios fail to do. They proposed the use of financing gap measures to measure bank liquidity.

One of the main reasons why liquidity ratios fail to detect waning liquidity conditions in a particular bank is that banks tend to keep holding liquid assets even during a liquidity crisis (Gale and Yorulmazer, 2013), partly because they fail to sell their assets in a distressed market. Thus, liquidity ratios tend to change slightly even in a crisis. On the same note, Shen and Chen (2014) further argue that a good liquidity metric should be able to timely, correctly and substantially distinguish liquid and illiquid banks. In light of this, the Basel Committee on Banking Supervision (2010b) submitted two new liquidity metrics, namely the Liquidity Coverage Ratio and the Net Stable Funding Ratio after realizing the shortcomings of liquidity ratios. Basel metrics are consistent with Angora and Roulet (2011) who suggested that more focus should be placed on examining asset and liability mismatches to measure the liquidity position of the bank.

2.4.1.3. The Flow Approach

Under the flow approach, a bank examines its liquidity position by contrasting differences in cash inflows and cash outflows in each time period to establish surpluses and deficits. Thus, the approach is based on maturity laddering (gapping). If inflows are greater than outflows in a particular time bucket, the bank is said to have a positive gap (Heffernan, 2005). This excess cash can be used to build liquidity buffers. On the same note, if inflows are less than outflows in a particular time bucket, the bank is said to have a funding gap (Heffernan, 2005). Banks manage funding gaps by adjusting the maturity of their assets and liabilities. Flow metrics aim to preserve the bank's ability to cover its obligations by restricting maturity transformation risk in each time bucket because they consider liquidity risk to be built in cash flows (Moore, 2010). In spite of the fact that flow methods look appealing, the flow approach requires substantial amount of data and there is no intuitive method of predicting inflows and outflows.

As such, stock approaches are mainly used by practitioners and academics (Hemple and Simonson, 1998; Fielding and Shortland, 2005).

2.4.2. Treatment of specific elements

In analyzing liquidity, banks need to put in place strategies to handle specific aspects such as assets with different tenor, non-contractual maturity liabilities (e.g. retail deposits) and loan backstop facilities, such as commitments (European Central Bank, 2002). These aspects have a bearing on the liquidity profile of the bank. To handle the first issue, individual banks assesses their liquidity by grouping their assets according to their maturity. Thereafter, they can apply haircuts⁵ in correspondence to the degree of the asset's liquidity. The second aspect can be managed by behavioral analysis (Nikolaou, 2009). Banks can examine their liquidity by analyzing historical data of their non-contractual liabilities under normal conditions. This analysis helps them to envisage how these liabilities have evolved over time and predict their future patterns, hence their liquidity standing. The third aspect can be managed through behavioral analysis (Bearingpoint, 2013). Here, banks analyze historical data on credit drawdowns in both normal and stress times. That way, they can forecast their likely future drawdowns and make provisions for them such that they remain able to meet contingent liabilities.

2.4.3. Limits

In most jurisdictions, banks are subjected to certain limits (internal or external) on aspects that comprise statutory reserve requirements, minimum liquidity asset holdings, liquidity ratios, volume limits in each time band, asset and liability mismatches and funding concentration (Basel Committee on Banking Supervision, 2008a). These limits are meant to constrain bank's exposure to liquidity risk. These limits can be set for both normal and stress times and they are depended on the framework employed by the bank to monitor its liquidity (European Central Bank, 2002).

⁵ A haircut refers to the difference between the loan amount and market value of an asset pledged as collateral (European Central Bank, 2016). It demonstrates the lender's perceived risk of loss due to fall in value of the pledged asset.

2.4.4. Time Horizon

In analyzing their liquidity, banks consider a wide range of time horizons and set up plans for managing both short term (operational) and long term (strategic) liquidity. Operational liquidity management typically focuses on a horizon of one day to between one month and three months (European Central Bank, 2002). This period is considered to be the critical survival period in case of a crisis. Basel LCR considers a period of one calendar month (Basel Committee on Banking Supervision, 2013). Strategic liquidity management concentrates on a time horizon that spans up to one year. This time horizon corresponds to Basel NSFR. By differentiating time horizons, banks endeavor to come up with strategies that ensure that both their short term and long term needs are fully satisfied.

2.4.5. Spectrum of Currencies

Banks employ various strategies to manage liquidity in different currencies. The European Central Bank (2002) suggest the following strategies: First, banks can aggregate currencies, on the assumption that the currencies are fungible as a result of the presence of a vibrant and liquid foreign exchange market. Second, banks can aggregate currencies based on their liquidity, such that vehicle currencies such as the USD, Euro, Pound, Swiss Franc, etc. are grouped together and less traded currencies are collected together. Third, banks can aggregate or differentiate between individual currencies based on their business or funding strategy. After aggregating or differentiating currencies, banks would manage their liquidity exposures as per the chosen strategy.

2.4.6. Scenario analysis and Stress testing

The Bank of England (2013) describes stress testing as the manipulation of values of factors that influence the liquidity position of the bank under different events and observe how they affect the bank's liquidity. The Risk Management Association (2013) defines scenario analysis as the process of varying multiple (sometimes simultaneously) variables that affect the bank's liquidity and analyze how they affect the bank's liquidity standing. Stress tests and scenario analysis helps a bank to identify and measure its vulnerabilities to potential future liquidity stress, examine possible effects of the vulnerabilities on its cash flows, liquidity position, profitability and solvency (European Central Bank, 2008). Similarly, Basel Principle 10

on Principles of Sound Liquidity Management and Supervision call for banks to conduct periodic stress tests to identify potential liquidity stress and ensure that existing exposures are in line with the bank's risk appetite. In short, stress tests and scenario analysis seek to identify potential weaknesses and threats in a bank's liquidity position which enables management to put in place measures to deal with identified weaknesses and vulnerabilities. Nevertheless, the European Central Bank (2008) points out two shortcomings of liquidity stress tests that were exposed during the global financial mayhem. First, liquidity stress tests lies in the assumption that the main funding markets like the interbank market, repo market, commercial paper market and securitization market do not fail or at least do not collapse simultaneously. However, during the global financial crisis these key funding markets simultaneously dried up leading to acute liquidity challenges for banks. Second, liquidity stress tests assume that secured funding is always available even in times of severe crisis. However, this assumption was defied during the global financial crisis because banks faced difficulties in accessing funding in all key funding markets.

2.5. MEASURES TO PREVENT LIQUIDITY SHORTFALLS

Banks have multiple strategies that they can engage in to prevent liquidity risk. These strategies are influenced by the bank's business model, market structure and development and the regulatory environment as discussed herein.

2.5.1. Stable and diversified funding

In the course of providing intermediation services to economic agents, banks typically mismatch their assets and liabilities structures (Angora and Roulet, 2011). In order to minimize the probability of running out of funds due to asset and liability mismatches, banks should fund their activities with relatively stable and diversified funding tools. According to Farag *et al.* (2013) stable funding sources should embed the following characteristics: diversified over a number of sources, obtained from depositors and investors who are unlikely to withdraw their money when the bank makes losses and obtained through instruments that bind depositors to keep their money for a lengthy time period. Farag *et al.* (2013), went on to highlight that banks evaluate the stability of their funding sources by looking at depositors' contractual rights and depositors' behavior in both normal and stress times. In normal times, retail deposits appear to be

stable, partly due to the presence of reliable depositor protection insurance (Hartlage, 2012). However, in times of stress, the stability of retail depositors can be very difficult to model, because under stressed market conditions these depositors make significant withdrawals (Diamond and Rajan, 1983). On the other hand, unsecured wholesale depositors, in normal times, are likely roll over their debt upon maturity. Nevertheless, these sophisticated huge depositors are very sensitive to obtaining conditions. Once they doubt the credit standing of the bank, they move their money hastily to safe havens which could have destabilization effects to the bank (Elliott, 2014).

2.5.2. Liquidity buffers

Another way to prevent liquidity shocks is for banks to keep an adequate buffer of liquid assets. A liquidity buffer is defined as a pool of liquidity assets that a bank keeps to cover unforeseen large liquidity demands (Basel Committee on Banking Supervision, 2013). It is made up of vault cash (coins and notes); claims on sovereigns, central banks, public sector utilities and multilateral development banks; central bank reserves; high grade corporate debt securities; covered bonds; residential mortgage backed securities and common equity shares. Casu *et al.* (2006) and Kowalik (2013) highlight that liquidity buffers can mitigate liquidity risk in several ways: First, the buffer can be turned into cash through asset sales or used as collateral to borrow. Second, the very presence of the buffer can act as an assurance to creditors that the bank is liquid, therefore able to meet its maturing obligations. This can calm depositors and prevent a run on the institution. Third, the buffer gives a sign to the market that the bank is properly and prudently managed. Fourth, the buffer acts as an assurance that all lending promises will be fulfilled. Fifth, the buffer prevents forced fire sales of assets, central bank borrowing or borrowing at punitive rates in the interbank market.

In spite of their significance, liquidity buffers present an opportunity cost to the bank. By their design, they carry low returns; hence, are costly in terms of foregone interest in other high interest earning investments that the bank could have made (Bordeleau and Graham, 2010; Hull, 2012). Thus, banks need to consider the tradeoff between liquidity and profitability when designing their liquidity policies.

2.5.3. Contingency funding plan

The European Central Bank (2008) defines a contingency funding plan as a policy document that spells out how a bank proposes to manage liquidity shortfalls in a crisis. The plan outlines in detail specific tasks and responsibilities of the crisis management team and alternative funding measures that the bank can utilize (Subhanij, 2010). By making use of cash flow forecasts, the plan simulates future funding developments under different scenarios and designs a plan to manage shortfalls in each time band.

2.6. FACTORS AFFECTING BANK LIQUIDITY

Bank liquidity is driven by several factors which can be grouped into two categories. The first category relates to management controllable factors which are known as internal or bank specific factors. Internal factors indicate bank management's decisions and policies with regard to liquidity management. Since bank management's decisions are unobservable, they can be analyzed by investigating banks' financial statements because balance sheet items can highlight bank management's policies and decisions with regard to liquidity management (Guru et al., 2002). The management controllable factors considered in this study are similar to those in extant literature. These factors include past year liquidity ratio, capital level, asset quality, loan growth, securitization, loan commitments, transaction deposits, profitability and bank size (Aspachs *et al.*, 2005; Delechat *et al.*, 2012; Vodova, 2013). The second classification relates to factors beyond management's control which are classified as external or macroeconomic factors. External factors are driven by economic conditions and include variables such as policy rates, economic growth and capital market developments (Aspachs *et al.*, 2005; Chen and Phuong, 2014; Sudirman, 2014). A number of studies have examined factors that drive bank liquidity. These studies are summarized and presented in Appendix 1.

2.7. REVIEW OF LIQUIDITY MANAGEMENT PRACTICES FOR BANKS IN SELECTED EMERGING MARKET ECONOMIES

2.7.1. Cambodia

The ensuing discussion of liquidity management practices of banks in Cambodia is mainly centered on a paper titled, '*Liquidity management and measurement in Cambodia*,' by (Sarat, 2010) and the National Bank of Cambodia (Cambodia Central Bank).

Antecedent to the 2007/9 global financial crisis, Cambodian banks had ample liquidity and they practiced conventional methods of liquidity management. During the period, banks held adequate cash in order to cover their liabilities. By analyzing historical liquidity trends, banks were able to forecast their daily, weekly and monthly cash demand and to also estimate the cash reserve level. In most cases, banks maintained a cash level that averaged 7% of total assets. This level of cash holdings was considered to be relatively high compared to neighboring economies, in part because Cambodia is a cash-based economy. In addition to cash holdings, Cambodian banks maintained deposits with the central bank and other banks (both domestic and foreign) as part of their liquidity management. These placements were mainly made up of correspondent accounts and certificates of deposits. Furthermore, banks liquidity management practices were also influenced by limited financial instruments in the market and weaknesses in the existing regulatory framework. Due to limited financial instruments, most deposits are mainly kept in the form of interbank deposits and required cash reserves. Since the regulator forbid banks to use local sources of cash to invest overseas, banks cannot buy foreign assets. In this regard, banks are obliged to maintain a liquid ratio of no less than 50% on an ongoing basis and this ratio was used as the threshold for liquidity management.

In terms of internal governance, Sarat (2010) noted that liquidity management practices of Cambodian banks were weak in the period preceding the global financial turmoil. First, Cambodian banks did not have liquidity management policies in place which compromised their liquidity management. Second, they did not have ALM committees delegated to liquidity and interest rate risk management. This affected banks capacity to evaluate and manage liquidity risks. Third, the pricing, determination of cost of funds and the management of market risk was left in the hands of the treasury department. However, a greater part of the time these departments were poorly performing which prejudiced banks' operations. Fourth, most of the banks did not have contingency funding plans. They thought it was not necessary since they had ample liquidity and were still engaged in traditional banking business – deposit acceptance and loan extension. Nevertheless, a contingency funding plan is necessary to prepare for the rainy day.

Sarat (2010) also observed that prior to the global financial crisis, liquidity management strategies differed significantly across banks depending on their ownership structure – local or

foreign. Local banks relied on central bank support in times of crisis while foreign banks obtained assistance from parent companies. Notwithstanding this, it cannot be said that foreign banks had better liquidity management practices compared to local banks. This factor lies in the competence of management. Some indigenous banks had sound liquidity management processes that fared well with foreign banks. On the same note, some foreign banks were found to have weak systems compared to their local counterparties.

At the height of the global financial crisis in 2008, both banks and regulators saw that there was a need to strengthen banks liquidity management framework. Banks became more focused on managing liquidity risk in order to withstand the crisis. At the same time, regulators encouraged banks to adopt strict liquidity management practices. As part of the regulatory reforms, banks were compelled to pursue daily liquidity ratio monitoring in order to analyze their liquidity position in a timely manner. In response, banks devised more tools and stricter liquidity management processes. Banks began to estimate credit and deposit growth in order to maintain a smooth flow of funds. In the same period, banks began to hunt for more retail deposits to improve their funding structures. This led to a rise in deposit rates as banks competed for retail deposits. Furthermore, banks adopted the maturity gap analysis tool as part of their liquidity monitoring process. In addition to daily liquidity monitoring and maturity mismatch analysis, banks also considered possible non-performing loans, off balance sheet commitments and potential large withdrawals to estimate whether the impact of these items would significantly affect their liquidity. Some mega banks incorporated stress testing and scenario analysis into their liquidity management in order to examine the impact of adverse conditions on their liquidity.

Likewise, banks improved their internal governance systems for liquidity management. Banks that did not have an ALCO established one and those that already had this committee made improvements to it. This was followed by improving efficiency in the operations of their treasury departments so as to enable the implementation of policies and procedures forwarded by the ALCO. Overall, liquidity management and risk management was strengthened. Contingent funding plans have also been established as part of improvements in liquidity management.

2.7.2. South Korea

The succeeding discussion of liquidity management practices of banks in South Korea is primarily drawn from Kim's (2010) paper titled, '*Liquidity management and measurement in Korea*, ' and the Bank of Korea (South Korean Central Bank).

Prior to the global financial crisis, South Korean banks already had Asset and Liability management plans which took into consideration the prudential liquidity ratio established by the regulator. Besides monitoring liquidity ratios, South Korean banks employed a number of liquidity management tools that included maturity gaps, periodic stress tests and contingency funding plans. The fact that South Korean banks had better liquidity monitoring and management tools could be attributed to lessons learnt out of the 1997/8 Asian financial crisis. In the same period, South Korean banks had ample liquidity. This made it easy for banks to raise wholesale funding through certificates of deposits and bond issues. However, debt funding caused significant challenges for banks in the course of the global financial crisis. This made South Korean banks to be vulnerable to liquidity risk soon after the collapse of Lehman Brothers in September 2008.

After the crisis, South Korean banks continued to enjoy abundant liquidity as a result of phenomenal growth in deposits and decreasing dependence on wholesale funds, in part because of banks initiatives to improve liquidity and investors growing appetite for safe assets. This has made South Korean banks funding structures to remain relatively stable. To further strengthen banks' liquidity management, the Financial Supervisory Service issued guidelines for bank liquidity management in September 2009. The guidelines contain detailed approaches for liquidity risk management, which include specifics on liquidity risk management strategies, stress testing and contingency funding plans.

2.7.3. Malaysia

The discussion on liquidity management practices of Malaysian banks is drawn from Sabri's (2010) paper titled, '*Malaysia Liquidity risk: Sailing through the turbulent years*, ' Bank Negara Liquidity Framework and the Bank Negara Malaysia (Malaysian Central Bank).

Malaysian banks had been subject to tight liquidity regulations since the 1997/8 Asian financial crisis. Liquidity management guidelines, known as *Liquidity Framework*, established in 1998 by Bank Negara Malaysia in response to the Asian financial crisis have been guiding banks liquidity management up to Basel III. The framework had three main objectives, namely to assist banks on their funding structures and their capacity to address short run to medium term liquidity problems, to encourage banks to implement a more robust liquidity measurement and management tools and to provide banks with an efficient way of examining their current and future liquidity standing. In light of the regulation, Malaysian banks would manage their liquidity by following a three tier approach as described below.

1) First level liquidity measurement

Banks were supposed to construct maturity ladder profiles made up of five time bands that varied from ‘up to 1 week’ to ‘more than 1 year.’ These time bands are displayed in Table 2.2 below.

Table 2.2: Maturity bands for banks in Malaysia

Maturity band
Up to 1 week
1 week to 1 month
1 month to 3 months
3 months to 6 months
6 months to 1 year
More than 1 year

Source: Bank Negara Malaysia

Determination of the time bands was based on contractual maturity. In each time band, banks were supposed to determine cumulative liquidity gaps based on behavioral maturity cash flow projections. Furthermore, banks were obliged to keep adequate liquidity to cover unexpected large cash withdrawals by observing a minimum surplus in the cumulative net gap of ‘1 week’ and ‘1 month’ time band.

2) Second level liquidity measurement

After this gap analysis, banks would now need to establish their resiliency to unexpected large withdrawal shocks emanating from bank specific factors. Based on cumulative gaps identified in the first stage, liquidity measurement at this stage would take into consideration additional sources of emergency cash at the banks' disposal. This cash could be obtained either through the sale of liquefiable assets or draw downs on existing backstop facilities. By and large, banks were expected to be able to withstand large withdrawals for a period of one month.

3) Third level liquidity measurement

The third level consisted of ratio analysis, whereby a bank would determine its level of exposure to specific markets for their funding. In this regard, exposure to large customer deposits, the interbank market and offshore market was evaluated. This enabled banks to assess their vulnerability to certain markets and come up with appropriate diversification plans. Moreover, banks were obliged to maintain a pool of liquefiable assets and establish backstop facilities from other financial institutions in order to be able to withstand large liquidity shocks emanating from both bank specific and market wide effects. Asset and Liability Committees were also established to oversee the management of liquidity. Also strategies for liquidity management had to get a nod from this committee before the Board endorsed them.

Liquidity has remained relatively high in Malaysia in the period before and after the global financial crisis. Ample liquidity is envisaged in considerable liquidity surplus, stable loan to deposit ratios, significant bank deposits and minimal dependency on wholesale funding. This can be ascribed to a primarily deposit-based funding system for banks, large holdings of liquefiable assets to cover liquidity outflows, depositor protection insurance (that eliminated the need for depositors to monitor banks), routine supervision by the regulator, establishment of liquidity risk measurement and management tools and sound liquidity management practices of the banks. Malaysia takes liquidity management seriously. As such, ALCO members routinely monitor and manage their liquidity positions to ensure that they remain able to meet their payment obligations. After the global financial crisis, two specific areas significantly improved: stress testing and construction of contingency funding plans. Stress came in the wake of the Basel III recommendations. Today, Malaysian banks take into account both market wide and bank specific scenarios in their stress testing to examine their resilience to such scenarios. Furthermore, banks are required to submit results of their stress tests semiannually to the central

bank. Banks are also developing contingency funding plans to make plans for the unforeseen rainy day.

2.7.4. Thailand

The discussion on liquidity management strategies of banks in Thailand is drawn from Rattanapintha's (2010) article titled '*Liquidity management and measurement in Thailand,*' and the Bank of Thailand (Thailand Central Bank).

Thai banks manage their liquidity along guidelines provided by the Bank of Thailand: *Guidelines on Liquidity Risk Management*. The guidelines document was revised in January 2010 to incorporate the Basel III recommendations. According to the guidelines, banks should assume risk that is commensurate with the bank's complexity, risk appetite and business model. In the process of managing their liquidity position, the guidelines enforce banks to maintain a pool of unencumbered HQLA that they would use to pay off maturing liabilities in a crisis. Besides holding a pool of HQLA, banks must also establish an ALCO that is responsible for liquidity risk management. In this regard, banks have to establish a framework for identifying, measuring, monitoring and controlling liquidity risk.

In the normal course of business, banks have to set up an organizational system that is charged with the mandate of measuring, monitoring and managing bank liquidity. The practice of liquidity management in Thailand is to set up an ALCO that manages the aggregate liquidity of the bank. The ALCO establishes liquidity policies and strategies and designs funding strategies for the bank. The treasury department manages short term and intraday liquidity as well as cash flow projection, whilst the risk management unit is responsible for managing liquidity risk of the bank. Long term liquidity management is left in the hands of the ALM. Thai banks use cash flow projections technique to measure and manage their liquidity position. This is achieved by mapping expected cash inflows and outflows to time buckets and analyzing liquidity gaps in each time band. Besides being used for monitoring and managing the bank's liquidity, gapping is also used as a liquidity risk measurement tool. In this vein, negative gaps would indicate exposure which needs to be managed, while positive gaps indicate excess liquidity which needs to be properly invested. In addition to these tools, Thai banks have also developed early warning systems to diagnose liquidity risk. The early warning system set a certain limit or

point as a warning sign of danger which needs quick attention. The early warning sign can be derived from a qualitative or quantitative indicator such as a significant downgrade of the bank's rating, persistent fall in the bank's stock price, massive withdrawals and so on. To be effective, the early warning system should clearly outline how the bank intends to deal with the symptoms.

2.8. CHAPTER SUMMARY

This chapter discussed the concept of bank liquidity and how liquidity is managed in banking institutions. It also highlighted the evolution of the concept of bank liquidity management. In practice, banks have to hold optimal liquidity: high enough to be able to cover all outflows and low enough to minimize the opportunity cost of holding idle cash balances. This is achieved through sound liquidity management. Banks manage their liquidity by employing a number of tools, such as gap analysis and ratio analysis. In addition, banks have recently been incorporating stress testing and contingency funding plans to their liquidity management strategies. The present day concept of bank liquidity management developed through different stages. Initially, the Real Bills doctrine (Commercial Loan theory) influenced the way banks managed their liquidity from the late 1700s to 1920s. The Commercial Loan theory became irrelevant as banks realized that they could obtain liquidity from holding liquid assets that could be sold to manage liquidity shortfalls. Thereafter, as commerce grew, the Anticipated Income theory gained popularity, but waned with the emergence of Negotiable Certificate of Deposits and the inception of the Liability Management theory. Nowadays, Asset and Liability Management, Asset Securitization and Risk Management dominate banks' liquidity decisions.

The chapter also explored factors influencing bank liquidity as well as liquidity management practices of banks in selected countries. Bank liquidity is driven by a combination of bank specific factors such as capital level, bank size, loan growth, asset quality and profitability and macroeconomic fundamentals like monetary policy rates and economic output. However, most empirical studies on bank liquidity management have not explored the dynamic nature of bank liquidity. This study aims to fill this knowledge gap by investigating liquidity dynamics of banks in emerging market economies using dynamic panel regression. The next chapter attends to bank regulations. It discusses the chronicle development of Basel regulations and the new liquidity regulations. Furthermore, it reviews literature on the behavioral response of banks to binding regulations.

CHAPTER III

BANK REGULATION

3.0. INTRODUCTION

The financial sector all over the world is susceptible to instability. Prominent financial crises witnessed over the years such as the Asian financial crisis, Eurozone debt crisis and the recent global financial crisis have been characterized by several bank failures and near bank failures. The effect of bank failures and near failures of banking institutions across the world, especially in the course of the recent global financial mayhem, has reiterated the need for healthy and sound banks to foster financial sector and economic stability and growth. In spite of the fact that banks are the tightly regulated entities throughout the world, they continue to experience failures. Therefore, bank regulation remains a contemporary and topical issue of significant interest to policy makers, regulators, banks' stakeholders and academics at large. In view of the importance of bank regulation, this chapter seeks to examine theories and the evolution of bank regulation, establish factors that justify bank regulation, investigate tools that are employed by regulators to control banks' activities, review Basel Accords and examine theoretical and empirical literature on the behavioral response of banks to liquidity regulations.

3.1. THEORETICAL LITERATURE REVIEW

3.1.1. Theories of Regulation

There are two broad theories that attempt to explain why the government regulates firms, namely the public interest theory and the economic theory of regulation. The public interest theory was postulated by Pigou (1932). The theory is premised on two propositions. First, free markets frequently fail due to problems of monopolies or externalities. Second, governments are compassionate and able to correct market failures through regulation (Shleifer, 2005). The theory maintains that it is necessary for the state to intervene in the market place to mitigate market failures and also to promote equity and fairness. Therefore, the notion of regulation grew out of government efforts to enhance optimal allocation of resources which would not otherwise occur without government intervention (Uche, 2001). This view is true because most regulations have

been enacted in response to a crisis or market failure. For example, one of the reasons that prompted the establishment of Basel I was the collapse of Bankhaus Herstatt in Germany and Franklin National Bank in the United States of America (Alessi, 2012; Capie and Wood 2013). Similarly, from a non-banking perspective, the Sarbanes Oxley Act of 2002 was enacted following a series of corporate governance scandals at World Com and Enron. In finance, the public interest theory implies that governments regulate financial intermediaries to promote the efficient functioning of financial markets by preventing corporate failures.

The theory of economic regulation was proposed by Stigler (1971) in an article titled, '*The theory of economic regulation*'. Stigler (1971)'s main presentation is that regulation is lobbied for by the industry for its own benefits. The proposition starts by noting that regulation is a good that the government can supply to the marketplace. This good is supplied through the government's coercive power. That power can be used in such a way that it can help or hurt some businesses. In order to obtain this state's coercive power, businesses lobby for one or more of the government's protection: price controls, subsidies, entry barriers and manipulating substitutes and compliments. Nevertheless, the industry has to pay 'something' to get this government protection. To get these private benefits from government firms pay two things: votes and financial resources. In the end, the public who are incapacitated to influence government regulations suffer at the expense of industries who gain state favors in the form of self-centered regulation. Therefore, Stigler (1971) maintains that the reason why regulation is imposed is for the benefit of a few minority groups, that is, industries who are able to 'pay' for the good (regulation) at the expense of the public. Out of the paper, two competing schools of thought that explain economic regulation were advanced, namely positive and normative theories. Normative theories explain why governments intervene as well as the implications of regulation, while positive theories try to establish the most optimal way of regulating institutions (Hertog, 2010).

3.1.2. Definition of Terms

3.1.2.1. Bank Regulation

The term regulation has been defined in different ways. Patrikis (1997) describes regulation as the establishment and discharge of specific rules and regulations under an administrative law, to monitor the behavior of businesses. Den Hertog (1999) defines regulation

as the application of legal instruments to achieve socio-economic goals, while the Federal Reserve (2005) defines regulation as specific rules and guidelines enacted by a country's regulatory body to control the operations and activities of banks. From these definitions, regulation can be described as rules formulated and discharged by the government to control the activities of businesses. According to Uche (2001) regulation tends to be paternalistic in nature. In other words, although regulations are intended for good, they override someone's autonomy. For instance, minimum capital requirements imposed on banks to prevent their failure tend to limit banks' freedom in the use of their funds. This partly explains why banks in most cases attempt to circumvent regulations. In defining regulation, three categories can be identified: economic regulation, social regulation and antitrust policies (Button and Swann, 1989). Economic regulation refers to price and entry controls, social regulation are controls put in place to prevent externalities whilst antitrust policies are rules imposed by the government to control business practices in an effort to promote fair competition (Hebbink *et al.*, 1998). Bank regulation consists of two facets: supervision and oversight.

3.1.2.2. Bank Supervision

The Federal Reserve (2005) defines bank supervision as the practice of monitoring, inspecting and examining banks, in order to assess their health and compliance with existing laws and regulations. It involves an evaluation of the bank's risk management systems, financial health and compliance with existing laws and regulations (Federal Deposit Insurance Corporation, 2016). Bank supervision is more qualitative and is meant to establish overall safety and soundness of banks by identifying undue risks and inadequate risk management practices timeously. During the process of supervision when the regulator identifies particular bank(s) to be non-compliant or experiencing idiosyncratic challenges, it may exercise its authority to address such challenges through formal or informal action (Kasendeke *et al.*, 2011). Bank supervision is conducted through on-site examinations as well as off-site surveillance and monitoring (Mason, 2015). The former imply physical checks by the supervisor on business activities of the regulated depository institutions on their premises on a periodic basis, for instance, once or twice per annum. Under the latter method, bank supervisors use reports and accounting statements sent by banks to find out institutions with poor or waning financial conditions as well as to identify adverse trends in the banking sector (The Central Bank of the

Bahamas, 2008). Since the difference between regulation and supervision is thin in practice, as pointed out by Wymeersch (2007), this study uses the terms interchangeably.

3.1.2.3. Oversight

This is a form of general supervision which is more focused on monitoring a group of institutions rather than a specific firm. It is considered to be less aggressive compared to supervision and might be regarded as surveillance, usually carried out at a distance while supervision is conducted through close, first hand observation and analysis (Patrikis, 1997).

3.1.3. Rationale for bank regulation

Based on the two competing broad theories of regulation described above, bank regulation can be said to have emerged in response to several market failures that include asymmetric information between buyers and sellers, market imperfections and agency costs (Santos, 2001). In the absence of regulation, these problems would bring about sub-optimal results and diminish consumer welfare (Llewellyn, 2006). As such, bank regulation is justified for the following reasons: depositors' protection, systemic stability enforcement, promotion of fairness and efficiency in financial markets, maintain monetary and financial stability, address moral hazard problems and to promote the safety and soundness of banks.

3.1.3.1. Depositors' protection

One of the main reasons for regulating banks is to depositors' protection. The need for depositors' protection arose when the public and firms began to use banks to make financial transactions and to keep a considerable portion of their savings (Spong, 2000). However, in the process of providing these services to the society, Spong (2000) observed that banks present two unique challenges for both customers and creditors. Firstly, in order for economic agents to transact with banks they have to maintain a deposit account with a certain bank, thereby becoming both customers and creditors of the bank. Therefore, the need for customers' deposits and interests in the bank to be protected emerged. Second, the safety of bank depositors is centered on several aspects such as the amount of capital the bank is holding, quality and value of its loans, securities and other assets of the bank. Due to the opaqueness of bank activities, confidentiality and non-availability of information to the general public and agency costs it is

very difficult and costly for retail depositors to monitor banks leading to free rider problems (Hebbink *et al.*, 1998). Pursuant to this view, Santos (2001) adds that monitoring is very costly and demand greater access to information, of which retail depositors who constitute a greater part of the bank's deposits lack requisite skills and resources to monitor banks' activities. In addition, monitoring is a waste of time if it is done by several parties. These factors lead to the free rider problem which brings into existence the need for private or public representation of retail depositors. This task can be achieved through regulation. Regulation imitates the control and monitoring that depositors would have done in the event that they had relevant information, were sophisticated and fully coordinated (Chaves and Gonzalez-Vega, 1992).

3.1.3.2. To foster systemic stability

The nature of banks activities, borrowing 'short' and lending 'long', make their balance sheets to be very fragile. Due to this fragility, a run can occur on an otherwise sound institution due to asymmetric information (Diamond and Dybvig, 1983). If depositors panic, and because of the first come first served rule, they will all attempt to withdraw all their money, out of fear that other depositors will get their money first, with domino effects on other banks (bank contagion). Bank contagion transcends in two dimensions: either through consequent failure or contagion failure. The former relates to failure of an individual bank which causes a significant fall in the value of assets of other institutions connected to the bank (Kaufman, 1996). The latter results from asymmetric information whereby, due to asymmetric information, depositors cannot tell which institution is solvent and which one is not. Accordingly, when one institution fails, depositors believe that other institutions are also facing difficulties (Biggar and Heimler, 2005). Consequently, depositors move with haste to withdraw their money from both solvent and insolvent banks since they cannot tell which one is financially sound and which one is not. In the end, the failure of one bank may lead to massive cash withdrawals at other banks which can trigger massive bank failures (Mishkin, 1990). Therefore, bank failures are contagious unlike the failure of other entities and the social costs of bank failures exceeds private costs of bank failures hence the growing concern about bank failures worldwide. Besides bank contagion, Casu *et al.* (2006) highlight that the interconnectedness of banks via the interbank market and payment system makes banks to be liable to systemic risk; thus, the need to supervise activities of banks to avoid externalities associated with systemic risk.

3.1.3.3. To promote fairness and efficiency of markets

Bank regulation also exists to provide a regulatory framework that stimulates efficiency and competition among banks as well as ensuring that there are enough banking services in the economy. In line with Fresh and Baily (2009) a competitive environment promotes efficiency, brings quality and correctly priced services and breakdown curtails and monopolies in the financial sector. Bank competition and efficiency hinge on the number of market participants, entry and exit barriers (Claessens, 2009). An economy with too few banks (under banked) can lead to cartels, which results in monopolistic exploitation. At the same time, too many banks (over banked) may lead to excessive competition which can compromise service delivery (Beck, 2008).

3.1.3.4. To maintain monetary and financial stability

An efficient payment system which facilitates the full and timeous transferability of payments is essential for trade and commerce. Banks provide the payment platform in the economy. A disturbance in the payment and settlement system affects aggregate economic activity (Benston and Kaufman, 1995). In fact, Barth *et al.* (2001) assert that when the banking or financial system is disturbed or operate inefficiently, credit supply is curtailed leading to the abandonment of both existing and new ventures thereby reversing the gains of economic and social development. Given the volume of transactions carried out by individuals and businesses on a daily basis, there is need for the central bank to guarantee a safe and acceptable payment system. In light of this, bank regulation is there to ensure that fluctuations in business activity and idiosyncratic problems at individual banks do not disrupt the smooth flow of financial transactions throughout the economy so as to preserve public confidence in the financial system (Spong, 2000). In addition, the fact that the provision of a payment service is considered to be a public good, the government automatically becomes interested in protecting the system (Hebbink *et al.*, 1998).

3.1.3.5. To address the moral hazard problem

Government safety nets in the form of deposit guarantees and lender of last resort facility tend to create moral hazard problems (Llewellyn, 1999). Moral hazard exists when bank managers engage in risky behavior on the belief that they can get bailouts from the central bank

in times of liquidity crisis and depositors have recourse to their money via depositor protection schemes (Allen *et al.*, 2015). In other words, managers tend to invest a greater part of deposits in riskier assets thereby keeping low levels of liquidity hoping to be bailed out in the event of a crisis. Regulation becomes the ultimate tool at the disposal of regulators that they can use to restrain bad behavior (Bouwman, 2013). Regulators control banks' activities by imposing tight capital requirements as well as continuous monitoring through on-site and off-site bank surveillance.

3.1.3.6. To promote the safety and soundness of banks

Bank safety and soundness pertain to regulatory action that is aimed at reducing the likelihood of bank defaults and the magnitude of losses suffered by shareholders and various creditors in the event that the bank collapses (Jickling, 2010). Jickling (2010) went on to highlight that the main reason for monitoring the safety and soundness of banks is because individual bank risk decisions are affected by the fallacy of composition⁶. Several protective mechanisms are instituted by regulators to protect bank depositors and creditors. Based on the literature of Cornett and Tehranian (2004) these mechanisms include: credit allocation controls (whereby the regulator set sectorial limits in terms of credit extension); minimum capital requirements; bank insurance funds (to protect claimholders against losses in the event the bank fails); monitoring and surveillance (done through on-site and off-site examination).

3.2. FORMS OF BANK REGULATION

There are two broad dimensions upon which bank regulation can be considered, that is from a micro or macroprudential perspective. Basically, the microprudential perspective focuses on individual banks whereas the macroprudential view is centered on the whole financial sector. The differences between these perspectives can be summarized in a table as discussed by Borio (2003). Table 3.1 shows the main differences between micro and macroprudential regulation.

⁶ Fallacy of composition can be described as the notion that what is true for the whole is based on the fact that it is true for some part of the whole.

Table 3.1: Differences between micro and macro prudential regulation

	Macroprudential	Microprudential
Proximate objective	Limit financial system-wide distress	Limit distress of individual institutions
Ultimate objective	Avoid macroeconomic costs linked to financial instability	Consumer (investor/depositor) protection
Risk characterization	“Endogenous” (depend on collective behavior)	“Exogenous” (independent of individual agents’ behavior)
Correlations and common exposures across institutions	Important	Irrelevant
Calibration of prudential controls	In terms of system-wide risk; top-down	In terms of individual institutions; bottom up

Source: Borio (2003:2)

In terms of objectives, microprudential policies are aimed at minimizing the risk of financial distress at individual banks without considering their effects on the general economy. In other words, it is concerned with maintaining the safety and soundness of individual banks (Bernanke, 2011). The health of individual intermediaries is an essential condition for a sound banking system (Osinski *et al.*, 2013). On the other hand, macroprudential regulation aims to minimize the risk of financial distress on the whole financial sector in order to prevent output and wealth losses through potential spillover (externalities) of the distress into the real economy (Crockett, 2000). Cecchetti and Schoenholtz (2015) mention two externalities (spillovers) that macroprudential aim to prevent, namely common exposure and procyclicality. Common exposures occur when a considerable number of institutions, including smaller ones, are exposed to a common systemic risk either directly or indirectly. Direct exposure materializes through financial contracts to a particular frail firm or market segment, whilst indirect exposure entail exposure to counterparties who are themselves directly exposed to the struggling firm (Cecchetti and Schoenholtz, 2015). In 2007 and 2008, many depository institutions were affected by disturbances that occurred in the United States of America subprime mortgage market either directly or indirectly. Generally, during economic booms, financial intermediaries tend to lend aggressively on the belief that risk is waning, so they may not internalize negative externalities

of their increased risk taking behavior (European Central Bank, 2014). Moreover, in episodes of booms markets tend to be very liquid and buoyant. However, bursts reverse these trends with adverse effects on financial markets. Once bursts occur, banks attempt to manage the crisis by deleveraging, hoarding liquidity and cutting back credit supply (De Haan and Van den End, 2013a).. This behavior gravitate liquidity and deleveraging spirals and the vicious cycle between finance and the economy is reinforced. Thus, macroprudential because it takes a general equilibrium perspective, induces institutions internalize the cost of their bad behavior as well as spillover costs on others.

In terms of risk characterization, microprudential assumes that risk is endogenous (that is, it is determined internally), whilst macroprudential assumes that risk is exogenous (that is, it is determined externally) in relation to behavior of the financial system (Borio, 2003). When it comes to prudential controls microprudential regulation assesses individual firm risks from the bottom upwards (Hirtle *et al.*, 2009). It establishes prudential controls based on the risk profile of individual firms. As a result of this risk treatment, individual firm risk is considered to arise purely as a result of aggregation. Thus, correlations across institutions are ignored. On the contrary, macroprudential treats system wide risk from the top to the bottom (Bank for International Settlements, 2011). It applies prudential controls in relation to the marginal contribution of each institution to systemic risk. In light of the portfolio allocation theory, correlations across assets institutions as well as the differences between systemic and idiosyncratic risks are considered to be important (Borio, 2003).

The notion of macroprudential grew louder in the wake of the 2007-09 financial mayhem. Prior to the financial crisis, Basel regulations were focused on microprudential policies. Allen and Carletti (2012) contend that microprudential failed to contain bank failures in the course of the crisis because it ignores systemic risk. This argument is supported by Osinski *et al.* (2013) finding that microprudential policy is not adequate to curb instabilities in financial markets as a result of the sophistication of the financial system and fallacy of composition issues that may emerge. Improper behavior at individual institutions may destabilize the whole financial system due to the interconnectedness of the financial system and markets. Concomitantly, Goodhart (2015) maintain that microprudential oversight may not breed system wide stability for two reasons. In the first place, microprudential policies are designed in a way that they encourage

market players to benchmark themselves against the so called ‘best’ in the game. This creates self-similarity since all players end up having the same portfolio and tend to behave in the same manner. This behavior can strengthen banks against idiosyncratic shocks; nevertheless, the fact that diversity is discouraged actually weakens the system against systemic shocks. Subsequent to this view, if individual banks simultaneously engage in momentum trading such behavior can cause macro disasters in financial markets (Daniel and Moskowitz, 2016), as witnessed in the crash of the Wall Street in October 1987 and the United States of America financial turmoil in 2008.

On another note, Wall (2015) outlines a number of weaknesses of microprudential regulation. To begin with, microprudential supervision is prone to regulatory arbitrage. Tight regulation in a particular firm or sector may actually encourage the tightly regulated firms to move their risks to less regulated entities or sectors. For example, before the global financial crisis, tight capital requirements were imposed on the United States of America’s commercial banks. However, the perceived stability gains of tight capital requirements were reversed by excessive risk assumed by other intermediaries such as investment banks and insurance firms especially in structured products business (Crotty, 2009). Next, microprudential places a lot of focus on systemically important institutions (Wall, 2015). Such focus may overlook the contribution of other institutions and markets to systemic instability, of which due to the interconnectedness of financial markets, the collapse of overlooked segments or institutions can pose serious threats to the financial sector’s stability. For instance, the bursting of the United States of America subprime mortgage market in 2007 destabilized not only the United States of America’s financial market, but also the world at large. Furthermore, financial innovation has resulted in the shifting of risks to nonfinancial entities (Jenkinson *et al.*, 2008), thereby reinforcing mutual spillover effects between the financial and nonfinancial firms.

Therefore, in order to achieve sector-wide resilience and robustness, microprudential should be complemented by macroprudential (Osinski *et al.*, 2013). And for macroprudential policies to be effective, they must be designed in such a way that they take into consideration the sophisticated linkages and interrelationships among financial intermediaries and financial markets since these linkages influence the transmission of instabilities through the system (Bernanke, 2011). There are several tools that can be used by regulators to carry out effective

macroprudential regulation and supervision. According to Schmitz (2013) macroprudential instruments are aimed at mitigating time-varying, cross sectional and cross border systemic risk. The time-varying dimension attends to extreme credit growth or asset price booms as well as procyclicality. For each of these dimensions, possible remedies are given to address each risk. For instance, regulators would control too much credit growth by imposing caps on loan-to-value ratios (Morgan *et al.*, 2015) or by raising minimum capital and reserve requirements (Admati *et al.*, 2013). Similarly, procyclicality can be addressed by constraining leverage use by banks or by increasing market liquidity (Basel Committee on Banking Supervision, 2010b). The cross-sectional dimension focus on contagion, structural vulnerabilities and risk profiles of systemically important institutions, whilst the cross boarder dimension looks at cross border arbitrage and spillover effects as well as excessive capital flows (Schmitz, 2013). For example, Schmitz (2013) points out that excessive capital flows can be addressed by putting caps on foreign currency loans or taxing capital flows while currency volatility induced by excessive capital flows can be contained by imposing limits on currency mismatches.

3.3. BASEL ACCORDS

The preceding discussions have demonstrated that the main reason for regulating banks is to foster banking sector stability. Globally, banks are regulated in line with rules set by the Basel Committee on Banking Supervision which are formally known as Basel Accords. This subsection tracks the evolution and development of the Basel Accords.

3.3.1. Basel I Accord (1988 – 1998)

3.3.1.1. Historical development

Before Basel I, national regulators controlled bank capital by setting minimum ratios of capital to total assets. However, definitions of acceptable capital and the ratios differed remarkably across countries (Hull, 2012). Some jurisdictions enforced their regulations more diligently than others. As a result, there was unfair competition among banks in the international markets, prompting the need for harmonized international capital requirements (Hand, 2007).

The idea of harmonized bank regulations came in the wake of two particular events that transpired in the 1970s, namely the oil crisis of 1973 and 1979 and the failure of two high profile banks in 1974: Bankhaus Herstatt (Germany) and Franklin National Bank (United States of

America) (Alessi, 2012; Capie and Wood 2013). The oil crisis led to significant international finance imbalances and made the Eurodollar system to be very fragile, thereby posing risks to internationally active banks and also threatened global macroeconomic stability (Goodhart, 2011). The fall of Bankhaus in particular, led to significant losses to other banks as a result of settlement and counterparty risk (Basel Committee on Banking Supervision, 2015b). Furthermore, Herstatt failure led to serious disruptions in foreign exchange markets that lasted for close to a year, hence the need to supervise cross border national banks in order to avoid externalities that arise from a failure of a national bank on the global financial markets (Barrel and Gottschalk, 2005). Thus, central bank governors of the ten most industrialized economies (the G10⁷) realized that there was a need to design harmonized global bank regulations for member states. In light of this, the Group of Ten formed a Committee on Banking Regulations and Supervisory practices in 1974 and later renamed it to Basel Committee on Banking Supervision to spearhead the establishment of global banking regulations. There was also a recognition that banks were increasingly going international hence the need for the internationally active banks to hold adequate capital to protect the global financial system as well as depositors (Joseph, 2013). This general consensus on the need for broad capital requirements gave birth to Basel Accords.

On another note, Goodhart *et al.* (2010) state that Basel I was pushed by worries about the exposure of international banks to Latin American⁸ debt crisis of 1982. The crisis weakened capital ratios of internationally active banks, thereby drawing the attention of the Basel Committee to look into capital ratios for internationally active banks. The United States of America responded to these concerns by advocating for higher capital requirements for banks, but this move was hindered by the ‘level playing field’ argument. In what became known as “the race to the bottom” banks with an international flair moved to countries that had regulations they were perceived to be less strict (Balin, 2010). Although banks were increasingly going

⁷ The G10 comprises Belgium, Netherlands, Canada, Sweden, France, Germany, United Kingdom, Italy, United States of America, Japan, Switzerland and Luxembourg. Presently, the Committee is made up 28 member states that comprise the Group of Ten plus Argentina, Australia, Brazil, China, Hong Kong SAR, India, Indonesia, Korea, Mexico, Russia, Saudi Arabia, Singapore and South Africa (Basel Committee on Banking Supervision 2015b).

⁸ The crisis was experienced in Argentina, Brazil and Mexico.

international in terms of the scale of their operations, the regulation and supervision of banking institutions had however remained in the hands of national supervisory authorities (Darvas *et al.*, 2016). This created unfair competition between international and local banks. Therefore, there was a need to design regulations in such a way that they did not disadvantage domestic banks at the expense of foreign rivals both locally and abroad. On that note, Goodhart (2011) asserts that for regulation to create a level playing field between local and foreign banks, it has to be coordinated at an international level. Thus, Goodhart (2011) went on to highlight that the significant role of the United States of America and Japanese banks during that period led to the establishment of standardized capital requirements that were palatable with the United States of America, Japanese and European depository institutions.

Moreover, the inception and growth of derivatives in the late 1970s and early 1980s complicated the activities of banks and also increased credit risk for banks (Hull, 2012). It became apparent that a more advanced approach to risk quantification than the traditional capital to asset ratio was necessary. This led to a general agreement of establishing a risk weighted approach in the determination of capital for both on and off-balance sheet activities. Subsequent to comments made to a consultative paper issued in December 1987, a capital measurement system known as *The International Convergence of Capital Measurement and Capital Standards* (informally known as Basel I) was accepted by the Group of Ten governors and subsequently issued to banks in July 1988. The ensuing discussion on Basel I is primarily drawn from Basel I document issued by the Basel Committee on Banking Supervision in July 1988 (*The International Convergence of Capital Measurement and Capital Standards*) and a nontechnical summary of Basel I and II provided by Balin (2010).

3.3.1.2. Basel I Accord structure

Broadly, the general aim of Basel Accords is to advance financial sector stability, in particular the banking sector, by reinforcing supervisory knowledge and the quality of bank supervision throughout the world. This goal is achieved by establishing minimum standards for bank regulations and supervision; sharing supervisory affairs, approaches and techniques in order to improve common understanding and cross border cooperation; and sharing information on developments in the banking sector and financial markets so as to identify existing or emerging risks in global financial markets (Basel Committee on Banking Supervision, 2015b). It is worth

to note that the Basel Committee does not have supranational supervisory authority: its supervisory standards and guidelines are recommendatory and non-binding and are expected to evolve over time. Notwithstanding this, the Basel Committee expects member states to fully implement their guidelines (Basel Committee on Banking Supervision, 2001).

❖ *Main aim*

Basel I was aimed at enhancing the soundness and stability of the global banking system as well as to create a level playing field for internationally active banks. The first objective was to be achieved by stipulating minimum capital requirements that were perceived to ameliorate the probability of bank failures as well as to provide a capital buffer to absorb bank losses. The second goal was to be achieved by harmonizing bank regulations for member states. The Basel Committee believed that this move would create competitive neutrality among international active banks and also eliminate regulatory arbitrage.

❖ *Scope*

Initially, Basel I was established to facilitate the standardization of regulatory and capital requirements for member states only, in particular the Group of Ten. The Group of Ten was presumed to be made up of countries with well advanced financial markets; therefore, the standards were tailored to banks that operated in developed markets. The Basel Committee expressly stated that Basel I was not meant for emerging markets because they had several issues at stake, such as volatile currencies, rudimentary markets, volatile economies as well as other factors, which would hinder smooth implementation of the guidelines (Basel Committee on Banking Supervision, 1988). Next, Basel I was focused on establishing capital charges for credit risk in the banks' loan book. The framework excluded capital charges for other risks such as market risk, interest rate and foreign exchange rate risk. The Basel Committee did not consider capital allocation for these other risks because they were considered to vary remarkably across jurisdictions, therefore, they decided to leave capital allocation for these other risks in the hands of national regulators who are more conversant with their environments. Lastly, Basel I stated that its proposals were meant for internationally active banks, as such national regulators were advised to be more cautious in the design of their own regulations. Furthermore, the Basel Committee acknowledged that capital adequacy ratios are not the ultimate measure of a bank's

solvency hence stakeholders in the banking fraternity were supposed to scrutinize a bank's solvency beyond its reported capital adequacy ratio.

❖ *The Accord*

Basel I consisted of four 'pillars'. 'Pillar' 1 was known as *the constituents of capital*. It defined the components considered to be banks' capital, the amount of capital that banks were supposed to hold, limits and restrictions on capital as well as capital deductions. Basel I had two tiers of capital: Tier 1, also known as the core capital and Tier 2, also known as complementary capital. Tier 1 capital comprised of paid up share capital and disclosed reserves while Tier 2 capital was made up of undisclosed reserves, asset revaluation reserves, general provisions, hybrid capital instruments such as convertibles and subordinated debt.

The second 'pillar', *the risk weights*, provided a comprehensive method for calculating the capital ratio under the risk weighting system. The risk weighting method calculates capital charges on different classes of on and off-balance sheet assets weighted according to the relative riskiness of the assets. The Basel Committee considers this method to be the most appropriate way of examining capital adequacy in banks for two reasons. First, it enables fair comparison of banks' capital ratios cross banks throughout the world that operate in markets with different structures. Second, it facilitates easy computation of off-balance sheet exposures into the capital measurement and it does not preclude banks from holding liquid and other securities deemed to be of low risk.

The third 'pillar'- set the *target standard ratio*. The Basel Committee agreed on a target minimum capital ratio of 8% of capital to risk weighted assets (RWA), of which at least 4% should be made up of core capital. This ratio was informally known as the Cookie ratio (named after the then Bank of England Governor who pioneered the concept of the risk weighted ratio). The ratio took into account the bank's credit risk exposure to both on and off-balance sheet activities. It was based on the bank's total risk weighted assets (RWA), whereby RWA is established by multiplying the loan amount by its corresponding risk weight and summing the respective products.

The last 'pillar' attended to transitional and implementation arrangements. The transitional period for Basel I implementation was set at 4.5 years from June 1988 to the end of

1992. International banks in member states were thus expected to comply with the minimum capital ratio by the end of 1992. This transitional period was considered adequate to give banks ample time to adjust their balance sheets towards the target ratio since they were operating in different supervisory systems. Basel I was expected to be implemented at national level in the shortest period possible for each country. Countries were given the leeway to decide the way they would implement the rules based on their legal structures and supervisory arrangements. In some jurisdictions, changes in capital regime would require legislation while in others there was no need of legislation; thus, individual member states were given the green light to decide how they would implement the Accord. All Basel member states managed to implement Basel I by the end of 1992, except Japan (which had its own domestic problems emanating from the banking crisis that occurred in the late 1980s to early 1990s) (Balin, 2010). Japan later complied in 1996 when the crisis was over. It is interesting to note that several emerging market economies voluntarily implemented Basel I in their jurisdictions although it was meant for member states. The motivation for this move was driven by the desire to source cheap funding from international banks who perceived Basel compliant countries to have strong regulations and more stable financial markets (Balin, 2010). By the end of 1999, several countries had or were in the process of implementing Basel I. To date, many countries have voluntarily adopted the Basel Accords.

3.3.1.3. Basel I Amendments

Since its inception in 1988, the Basel I Accord was amended several times. The first amendment occurred in November 1991 to give a more concise description of general provisions to be included in capital determination. It was provoked by debt defaults that emanated from the Latin American debt crisis. In April 1995, the Accord was amended for the second time to incorporate the impact of bilateral netting of banks' credit exposures in derivative transactions and also to enlarge the matrix of add-on factors. The third amendment took place in January 1996 to incorporate capital charges for market risk which were earlier ignored. This amendment was a more comprehensive and significant relative to earlier modifications.

❖ *Brief summary of the 1996 Amendment*

In the 1990s, the Basel Committee recognized weaknesses in the Basel I Accord and instituted some revisions. In 1996, the Accord was revised to incorporate market risk charges. In a document titled, '*Amendment to the Capital Accord to Incorporate Market Risks*', the Basel Committee spelt out the scope and coverage of capital charges, approaches that banks would apply to determine market risk charges and transitional arrangements. Market risk capital charges were based on exposures to interest rate, equities, foreign currency and commodities. Capital charges for interest rate related assets and stocks were to be applied to the existing market value of such items in the bank's trading book⁹. Capital allocation for foreign exchange rate risk and commodities risk was to be applied to the bank's total currency and commodity positions, but with a provision of excluding structural foreign currency positions.

In determining capital allocation for market risk banks were allowed to choose between two broad approaches, namely the standardized and internal based approach. Under the former approach banks would calculate minimum capital requirements based on specific risk or general market risk. Capital charges for specific risk was meant to insulate banks against unfavorable price changes in an individual asset as a result of factors linked to the particular issuer. Minimum capital requirements for general market risk were created to absorb losses emanating from adverse movements in market prices. The latter approach gave banks room to establish their own internal models (VaR models) to calculate market risk capital charges, subject to regulatory approval. The transitional period for the implementation of the proposed amendments was set at December 1997. Thus, starting 1 January 1998 banks were expected to have fully complied with the proposed revisions.

3.3.1.4. Evaluation of Basel I

Achievements of Basel I

❖ *Introduction of the risk weighting system*

⁹ A bank's trading book is described as a pool of securities that a bank holds for the purposes of making short term gains from price variations, brokering fees or dealing spreads and to hedge market risk (Balthazar, 2006).

The main achievement of Basel I was the introduction of the risk weighting system in the determination of minimum capital charges. The Cookie ratio (capital ratio) managed to separate assets based on their perceived risk and it also included a capital charge for off-balance sheet transactions that had grown significantly following the advent of derivatives (Balthazar, 2006).

❖ *Increase in banks' capital ratios*

The passage of Basel I in 1988 caused member states banks to substantially increase their capital ratios. Jackson *et al* (1999) report that average capital ratios of banks in developed economies rose from 9.3% in 1988 to 11.2% in 1996. Moreover, studies by Van Roy (2008) and Roy *et al.* (2013) confirm that banks responded to Basel I by increasing their capital ratios.

❖ *Create a level playing field*

One of the principal aims of Basel I was to create an even playing ground for internationally active banks through the introduction of harmonized capital requirements. This aspect can be assessed in terms of convergence in accounting treatment across jurisdictions and cost of capital. According to Heid *et al.* (2004) Basel I managed to create an even playing ground in terms of competition neutrality although Jackson *et al.* (1999) contend that fundamental aspects like variations in cost of capital across jurisdictions remained prominent.

Shortcomings of Basel I

In spite of some milestones achieved by Basel I, it had a number of flaws that eventually led to its abandonment in favor of Basel II. This sub-section highlights the main weaknesses inherent in the Basel I Accord.

❖ *Focus on credit risk alone*

Basel I focused on capital allocation for credit risk only. The bias on credit risk proved to be problematic (Capie and Wood, 2013). Developments in the financial market such as the spectacular fall of Barrings Bank in 1995 revealed weaknesses in this approach. After realizing the significance of market risk, the Basel Committee partially amended the Accord in 1996 to incorporate capital charges for market risk. Barrel and Gottschalk (2005) add that the omission of other risks in the Accord gave rise to misinterpretation of risk. For instance, a 20-year bond

issued by an Organization for Economic Cooperation Development bank (with a risk weight of 20%) carried a higher interest rate risk compared to a one year loan issued to a private firm (with a risk weight of 100%). However, Basel I did not recognize this interest rate risk in capital allocation.

❖ *Regulatory arbitrage*

The weighting system gave banks room to side-step the rules by engaging in regulatory capital arbitrage in an endeavor to achieve the least possible funding cost and to maximize returns (Jones, 2000). Capital arbitrage was conducted via two principal ways: asset securitization and cherry picking (Jackson *et al.*, 1999). Securitization enabled banks to take on-balance sheet assets (requiring greater weighting such as mortgages) off-balance sheet via the special purpose vehicles (SPVs), where they could get lesser weightings, thereby lowering their capital requirements and increase their capital adequacy ratios without corresponding reduction in risk (Jablecki, 2009). Cherry picking was a practice whereby banks would switch their portfolios towards lower quality assets of a specified risk weight category (Balin, 2010).

❖ *Overly simplistic approach*

Basel I had an umbrella approach to the quantification of minimum capital ratios across jurisdictions. The simplistic approach created room for banks to engage in regulatory arbitrage (Barrel and Gottschalk, 2005).

❖ *Rigid weightings*

Basel I weightings were deemed to be too rigid and unrealistic in some circumstances because the weighting was premised on the nature of the borrower (Capie and Wood, 2013). For instance, private sector counterparties all had a risk weight of 100% regardless of their financial strength; thus, Basel I ignored individual risks.

❖ *Basel I was 'oversold'*

Over-sale in simple words means promising more than what you can deliver. Balin (2010) argues that the way Basel I was publicized made it look as if the Accord was a true panacea to bank failures that had wreaked havoc throughout the world. This 'over-sale' triggered

large international banks and rating agencies to call for the adoption of the standards by emerging markets as well. However, Basel I proved to be weak to foster global banking stability hence its revision in 2006. The revised Accord became known as Basel II.

3.3.2. Basel II Accord (1999 to 2008)

As the weaknesses of Basel I became evident, calls for an improved capital adequacy framework grew louder. Growth in asset securitization and over the counter derivatives activities enabled banks to exploit weaknesses in Basel I. In 1999, the Basel Committee set to revise Basel I framework and proposed a more comprehensive document for capital regulation formally known as *A Revised Framework on International Convergence of Capital Measurement and Capital Standards* and informally known as Basel II. Basel II brought a more complex approach to the quantification of minimum regulatory capital and proposed a three pillar approach that sought to line up regulatory capital with economic capital. Basel II goal was to estimate capital requirements for credit, market and operational risk. There are three key elements related to capital requirements under Basel II, that is, the definition of regulatory capital, risk weighted assets and minimum capital ratio. The ensuing discussion of Basel II is drawn from the Basel II document (*bcbs128*) proposed by the Basel Committee on Banking Supervision in 2004.

3.3.2.1. Objectives of Basel II

As contained in the Basel Committee's 2001 Consultative document, Basel II sought to: advance the safety and soundness of banking institutions agenda, maintain the goal of promoting competitive neutrality, offer extensive approaches for risk management and provide capital adequacy determination techniques that better align banks' capital to their activities and positions. The Basel Committee recognized that these safety and soundness goals cannot be attained solely through minimum capital requirements thus Basel II was built on three complementary pillars: minimum capital requirements, supervisory review process and market discipline. These "pillars" are described in detail below.

❖ Pillar I – Minimum Capital Requirements

The first Pillar attended to minimum capital requirements for banks. Basel II capital charges were to be made on three main risks facing banks: credit, market and operational risk.

Pillar I was similar to risk charges under Basel I, save that it is broader to encompass both market and operational risk charges. It maintained the minimum capital ratio at 8% as in Basel I. Several approaches were proposed for determining capital risk charges. Banks were given the freedom to choose between the simple standardized approach and sophisticated internal ratings based approach.

❖ Pillar II – Supervisory Review Process

The Supervisory Review Process is aimed at ensuring that banks hold capital that is commensurate with the risks they are taking and also to encourage banks to design and implement better risk management practices. The “pillar” outlined responsibilities for both bank executives and regulators in the advancement of banks safety and soundness. Bank executives are responsible for designing risk measurement and management approaches as well as to establish capital charges that are consistent with the overall risk profile of the bank and operating environment. Supervisors’ task is to assess how well banks are measuring their capital adequacy relative to their risk profiles. This oversight function enables regulators to ensure that banks hold capital that is equal to or above the minimum regulatory capital and to intervene at an early stage when the need arises. Hasan (2002) asserts that this interaction is aimed at advancing an active communication between the regulator and regulated institutions so that when capital shortfalls are recognized, prompt corrective action is instituted to prevent disasters. Pillar II also calls for regulators to assess the compliance, on an ongoing basis, of banks to minimum standards and disclosure prerequisites set for more advanced risk measurement approaches, especially the Internal Ratings Based approach for credit risk and the Advanced Measurement Approach technique for operational risk.

Unlike Basel I, which had rigid and easy to apply risk weights, Basel II offered banks a ‘menu’ of risk measurement and management approaches. However, since banks were given a leeway to choose the most suitable approach, a *review process* was required (Basel Committee on Banking Supervision, 2004). The review process is done to vet the ability of a bank to adopt its preferred approach. In addition, the adoption of internal based approaches requires banks’ internal risk parameter inputs to be measured correctly in a robust manner. Accordingly, the Basel Committee proposed four guiding principles for regulators to monitor the review process. Moreover, Pillar II was designed to address risks not adequately covered in Pillar I such as

concentration risk, business and strategic risk as well as external factors beyond the bank's control such as business cycles. Basel II also set out particular oversight responsibilities for the Board of Directors and bank management which reinforced the principles of internal control and sound corporate governance.

❖ Pillar III – Market Discipline

Pillar III is intended to complement Pillar 1 (minimum capital requirements) and Pillar 2 (supervisory review process) by advocating for full disclosure. Full disclosure was meant to give the bank's stakeholders pertinent information about the bank's business practices and risks assumed. The Basel Committee proposed to promote market discipline by establishing a number of disclosure requirements. Key information that banks had to disclose include the capital structure of the bank, capital components and the level as well as risk management practices for fundamental risks facing banks, that is credit, market and operational risk. Banks were expected to have a formal disclosure policy endorsed by the Board of Directors. The policy should spell out the approach that the bank plans to use in order to establish aspects to disclose as well as internal control systems set for the disclosure process. Furthermore, banks had to establish a process of evaluating the aptness of their disclosures, embracing validation and regularity of disclosure (Basel Committee on Banking Supervision, 2004).

3.3.2.2. Basel II Amendment (Basel II.5)

In the course of the global financial crisis, the Basel Committee realized that Basel II framework was inadequate to determine capital requirements for market risk. Accordingly, they made the following amendments to Basel II.

i. Introduction of stressed Value at Risk (VaR)

Between 2003 and 2006 the volatility of several market variables was generally low. Consequently, market value at risk allocated during the period was also low even up to the start of the financial crisis banks had low market value at risk. However, during the financial crisis volatility rose significantly; thus, it became evident that value at risk that banks calculated needed to be changed to capture market developments. Hence, the introduction of stressed market value at risk in 2009. Stressed value at risk was more appropriate during the period

because it is determined by the movement of variables in stressed market conditions unlike the existing method (for that period) that looked at historical asset price movements. Stressed value at risk calculation hinges on 250-day stressed market conditions, unlike the last one to four years market changes time frame used before the amendment. Basel 2.5 required banks to compute two VaRs: conventional VaR (premised on the last one to four years' markets changes) and the stressed VaR (determined for 250 days of stressed market conditions). The two market VaRs are added to establish total capital allocation for market risk.

ii. *Incremental risk charge*

In 2005, the Basel Committee realized that risks in the trading book were allocated less capital compared to similar exposures in the banking book. To address this anomaly, the Basel Committee advanced an incremental default risk charge in 2005. The incremental default risk charge was to be derived on a 99.9% confidence level and 1-year time band for products in the trading book that are more susceptible to default risk. This adjustment would ensure that capital allocation for a product in the trading book would be the same to capital charges in the banking book. Furthermore, in 2008, the Basel Committee also observed that most losses realized by banks between 2007 and 2008 were not solely as a result of loan delinquencies but changes in credit ratings, growing credit spreads and liquidity losses also significantly increased bank losses. As a result the Basel Committee amended Basel II to take into account this observation and the incremental default risk charge was changed to incremental risk charge (Basel Committee on Banking Supervision, 2009). The incremental risk charge obliges banks to determine a one year 99.9% value at risk for losses that emanate from credit sensitive products in the bank's trading book, taking into account both credit rating changes and defaults. Given that assets subject to the incremental risk charge are located in the bank's trading book, it was presumed that the bank would be able to rebalance its portfolio during the year to limit default risk.

iii. *The comprehensive risk measure*

The comprehensive risk measure capital charge was intended to take into account risks in the correlation book. The correlation book is a portfolio of assets that are susceptible to the correlation of default risks and various assets such as asset based securities and collateralized

debt obligations (Hull, 2012). It replaced the incremental risk charge and the specific risk allocation for assets that rely on credit correlation.

3.3.2.3. Evaluation of Basel II

❖ Achievements

Basel II had some significant achievements. To begin with, it introduced the concept of mapping capital requirements to economic risks assumed by the bank. Instead of a 'one size fit all' weighting system under Basel I, Basel II brought improved alignment of regulatory capital to the credit worthiness of borrowers by tying capital allocation to counterparty risk. Second, Basel II established capital requirements for operational risk and market risk which was omitted in Basel I. Third, Basel II proposed a 'menu' of risk measurement and management techniques, which differed in sophistication, that banks could use to calculate their capital requirements. This encouraged banks to improve their risk management practices as they sought to move towards more advanced techniques that had lesser capital allocation. Lastly, Basel II brought on board two new pillars: supervisory review and market discipline to enhance the role and power of supervisors in overseeing the activities of banks and market discipline through full disclosure.

❖ Weaknesses

The global financial crisis that wreaked havoc in 2007 caused doubts about the efficacy of the Basel Accords. Criticisms of Basel II lie in the following issues.

❖ *Insufficient attention to liquidity risk*

Inadequate attention to liquidity risk has been cited as one of main deficiencies in Basel II. Jacobs *et al.*, (2012) point out that omission of liquidity charges, despite their significance, in Basel II had adverse repercussions for banks and the economy at large. Liquidity crises, though it is a low probability event, but when it does occur it can trigger a series of bank failures. This is what actually transpired in 2007/8. Serious liquidity shortages caused a number of banks to fail and governments to intervene through bailouts to stop massive disruptions in the financial system.

❖ *Increased procyclicality*

In theory capital requirements are procyclical. Procyclicality is described as the tendency of banks to expand lending in good times (when risks are low) and cutting back lending in bad times (when risks rise) (Heid, 2007). The linking of capital requirements to economic risks under Basel II implied that capital requirements became more sensitive to business cycles. Saidenberg and Schuermann (2003) argue that in a downturn, borrowers are likely to suffer downgrades due to rising risk, which results in considerable increase in capital charges for banks to compensate for increasing risk. Since raising capital is more difficult in downturns, banks may be compelled to cut back lending in order to manage their capital ratios (Jokipii and Milne, 2011). The fact that risk weights and capital charges rise during recessions, due to increased loan delinquencies, implies that Basel II exacerbates economic recession (Repullo and Suarez, 2012).

❖ *Overreliance on external ratings*

Basel II, in particular Pillar I, relied on external ratings to determine capital allocation. However, the use of credit ratings in deriving capital charges had an impact on banks' capital adequacy. Due to the fact that highly rated securities required less capital allocation, banks were enticed to hold such securities (such as collateralized debt obligations), even though they were more risky (Joseph, 2013). Furthermore, during the crisis the market questioned the accuracy and value of ratings which effectively caused a dry up of liquidity provision to banks (Brunnermeier, 2009). Thus, credit rating agencies were blamed for causing the crisis (Kotios, 2012).

3.3.3. Basel III Accord (2010 to date)

The ensuing discussion of Basel III is drawn from Basel III document (**bcbs 189**) issued by the Committee in December 2010 known as *Basel III: A global regulatory framework for more resilient banks and banking systems*. One of the key factors behind the cause and severity of the global financial crisis that started in 2007 was excessive leverage assumed by banks, compounded by deteriorating quality and quantity of banks capital (Chan, 2011). At the same time, banks were holding inadequate liquidity buffers (Basel Committee on Banking Supervision, 2013). As a result of these weaknesses banks could not withstand system-wide trading and credit losses as well as reintermediation of off-balance sheet items that had significantly grew in the “shadow” banking system. In addition, the crisis was aggravated by

deleveraging and chain reaction that arose from the interconnectedness of financial intermediaries and markets via a number of transactions (Feyen and Del Mazo, 2013). Problems at banks were quickly transmitted to the whole financial system and the economy at large, leading to significant contraction of liquidity and credit supply (Basel Committee on Banking Supervision, 2010a). In order to address market failures highlighted by the global financial crisis and weaknesses in the Basel II accord, the Basel Committee proposed a raft of reforms to Basel II to strengthen prudential regulation (with a macroprudential perspective) so that banks can be more resilient to both exogenous and endogenous shocks. The pursuing discussion summarizes the key aspects of Basel III. Key aspects under Basel III include the reinforcement of capital requirements for banks and the introduction of liquidity standards.

A. Reinforcing banks' capital requirements

Basel III seeks to strengthen minimum regulatory capital for banks across member states and other jurisdictions that voluntarily adopt the Accord. This goal is to be achieved through the following initiatives.

1) Increasing the quality, consistency and transparency of banks capital

The Basel Committee observed a number of events that transpired during the global financial turmoil. Initially, banks credit losses and write offs were absorbed by retained earnings. Second, there was inconsistency in the definition of capital across jurisdictions and third, inadequate disclosure that inhibited the market to fully evaluate and contrast capital quality among institutions. In order to bolster the quality, consistency and transparency of banks' capital the Basel Committee proposed tight rules for instruments to be included in Tier 1 Core Equity capital. Tier 1 capital has been limited to going concern common equity and retained earnings. These components of capital are considered to be perpetual; therefore, able to absorb losses on a going concern basis. To bring consistency in Tier 1 capital, Tier 1 capital deductions have been harmonized to enable equal comparisons. Hybrid debt instruments which were previously considered as capital as well as Tier 3 capital have been eliminated. To enhance market discipline, transparency of the capital base will be improved through full disclosure of all capital elements.

2) *Enhanced risk coverage*

One of the weaknesses of Basel II was its inability to capture all off-balance sheet risks as well as exposures related to derivative contracts. Basel III brings measures to increase capital allocation for counterparty credit exposures emanating from the bank's derivatives and Repo transactions as well as securities financing activities. These measures will be achieved through the following reforms.

- Banks are now obliged to calculate capital charges for counterparty risk using stressed inputs. This requirement is meant to contain procyclicality.
- Basel III introduced a capital charge for possible mark-to-market losses, known as credit value adjustment (CVA) that is connected to deterioration in the credit worthiness of the borrower.
- The Committee is enhancing rules for collateral management and initial margining. Under this reform banks with significant and illiquid derivative exposures have to apply longer margining periods in their capital requirements determination.
- In order to limit systemic risk emanating from the interrelatedness of banks and other financial intermediaries via the derivative markets, the Basel Committee is working together with the Committee on Payments and Settlement Systems and International Organization of Securities Commission to set up tight requirements for financial markets infrastructure. In addition, the Basel Committee is also encouraging banks to transfer their over-the-counter derivatives and default fund exposures to the central counterparties which attract low risk weights and are subject to risk sensitive capital charges. Concomitantly, in order to limit systemic risk, the Basel Committee proposed that risk weights for financial exposures be raised significantly above risk weights for non-financial exposures because financial risks are more correlated compared to non-financial exposures.

- The Committee also offered increasing counterparty credit risk management practices in various areas including the management of ‘wrong way risk’¹⁰.

3) Introduction of a leverage ratio

The Basel Committee realized that before the global financial crisis banks had build-up excessive leverage on both on-balance sheet and off-balance sheet items, despite the fact that they were reporting good capital adequacy ratios. During the crisis most banks were forced to deleverage; however, that deleveraging process triggered a massive fall in asset prices which exacerbated the feedback loop between losses, waning banks’ capital and reduced credit supply (Brunnermeier, 2009). Accordingly, Basel III brings on board a non-risk based leverage ratio to supplement risk based capital requirements. The leverage ratio is intended to restrict the build-up of leverage within the banking system, which can have destabilizing effects and to augment risk based capital requirements with a simple, transparent and independent measure of risk, thereby providing more protection against model risk and measurement error.

4) Introduction of capital conservation buffer

The Basel Committee noted that at the beginning of the global financial crisis many banks continued to make significant distributions (through dividends, share buy backs and bonuses) even though the banks’ financial conditions were deteriorating. Still, though a number of banks returned to profitability after the crisis they did not substantially rebuild their capital buffers to support their lending activities. To that end, the Basel Committee sought to address this market failure by introducing a capital conservation buffer of 2.5%. The buffer is aimed at increasing the ability of banks to withstand economic downturns and also to advance mechanisms for banks to rebuild their capital during recovery.

¹⁰ The Basel Committee describes wrong way risk as a situation whereby a certain exposure raises in the event that the credit quality of the counterparty deteriorates (Basel Committee on Banking Supervision, 2010a).

5) *Introduction of countercyclical buffer*

In response to procyclicality issues raised under Basel II, the Basel Committee proposed a countercyclical capital buffer of 2.5%. This buffer is intended to prevent procyclicality and enable banks to continuously lend even in economic downturns. The buffer also places some constraints on distributions, specifically it stipulates that distributions can only be made if the buffer is fully met.

B. Introduction of liquidity standards

After realizing that a number of banks experienced liquidity problems due to deficiencies in their liquidity risk management practices, the Basel Committee in 2008 released a document titled, '*Principles for Sound Liquidity Risk Management and Supervision*', to provide guidelines for liquidity risk management for both banks and supervisors. To complement these principles, Basel III strengthened the liquidity framework by introducing two minimum requirements for liquidity: the liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) as well as liquidity monitoring tools. The liquidity coverage ratio is intended to enhance short term resilience of banks to liquidity shocks over the short run. The net stable funding ratio is intended to limit banks asset and liability mismatches by encouraging banks to fund their activities with stable and long term funding instruments.

3.4. BASEL LIQUIDITY REGULATIONS IN DETAIL

3.4.1. History of Liquidity Regulations

The Basel Committee began to work on both capital and liquidity regulations in 1975, although early discussions were centered on which jurisdiction between home and host should be responsible for supervision instead of methods of measuring banks risks (Bonner and Hilbers, 2015). This made liquidity regulations to remain prominently on the Basel Committee on Banking Supervision agenda until the Basel Committee's meeting in June 1980, when the then Chairman (Peter Cooke) moved the motion to have capital as well as liquidity regulations for internationally active banks. Table 3.2 below presents a summary of the chronological development of harmonized liquidity standards.

Table 3.2: Chronological Development of Basel Liquidity Regulations

Date	Title	Description
September 1992	BCBS10: A Framework for Measuring and Managing Liquidity.	Principles and Practices
February 2000	BCBS69: Sound Practices For Managing Liquidity in Banking Organizations.	Revised version of BCBS10
February 2008	BCBS136: Liquidity Risk: Management and Supervisory Challenges	Stock take of supervisory liquidity management Practices
September 2008	BCBS144: Principles for Sound Liquidity Risk Management and Supervision	Expansion of BCBS69
December 2010	BCBS188: Basel III: International framework for liquidity risk measurement, standards and Monitoring	Announcement of LCR and NSFR requirement proposals
January 2013	BCBS238: Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring Tools	Finalization of LCR details and phased introduction Schedule
April 2013	BCBS248: Monitoring tools for intraday liquidity management	Monitoring tools for intraday liquidity
January 2014	BCBS271: Basel III: The Net Stable Funding Ratio	Revised version of the Net Stable Funding Ratio Requirements
April 2014	BCBS284: Frequently Asked Questions on Basel III's January 2013 Liquidity Coverage Ratio framework	Technical aspects relating to implications of specialized transactions for the LCR

Source: Davis (2014:10)

In spite of the willingness of the Basel Committee to have liquidity regulations in place, discussions on this pertinent topic were pushed off the Basel Committee's agenda until 1984 due to the Latin America debt crisis (Bonner and Hilbers, 2015). In 1984, a sub-group was set to look into the measurement and management of liquidity risk. The subgroup managed to come up with a full report in February 1985 which highlighted a number of issues. The report highlighted that there was potential overdependence on wholesale funds, foreign currencies and central bank funding and recommended that the Basel Committee should establish harmonized liquidity regulations similar to capital requirements that have been standardized (Goodhart, 2011). However, the recommendations were not taken seriously because regulators perceived liquidity to be too convoluted and bank specific hence general guidelines for liquidity management were adopted instead of pursuing standardized liquidity requirements. In addition, the subgroup observed that most international banks mobilized deposits through foreign branches, therefore liquidity regulation was considered to be better placed in the hands of home rather than host supervisors (Bonner and Hilbers, 2015).

Hitherto, the general sentiment was that liquidity regulation was best left in the hands of home supervisors. In spite of the sub-groups' recommendations for further work on liquidity standards, the Basel Committee was complacent to design harmonized liquidity standards, instead the Basel Secretariat resolved that liquidity matters were best suited for national supervisors. This resolution was premised on the perception that banks were already burdened with capital requirements; therefore, mandatory liquidity requirements would exert tremendous pressure on the banks (Goodhart, 2011). Furthermore, Goodhart (2011) points out that harmonized liquidity standards were thought to be only possible if central banks collateral structures were also harmonized. Most of the Basel Committee member states concurred that it was fundamental to have common eligibility of assets in the regulation, of which without a common eligibility criterion it was difficult to come up with eligible/qualifying assets for regulatory purposes. In consideration of the fact that central banks assets eligibility varies remarkably across jurisdictions, the standardization of liquidity requirements was considered to be infeasible. After the abandonment of the liquidity harmonization 'project', the Basel Committee thought of developing the idea of survival concept by setting another sub-group to look into that in 1987. Again, due to wide variations in approaches and limited data, the idea of survival concept was not widely accepted. Notwithstanding these developments, the Basel

Committee still had to design a framework for liquidity measurement based on the survival concept and existing data.

The introduction of Basel I in 1991 and issues surrounding disturbances at the New York Stock Exchange caused the Basel Committee to put on hold liquidity standards discussions. Since critical views on the harmonization of liquidity standards remained a concern for Basel Committee on Banking Supervision, the subgroup continued to work on the subject between 1990 and 1992 and managed to pen two papers that stipulated a more systemic way of liquidity risk measurement and management as well as proposals on how the home and host can cooperate in assessing liquidity risk at foreign bank branches (Bonner and Hilbers, 2015). The subgroup was later dissolved in 1992. After further deliberations on liquidity management guidelines between 1992 and 1997, in February 2000 the Basel Committee came up with a revised version of its 1992 paper which had fourteen principles of sound liquidity risk management. The revision was primarily made in order to establish pillars for effective liquidity risk management. The 2000 paper also had principles on public disclosure and the role of supervisors in banks liquidity management. Subsequent to the 2000 liquidity guidelines document, the Basel Committee did not pay much attention to liquidity standards, up until 2004 when the Joint Forum¹¹ agreed that the issue of harmonizing liquidity regulations warranted further inquiry. Thus, the focus on standardized liquidity regulations was now directed at assessing how financial intermediaries in various sectors of the economy manage liquidity risk and also examining regulatory frameworks existing in different jurisdictions.

Beside this, attention was also drawn on analyzing the effects of institutions' and supervisors' reaction to stress scenarios and the effects of such reaction on systemic risk. By 2005, the Joint Forum came up with a number of observations concerning liquidity risk management. Pertaining to management policies and structures they observed that there was an inclination towards centralized liquidity risk management. Furthermore, firms were perceived to have improved their capability to specify quantitative indicators for liquidity risk by adopting techniques such as liquid asset ratio, cash flow projections and stress tests (Basel Committee on

¹¹ The Joint Forum was set up in 1996 under the auspices of the Basel Committee on Banking Supervision, the International Organization of Securities Commission and the International Association of Insurance Supervisors to work on issues that are common in the banking, securities and insurance industries.

Banking Supervision, 2006). Considering the fact that most of the indicators were focused on idiosyncratic stress, the Joint Forum implored supervisors to investigate factors that made firms to disregard market wide shocks in their liquidity management.

Due to divergences in liquidity risk management practices at firm level and regulatory level, the Basel Committee put in place a new group, the Working Group on Liquidity (WGL) in December 2006 to examine liquidity regulation approaches in member states. The Working Group on Liquidity managed to present its findings in 2007. The Working Group on Liquidity found that: although there was a general consensus on the need of liquidity regulations, objectives and practices varied remarkably across countries; contextual issues such as deposit insurance and central bank lender of last resort function have a great contribution in determining the optimal liquidity resilience; there are added costs for cross border banks that emanate from domestically determined liquidity systems and in view of the 2007 to 2009 global financial crisis the Working Group on Liquidity recommended that the Basel Committee should relook at liquidity risks in banks, specifically revising the 2000 liquidity management framework (Basel Committee on Banking Supervision, 2008b).

The Basel Committee took these recommendations into consideration and subsequently updated its liquidity management framework in September 2008. The 2008 document (titled *Principles for Sound Liquidity Risk Management and Supervision – (bcbs 136)*) was premised on the same principles as the 2000 document save that it includes a few alterations. Specifically, the 2008 paper proposed the introduction of liquidity costs and risks in the course of pricing products, measuring performance as well as new product endorsement. Furthermore, the 2008 document provided a more detailed framework for the management of liquidity risks of specific exposures for instance foreign currency, correspondent, custody and settlement exposures as well as off-balance sheet exposures. Another addition made to the 2000 paper was guidance on how to evaluate the healthiness of a bank using tools such as static ratios, forward looking techniques and liquidity risk early warning indicators. The 2008 document also suggested that banks should consider group wide rather than firm level assessment of liquidity risk.

Finally, the 2008 document outlined more detailed information on the conduct of stress tests and designing of contingency funding plans together with the responsibilities of supervisors in liquidity monitoring. Notwithstanding effort and progress made by the Basel Committee in

designing standardized liquidity regulation, the global financial turmoil revealed several deficiencies in banks liquidity management practices (Institute of International Finance, 2009; Basel Committee on Banking Supervision, 2010b). The crisis spurred regulators throughout the world to strengthen their frameworks for liquidity risk management. Likewise, the Basel Committee was prompted to strengthen international principles for the measurement and management of liquidity risk (Gomes and Wilkins, 2013). Subsequently, the Basel Committee released global liquidity regulations in 2010 under the new Basel III framework titled “*Basel III: International Framework for Liquidity risk measurement, standards and monitoring*” (**bcbs188**).

3.4.2. Key obstacles in the harmonization of Liquidity Regulations

From the foregoing discussion it is vivid that the Basel Committee took a long time to establish standardized global liquidity regulations. Bonner and Hilbers (2015) and Goodhart (2011) highlight three factors that impeded the development of global liquidity standards. First, *inadequate supervisory momentum* made regulators to believe that it would strain banks to report quantitative liquidity rules on top of existing capital charges. In the eyes of the Basel Committee, banks were already burdened with capital requirements; hence, they did not need an additional burden that would come through binding liquidity requirements. However, the global financial crisis proved to be an eye opener for the regulators to appreciate the need for liquidity standards as a complimentary tool to existing capital regulations. Thus, the Basel Committee moved with haste to establish liquidity regulations in 2010.

Next, *the view that capital charges address liquidity risk* delayed the establishment of harmonized global liquidity regulations. Bonner and Hilbers (2015) argue that prior to the global financial crisis regulators thought adequate capital levels would contain liquidity risk. This view was based on two assumptions: as long as a bank was well capitalized, it was reasoned that the bank could easily obtain funding in the debt markets or it could borrow from the central bank lender of last resort window; therefore, liquidity buffers were deemed unnecessary and by requiring banks to keep adequate capital proportional to its risk weighted assets regulators believed that this would incentivize banks to take up more assets with lower risk weights which are more liquid. Lastly, *differences in the way central banks conduct their monetary policy* created sticky points in liquidity standards negotiations. For some time, the Basel Committee recognized fully harmonized collateral frameworks to be a component of integrated liquidity

regulations. Their argument was that it is not achievable to harmonize the definition of central bank eligible assets (which were to be used in determining liquidity ratios) because they vary from country to country. As a result, the Basel Committee took a long time to reach a consensus on assets that would be eligible for LCR and NSFR specification.

In reaction to these hindrances, several jurisdictions started to develop and to implement their own liquidity standards. For example, in 2003 the Dutch regulatory authorities introduced the Dutch Liquidity Coverage Ratio (DLCR) akin to Basel's LCR. In 2007, the Germany regulators amended their quantitative liquidity rules by designing a more risk oriented and principles based prudential regulatory framework. In 2010, British Financial Services Authority enacted the Individual Liquidity Guidance (ILG) which is designed on a philosophy similar to Basel's LCR (Liebmann and Peek, 2015).

3.4.3. Basel Liquidity Regulations

3.4.3.1. Description of the Liquidity Coverage Ratio (LCR)

a) Definition of the LCR

The pursuing description of the Liquidity Coverage Ratio is extracted from *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, document (**bcbs238**) issued by the Basel Committee on Banking Supervision in January 2013. The LCR is built on the conventional concept of 'liquidity coverage' techniques that are internally employed by banks to evaluate their exposure to contingent liquidity scenarios. It is made up of two components: pool of unencumbered high quality liquid assets (HQLA) and total net cash outflows. It is expressed as a ratio of high quality liquid assets to total net cash outflows over a 30-day period as shown in formula (3.1).

$$LCR = \frac{\text{Amount of High Quality Liquid Assets}}{\text{Total net cash outflows over 30 day period}} \geq 100 \quad (3.1)$$

In the absence of a crisis, the ratio is expected to be at least 100% on an ongoing basis. However, in the event of a crisis the ratio may be allowed to fall below 100% because the bank would have drawn down its high quality liquid assets. Furthermore, preserving the LCR at 100% in periods of crisis can create adverse effects on the bank and other market players. Nevertheless,

the use of the high quality liquid assets buffer in episodes of stress requires supervisory approval. Since the calculation of the LCR is a bit lengthy, detailed components of the metric are presented in Appendix 2.

Description of the numerator: High Quality Liquid Assets

Definition of High Quality Liquid Assets

High quality liquid assets are financial securities that are presumed to be very safe and easily liquidated in the markets to meet a bank's obligations. There are two categories of high quality liquid assets: Level 1 and Level 2 assets. Level 1 comprises cash, central bank reserves and sovereign debt that can qualify for a 0% risk weight under the Basel II standardized approach for credit assets. These assets should make up at least 60% of the total high quality liquid assets and there are no limits to the amount of Level 1 assets that a bank may hold. Level 2 assets are comprised of two categories: Level 2A and Level 2B. Level 2A assets are restricted to the following: claims on securities issued or guaranteed by sovereigns, central banks, public sector enterprises and multilateral development banks, corporate debt securities and covered bonds that meet certain requirements spelt out by the Basel Committee. A 15% haircut is applied to all assets considered under level 2A. Level 2B assets are additional assets that may be considered under level 2 assets at the discretion of national regulators. These assets include residential mortgage backed securities (subject to a 25% haircut), corporate debt securities (subject to a 50% haircut) and ordinary shares (subject to a 50% haircut). The total value of Level 2 assets is restricted to a maximum of 40% of the total high quality liquid securities stock.

The value of high quality liquid assets is determined by the following formula:

$$\text{Stock of HQLA} = \text{Level 1} + \text{Level 2A} + \text{Level 2B} - \text{Adjustment for 15\% cap} - \text{adjustment for 40\% cap} \quad (3.2)$$

where:

$$\text{Adjustment for 15\% cap} = \text{Max} (\text{Adjusted Level 2B} - 15/85 * (\text{Adjusted Level 1} + \text{Adjusted Level 2A}), \text{Adjusted 2B} - 15/60 * \text{Adjusted Level 1}, 0) \quad (3.3)$$

$$\text{Adjustment for 40\% cap} = \text{Max} ((\text{Adjusted Level 2A} + \text{Adjusted Level 2B} - \text{Adjustment for 15\% cap}) - \frac{2}{3} * \text{Adjusted Level 1 assets}, 0) \quad (3.4)$$

Characteristics of High Quality Liquid Assets

The Basel Committee stipulates that for an asset to be considered liquid and of high quality it must have the following properties:

a) Fundamental features

❖ *Low risk*

For an asset to qualify as high quality liquid asset it must be of very low risk because low risk assets are generally liquid (Alger and Alger, 1999). Liquidity is determined by the creditworthiness of the issuer and the degree of subordination for the asset. The higher the credit worthiness of a borrower, the lower the risk profile of the assets and the more liquid the assets tend to be.

❖ *Ease and certainty of valuation*

A high quality liquid asset should be easy to value and market participants should generally agree on its valuation. Thus, the formula used to calculate the value of a high quality liquid asset must be easy and should not rely on strong assumptions.

❖ *Low correlation with risky assets*

Assets that are considered to be of high quality must be lowly correlated with risky assets. The lower the correlation between the high quality liquid asset and the risky assets the more liquid the high quality liquid asset is considered to be.

❖ *Traded on a developed and recognized market*

For an asset to qualify as a high quality liquid asset it must be listed on a developed and recognized market. In general listing increases an asset's transparency, which enhances its liquidity.

b) Market related features

❖ *Active and sizable market*

A high quality liquid asset should trade on an active and significantly large market because market breadth and depth are key drivers of an asset's liquidity.

❖ *Low volatility*

Assets whose prices are fairly stable and less susceptible to sharp price decreases over time carry a low probability of triggering forced sales in a crisis. Therefore, a high grade security should prove to be relatively stable during stressed market conditions.

❖ *Flight to quality*

Liquid securities should provide investors a safe haven in periods of severe market disturbances. In other words, investors should have confidence in the security to the extent that when crisis hits they should hold such securities for safety reasons.

Description of the denominator: Total net cash outflows

The value of total net cash outflows is given as the sum of anticipated cash outflows less anticipated cash inflows in a stressed market environment for a period 30 days. Mathematically, it can be expressed as follows:

$$\text{Total net cash outflows} = \text{Total expected cash outflows} - \text{Min} \{ \text{Total expected cash inflows}; 75\% \text{ of total expected cash outflows} \} \quad (3.5)$$

where:

Total expected cash outflows are determined by multiplying the remaining balances of different categories or types of liabilities and off balance sheet items by the appropriate run off rate¹².

Total expected cash inflows are determined by multiplying the remaining balance of different categories of contractual receivables by the rates at which they are anticipated to flow in under the scenario up to an aggregate limit of 75% of total anticipated cash inflows.

¹² See Appendix 2 for the detailed run off -rates (weights).

b) Objectives of the LCR

The LCR is one of the key reforms taken by the Basel Committee to advance a more buoyant financial sector. The rule is aimed at addressing short term liquidity risk in banks by requiring banks to maintain a buffer of unencumbered high grade assets to meet net liquidity outflows under a stress scenario lasting 30 calendar days (Basel Committee on Banking Supervision, 2013). The 30-day calendar period is assumed to provide regulators and the bank's management ample time to resolve the bank's problems in the most prudential manner. The standard ensures that, during periods of idiosyncratic or market wide liquidity stress banks should be able to draw down the pool of high grade securities to meet maturing obligations. The rule is believed to strengthen banks' ability to withstand shocks emanating from either financial or economic crisis, thus reducing the procyclicality effects of banking sector crisis to the real economy.

c) Liquidity Coverage Ratio Implementation

After considering potential impact of the Liquidity Coverage Ratio standard on financial markets, banks' lending activities and economic growth, the Basel Committee decided to go for a phased approach in the implementation of the metric. The implementation phases of the Liquidity Coverage Ratio are shown in Table 3.3 below.

Table 3.3: Phase in implementation of the LCR

Period	1 Jan 2015	1 Jan 2016	1 Jan 2017	1 Jan 2018	1 Jan 2019
Min LCR	60%	70%	80%	90%	100%

Source: Basel Committee on Banking Supervision (2013:8)

Banks started to report the LCR as from 1 January 2015. The minimum ratio that banks were expected to satisfy is 60%, which would rise successively by 10% annually to reach the 100% threshold on 1 January 2019.

d) Application issues of the LCR

- *Frequency of calculation and reporting*

The LCR is to be reported on a monthly basis, but the frequency can be increased to weekly or even daily depending on circumstances. The reporting of the LCR should be on an ongoing basis and a bank is required to inform regulators once their ratio falls or is expected to fall below 100%.

- *Scope of application*

The LCR and monitoring tools are expected to be applied to all internationally active banks and foreign branches of such banks on a consolidated basis as well as other banks in other jurisdictions which may choose to adopt the rules. In order to foster consistency and competition neutrality, all jurisdictions that choose to implement Basel III liquidity requirements should apply them consistently.

3.4.3.2. Description of the Net Stable Funding Ratio (NSFR)

The following short description of the Net Stable Funding Ratio is extracted from Basel III: The Net Stable Funding Ratio, document **(d295)** issued by the Basel Committee on Banking Supervision in October 2014.

a) Definition

The NSFR measures the amount of stable funding (ASF) available to a bank relative the required amount of stable funding (RSF) over a 1-year horizon period. Its aim is to encourage banks to use relatively long term stable sources of funding. It addresses banks long term asset and liability mismatches emanating from their maturity transformation function. The ratio is expected to be not lower than 100% on an ongoing basis. The components of the NSFR are presented in Tables 3.4 and 3.5. The NSFR is given by the following formula:

$$NSFR = \frac{\text{Available Amount of Stable Funding (ASF)}}{\text{Required Amount of Stable Funding (RSF)}} \geq 100\% \quad (3.6)$$

b) Description of the numerator: Available amount of stable funding (ASF)

The available amount of stable funding is defined as equity and liabilities that are stable and can provide reliable funding to a bank over a 1-year period under stress conditions. The available amount of stable funding is calculated based on the various characteristics of the relative stability

of the bank's funding sources. It is computed by first assigning the carrying value¹³ of the bank's capital and liabilities to one of five categories set by the Basel Committee. The factors for available amount of stable funding are shown in Table 3.4.

Table 3.4: Available amount of stable funding factors

ASF factor	Components of ASF category
100%	- Total regulatory capital (excluding Tier 2 instruments with residual maturity of less than one year) - Other capital instruments and liabilities with effective residual maturity of one year or more
95%	- Stable non-maturity (demand) deposits and term deposits with residual maturity of less than one year provided by retail and small business customers
90%	- Less stable non-maturity deposits and term deposits with residual maturity of less than one year provided by retail and small business customers.
50%	- Funding with residual maturity of less than one year provided by non-financial corporate customers. - Operational deposits. - Funding with residual maturity of less than one year from sovereigns, public sector enterprises, and multilateral as well as national development banks. - Other funding with residual maturity between six months and less than one year not included in the above categories.
0%	- All other liabilities and equity not included in the above categories. - NSFR derivative liabilities net of NSFR derivative assets if NSFR derivative liabilities are greater than NSFR derivative assets. - "Trade date" payables arising from purchases of financial instruments, foreign currencies and commodities.

Source: BCBS (2014:10)

¹³ Carrying value is the amount at which a liability or capital instrument is recorded prior to the application of any regulatory deductions, filters or other adjustments (Basel Committee on Banking Supervision, 2014).

From Table 3.4 above, it can be noted that available amount of stable funding factors ranges from 0% to 100%. They are based on the relative stability of the liabilities. Very stable liabilities such as total regulatory capital and perpetual deposits have high factors of 100% and 95% respectively. Deposits from non-financial entities, public sector enterprises, multilateral as well as national development oriented banks have an available amount of stable funding factor of 50%. On the other hand, liabilities that are prone to runs in a crisis such as trade date payables attractive a steep factor of 0%.

c) Description of the denominator: Required amount of stable funding (RSF)

The value of required amount of stable funding is measured based on the broad features of the bank's assets and off-balance sheet commitments liquidity risk profile. It is calculated by first assigning a carrying value of the bank's assets to categories stated below. The value assigned to each category is then multiplied by its corresponding amount of stable funding factor, and the sum of amount of stable funding is given by the total value of weighted amounts added to the value of off-balance sheet commitments multiplied by the corresponding amount of stable funding factor shown in Table 3.5 below. The required amount of stable funding factors is based on the horizon period and liquidity of an asset. The more liquid and longer time to maturity an asset is the lower its required amount of stable funding factor. The rationale for such factors is to encourage banks to hold assets with low required amount of stable funding factors, of which by their nature such assets tend to be very liquid and carry little or no liquidity risk at all. Very liquid assets such as cash on hand and central bank reserves carry a required amount of stable funding factor of 0%. Level 2A assets carry a factor of 15% while level 2B assets carry a factor of 50%. Derivative assets due to their relative riskiness carry a factor of 100%.

Table 3.5: Summary of asset category and corresponding RSF factor

RSF factor	Components of RSF category
0%	- Coins and banknotes. - All central bank reserves. - All claims on central banks with residual maturity of less than six months. - "Trade date" receivables arising from sales of financial instruments, foreign currencies and commodities.
5%	- Unencumbered Level 1 assets.
10%	- Unencumbered loans to financial institutions with residual maturities of less than six months, where the loan is secured against Level 1 assets defined in LCR paragraph 50.

15%	- All other unencumbered loans to financial institutions with residual maturities of less than six months not included in the above categories. - Unencumbered Level 2A assets.
50%	- Unencumbered Level 2B assets. - Unencumbered high quality liquid assets with a maturity period of at least six months but less than one year. - Deposits held at other financial institutions for operational purposes. - All other assets not included in the above categories with residual maturity of less than one year.
65%	- Unencumbered residential mortgages with a residual maturity of at least one year. - Other unencumbered loans not included in the above categories.
85%	- Cash, securities or other assets posted as initial margin for derivative contracts and cash or other assets provided to contribute to the default fund of a central counterparty. - Other unencumbered performing loans with risk weights greater than 35% under the standardized approach and residual maturities of at least one year. - Unencumbered securities that are not in default and do not qualify as high quality liquid assets with a remaining maturity of one year or more and exchange traded equities. - Physical traded commodities like gold.
100%	- All assets that are encumbered for a period of one year or more. - NSFR derivative assets net of NSFR derivative liabilities if NSFR derivative assets are greater than NSFR derivative liabilities. - 20% of derivative liabilities as calculated according to paragraph 19 of the NSFR rule. - All other assets not included in the above categories such as non-performing loans, insurance assets and retained interest.

Source: Basel Committee on Banking Supervision (2014: 11)

d) Application issues of the NSFR

The NSFR rule is expected to become binding as from 1 January 2018. Banks are required to satisfy the metric on an ongoing basis and report it at least quarterly. The rule is applicable to all internationally active banks but other non-Basel member states can adopt the standard on condition that they apply it consistently. In line with Principle 6 outlined in the *Sound Principles of Liquidity Management*, a bank is supposed to monitor and control liquidity risk vulnerabilities and funding requirements at individual, foreign branches, subsidiaries and group level taking into cognizance legal, regulatory and operational restrictions to the amount of liquidity.

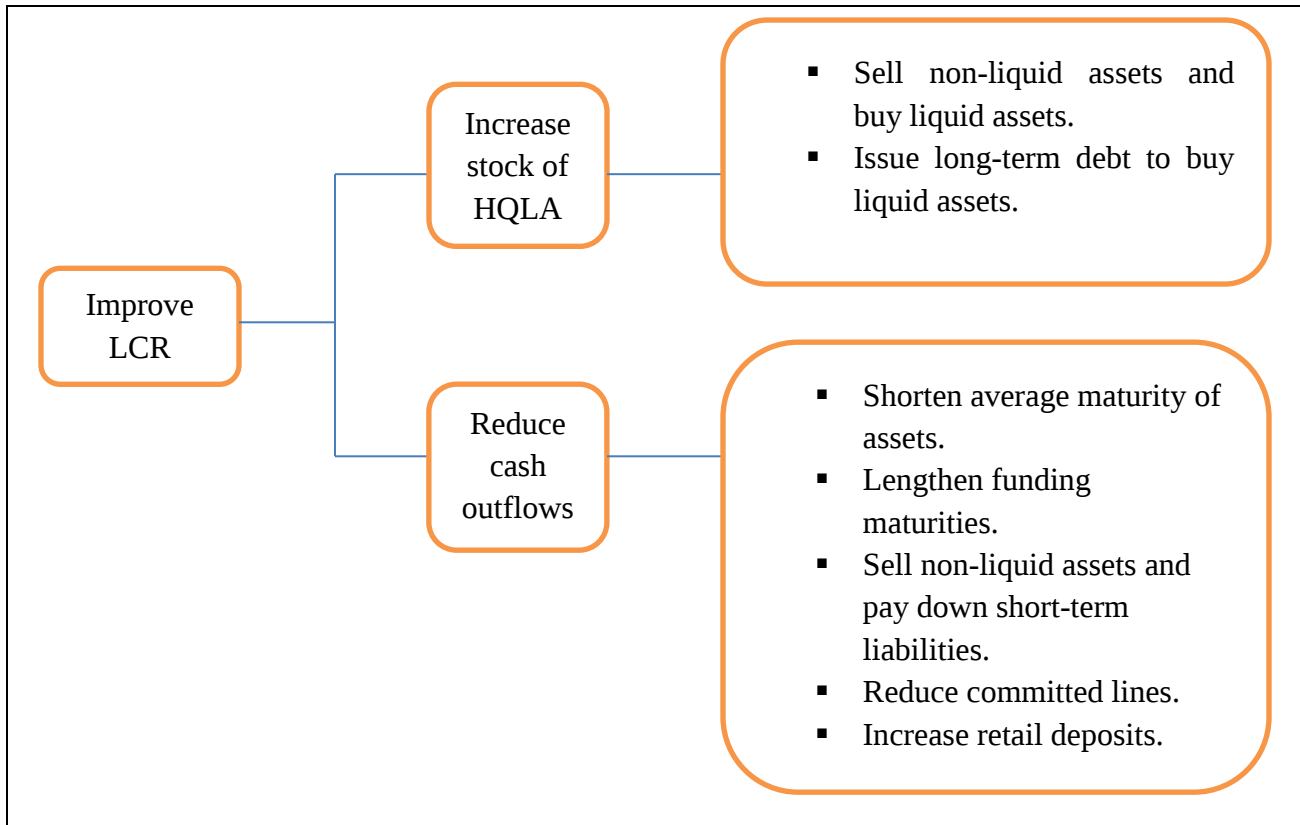
3.5. LIQUIDITY REGULATIONS AND BANK BEHAVIOR

3.5.1. Theoretical Framework

When regulators phase in new regulations, they expect to observe a certain change in banks' behavior. For instance, capital controls require banks to increase their capital ratios and reduce portfolio risk. Likewise, liquidity regulations require banks to elevate their liquidity ratios. Such a response is intended to foster banking and financial sector stability by minimizing liquidity risk. However, banks may not react to regulations as expected by regulators on two grounds. First, if the regulations are not deterrent enough to induce behavioral change in banks, that is to say, if the penalties/sanctions are not hard enough to provoke non-compliant banks to act (Calem and Rob, 1996; Berben, 2010). Second, in consideration of the fact that the goal of bank managers is to maximize value for the common stock holders, if regulatory costs far outweigh the benefits of complying with the regulations banks may be complacent to implement the regulatory reforms (Wall and Peterson, 1996).

Nevertheless, in the event that banks respond, and considering that the LCR is given as a ratio; banks can improve their liquidity ratios by altering either the numerator and/or the denominator of the metric. However, each strategy has its own merits and demerits as discussed herein. Furthermore, some strategies that are meant to improve one side of the balance sheet may have adverse effects on the other balance sheet side. For example, increased holdings of liquid assets may reduce loanable funds. Similarly, increased use of long term funding instruments like bonds can increase banks' funding costs which may diminish their profitability. Hence, a bank's adjustment strategy choice depends on the costs and benefits of each adjustment strategy they pursue. Pursuant to this discussion, Aronsen *et al.* (2014) highlight several adjustment options that banks can pursue in order to meet the LCR are shown in Figure 3.1.

Figure 3.1: Liquidity Coverage Ratio adjustment options



Source: Aronsen et al. (2014:16)

3.5.1.1. Asset side adjustment

Figure 3.1 above, indicates that banks can satisfy the LCR rule by either adjusting their assets and/or liabilities. Asset side adjustment relates to improving the LCR by increasing the pool of high quality liquid assets while liability adjustment entails satisfying the LCR by reducing expected outflows. Banks can increase their stock of high quality liquid assets by substituting non-eligible high quality liquid assets with eligible high quality liquid assets by selling non-eligible high quality liquid assets and buying more high quality liquid assets. This strategy does not result in new liabilities; hence, net cash outflows (LCR denominator) remain unchanged. Banks can also increase holdings of assets that carry low haircuts or by floating long dated securities to buy liquid assets. Nevertheless, this strategy would require banks to look for significant amounts of new funding to compensate funds tied in liquid assets. Moreover, other jurisdictions, especially in emerging markets may have inadequate stock of high quality liquid

assets to fulfill LCR requirements (Blundell-Wignall and Atkinson, 2010a). Besides limited stock of high grade securities, most emerging market economies have a limited pool of high quality liquid assets beyond government securities (Basel Consultative Group, 2014). This implies that the ability of banks in emerging market economies to diversify their asset portfolios might be constrained. Even if banks manage limited access to a wide pool of high quality liquid assets by holding more Level 2 assets such as corporate bonds, the banks may become more exposed to market risk given the high volatility of emerging markets equity markets and credit risk as some corporations may default on their debt obligations.

3.5.1.2. Liability side adjustment

On the liability side, banks can perform liability adjustment (reduce expected outflows) by decreasing their commitments, deleveraging, mismatch reduction or sourcing more stable retail deposits. Nevertheless, each strategy has its own merits and demerits as discussed herein. The first strategy that banks can adopt to improve their LCR is to reduce credit lines or lending. Although reducing credit lines or credit supply improves a bank's LCR by reducing expected outflows (denominator), its disadvantage is that it may hamper economic activity. This is the main concern of regulators, bankers and investors worldwide that Basel III liquidity requirements may adversely affect bank lending resulting in reduced economic activity (Blundell-Wignall and Atkinson, 2010b).

Second, through deleveraging banks would switch debt for perpetual equity. This strategy may work because equity is perpetual and carries a residual claim on the firm; therefore, equity will never be part of "net outflows" in the LCR calculation (Hartlage, 2012). Furthermore, capital can ameliorate liquidity risk by reinforcing the solvency of a bank thereby engendering banking sector stability (Elliot, 2014). On the other hand, moral hazard problems associated with deposit insurance and other government bailouts suggests that banks are reluctant to voluntarily hold capital buffers (McCoy, 2006); hence, banks may be reluctant to adopt this strategy. Besides, equity financing dilutes existing shareholders stake and may lower a firm's return on equity (Asquith and Mullins, 1986); hence, existing shareholders may resist new equity issuance. Thus, banks managers may find this strategy a bit difficult to implement.

Another way that banks may fulfill LCR requirements is to limit asset and liability mismatches by funding long term loans with long term debt instruments like covered or uncovered bonds. The advantage of this technique is that long term debt appears seldom in the LCR 30-day window, thus a bank's net cash outflows would be reduced which enhances the LCR. This strategy would also foster banking sector stability by reducing liquidity risk. Nonetheless, banks might fail to adopt this strategy because counterparties may refuse early retirement of their investments. In addition to this, liabilities switch also depends on banks' ability to issue long term debt securities. Hartlage (2012) adds that this approach depends on the depth and breadth of individual countries capital markets. Banks operating in shallow and illiquid markets may find it difficult to issue long term debt instruments. In addition, Gassmann *et al.* (2011) points out two trends that could adversely affect banks' ability to issue uncovered bonds. First, Solvency II regulations require insurance firms to allocate more capital for bank bonds. This makes bank bonds less attractive to insurance firms who are traditionally the major buyers of bank bonds. Second, uncertainty in financial markets is motivating asset managers to limit their exposure to banks debt.

Regulatory arbitrage entails substituting funding instruments with high runoff rates under the LCR specification like wholesale funding with low run off funding instruments like retail deposits (Hartlage, 2012). This approach reduces applicable runoff rates in the LCR calibration, thereby lowering net cash outflows and improving the LCR. The advantage of increased retail deposit funding is that retail deposits, especially in emerging markets attract low interest rates (Demirguc-Kunt and Huizinga, 1999); hence, banks may boost their profitability through reduced overall cost of funding. In addition, a large clientele base allows banks to sell other products to a large pool of customers and also increase non-interest income through transaction charges and other fees which may increase their profitability (Gassmann *et al.*, 2011). The main disadvantage of retail deposits is that they are susceptible to runs which may jeopardize banking sector stability (Diamond and Dybvig, 1983). Furthermore, heightened competition for retail deposits among banking firms may also compromise banking sector stability if competition is unregulated (Hartlage, 2012). Moreover, since banks in emerging market economies are significantly funded by deposits, this funding practice may result in high premium on applying run off rates on deposits and reduce the high quality liquid assets requirement (Basel Consultative Group, 2014).

Based on the possible balance sheet adjustment strategies discussed herein, the subsequent sub-section reviews empirical papers that investigated the behavioral response of banks to tightening liquidity requirements. It is also important at this juncture to note that, since harmonized and binding liquidity regulations only came into effect in 2010, there is still limited empirical work to date on the influence of liquidity regulations on banks liquidity management. Moreover, in context of emerging markets empirical work on the interplay between liquidity regulations and banks' liquidity management behavior is also very scanty if not non-existent. Consequently, this study attempts to make contributions to the discourse by exploring the behavioral response of banks in emerging markets to binding liquidity standards.

3.5.2. Empirical literature on the impact of liquidity regulations on banks' balance sheets and profitability

Berben *et al.* (2010) evaluated macro effects of stringent liquidity requirements on banks by using simulation regression analysis. The examination shows that on the asset side of the balance sheet, banks are likely to engage in asset substitution, by offloading non-qualifying high quality liquid assets with eligible liquid assets in order to boost their liquidity buffers. This behavior can result in a scramble for high quality government and other liquid assets which could subsequently lead to reduced credit supply (Blundell-Wignall and Atkinson, 2010b). On the liability side of the balance sheet, Berben *et al.* (2010) found that banks are likely to limit maturity mismatch by sourcing more stable funds, like retail deposits and long term bonds. This development can cause banks' funding costs to increase and depending on banks' pricing power, the increase in funding costs can be passed to consumers resulting in higher lending rates.

Making use of regulatory data, Schertler (2010), examined how banks manage their liquidity when confronted with higher payment obligations specified in the Germany liquidity standards. To achieve this objective, Schertler make use of quarterly regulatory data from 2000 to 2008 collected from three types of banks in Germany, namely commercial banks, savings banks and cooperative banks. The study employs dynamic panel data methods that recognize the simultaneity between liquid assets holdings and payment obligations. The model was estimated with the Blundell and Bond (1998) Generalised Method of Moments estimator. Given that a median liquidity ratio of about 2 was established, which demonstrates that there is asymmetric adjustment by banks to higher payment obligations, Schertler takes into account this asymmetry

by distinguishing banks close to and above regulatory liquidity requirements in the analysis. Findings of the study convey that the three kinds of banks employ different strategies in managing their liquidity when subjected to regulatory pressure. Commercial banks were found to depend more intensively on debt markets to manage their liquidity, whereas cooperative and savings banks rely on cash flow matching. Besides matching their cash flows, cooperative and savings banks close to the regulatory threshold were also observed to engage in asset substitution, that is reducing illiquid assets, such as loans, and increasing holdings of liquid assets. Likewise, all the three kinds of banks, save for large commercial banks, also employ asset substitution when they are faced with higher liquidity requirements.

Using the Dutch Liquidity Coverage Ratio (DLCR) as a proxy for the LCR, Bonner and Eijffinger (2012) evaluated the impact of binding liquidity standards on the behavior of banks in the interbank market. Data for the study was obtained from Dutch National Bank monthly liquidity reports, interbank market transactions data and individual banks' balance sheets. To analyze the response of banks interbank borrowing and lending rates, a panel regression specification was developed and estimated using the fixed effects estimator. The paper conveys that phasing in of liquidity rules induces banks to both pay and demand a higher rate in the interbank market. These effects were found to be more significant for assets with a tenor exceeding the LCR's 30-day horizon and became more pronounced following the collapse of Lehman Brothers in 2008. Moreover, the study established that in the course of the financial crisis banks just below or above their prudential liquidity ratio decreased lending.

Bonner (2012) assessed whether banks close to or just above the Dutch Liquidity Coverage Ratio (DLCR), which is structurally similar to Basel III LCR, asks for higher interest rates than its peers. To carry out the investigation, Bonner compiled regulatory liquidity data reports, lending and interest rates data from Dutch banks. The fixed effect estimator was used for analysis because the panel dataset exhibited heterogeneity and the author was mainly interested in analyzing time and not cross sectional variation in banks' behavioral adjustment. Model estimates revealed that banks close to or just above the regulatory minimum liquidity requirement do not charge higher interest rates on their loans. Plausible explanation for these findings is the fact that banks are not able to pass on the increased cost of funding to the private sector due to limited pricing power.

De Haan and Van den End (2013b) investigated liquidity management practices of Dutch banks subject to the Dutch Liquidity Balance rule, which structurally resembles Basel's LCR. The sample of the study comprised of 62 banks, which hold nearly 99% of total banking system assets, and the period of the study covered the period 2004 to 2010. Monthly data on banks' balance sheets for the research was sourced from Dutch National Bank prudential liquidity reports. For investigation, the researchers developed three panel regression models which they estimated with a fixed effects model. Research findings revealed that banks maintain liquidity buffers in the form of bonds as a cushion against demand withdrawals and other maturing obligations. This relationship was established to be stronger for Dutch banks compared to foreign banks. It was also found that when deciding how much liquid assets to hold, banks consider their expected future cash inflows, mostly those coming within a period of 1 year. Furthermore, study results indicate that when banks expect to receive cash inflows in the coming month, they prefer to hold less liquid assets, however on average, banks do not significantly reduce their liquid asset holdings when they expect an inflow in the coming month, demonstrating prudent liquidity management. Moreover, banks tend to stock more liquid assets when their projected future cash outflows are very high.

Turning to interaction of bank behavior and liquidity requirements, De Haan and Van den End (2013b) found that banks, generally, prefer to stock more liquid assets against expected liquidity outflows compared to what is strictly demanded by the liquidity balance rule. Such behavior was found to be prevalent in smaller banks and foreign subsidiaries. Furthermore, the study established that foreign banks have a tendency of stocking lower levels of liquidity because they dependent on the parent bank for liquidity support. Safer banks with high capital adequacy ratios and low default probability were also found to hold lower amounts of liquid assets because they have easy access and can obtain cheap funding from debt markets.

Hamm (2013) carried out a survey to establish how Germany banks intend to comply with the liquidity coverage ratio regulation. The survey indicated that most banks in Germany proposed to increase their liquidity buffers by holding more cash, central bank deposits and sovereign bonds. In addition, Germany banks also highlighted that they are also planning to switch non-eligible high quality liquid assets, in particular bonds with a rating lower than AA rating and high risk weight assets.

Covas and Driscoll (2014) developed a non-linear dynamic model to assess macroeconomic effects of introducing liquidity regulations on banks' lending activities. The study established that the imposition of minimum liquidity requirements would decrease loan volumes by 3%, aggregate output by approximately 0.3% and consumption by 0.1%, in the long run. On the other hand, empirical results demonstrated that banks would increase their securities holdings by at least 6% and decrease their interest rates by a few basis points.

Bonner *et al.* (2015) sought to establish factors that drive banks liquid assets holdings and further assessed the extent to which liquidity regulations influence banks liquidity management decisions. The study employed bank specific data from 30 Organization for Economic Cooperation and Development (OECD) countries sourced from Bankscope covering the period 1998 to 2007. Country specific regulatory data was extracted from World Bank's Bank Regulation and Supervision database and other control variables data which captures macroeconomic fundamentals and characteristics of the domestic financial sector was taken from World Bank (World Development Indicators) and International Financial Statistics respectively. Findings of the study showed that in the absence of liquidity regulations, banks liquidity holdings are influenced by bank specific factors, such as business model, profitability, deposit base and firm size, as well as country specific factors, like disclosure requirements and level of banking sector concentration. In addition, the study established that banks tend to hold low levels of liquidity with the belief that they will be bailed out by the government in the event that liquidity risk materializes. However, when a liquidity regulation comes into play, most of the factors that influence bank liquidity turn out to be insignificant, proving that regulation substitute banks' motivation to stock liquid assets. Moreover, the study established a non-linear relationship between bank size and liquid asset holdings, whereby large banks were found to hold more liquidity relative to small banks, contrary to the hypothesis that large banks hold low levels of liquidity.

The European Banking Authority Report (2015) made a comprehensive assessment of the implications of the new regulatory requirements on European banks' business models. The report indicated that liquidity regulations are anticipated to compel banks seek more retail deposits, reduce their reliance on wholesale funding and increasing their holding of high quality liquid assets at the expense of non-eligible high quality liquid assets. The report further pointed out that

the regulations are likely to raise banks' cost of funding and reduce their profitability as well as alter their funding mix. On the latter point (changes in banks' funding mix), the report predicted that banks will potentially move towards equity capital, long term bonds and more retail deposits. The report also documented that banks will possibly increase asset securitization to create cash inflows and also move illiquid assets from their balance sheets.

DeYoung and Jang (2016) examined how United States of America banks might respond to the yet to be phased in Net Stable Funding Ratio by analyzing how US banks have managed their core loan to deposit ratio, which structurally resembles the Net Stable Funding Ratio. In particular, DeYoung and Jang examined whether banks have target liquidity ratios they pursue and how the Net Stable Funding Ratio rule is likely to alter banks liquidity management strategies. Towards this end, DeYoung and Jang developed a partial adjustment model similar to Berger *et al* (2008) and estimated it with the Blundell and Bond (1998) Generalized Method of Moments estimator. An unbalanced panel comprising of 115 782 observations from 11 414 banks covering the period 1992 to 2012 was used for the study. Partial adjustment model regression results indicated that banks in the United States of America actively managed their liquidity and their liquidity management strategies were found to be in line with the forthcoming Net Stable Funding Ratio regulation. Based on these results, DeYoung and Jang concluded that phasing in of the Net Stable Funding Ratio will have significant effects on banks' liquidity management practices.

Duijm and Wierts (2016) investigated the impact of the liquidity coverage ratio on banks' asset and liabilities structures. Data for the research was sourced from Dutch liquidity regulatory reports for the period July 2003 to April 2013. Banks liquidity dynamics subject to liquidity constraints was analyzed with a vector error correction specification. Model estimate results revealed that when banks move away from their target liquidity level, they adjust their liabilities to revert to their optimal level contrary to Hamm (2013) finding that banks adjust their assets. Moreover, the study found that in response to a shock in their target liquidity levels, banks on average correct 22% of this disequilibrium within a month's period, highlighting that banks modify their asset and liability structures to satisfy Basel III liquidity standards. Since required liquidity is estimated by weighting liabilities and cash flows, these results predict that banks

modify their funding mix to a greater extent and portfolio allocation to a lesser extent when their liquidity position shifts.

Banerjee and Mio (2017) explored how British banks responded to the Individual Liquidity Guidance Rule (ILG), which is designed in the same philosophy as the Liquidity Coverage Ratio, using Jorda (2005) local projection impulse response analysis. The study found that British banks subject to the ILG rule modified both their assets and liabilities items to satisfy the liquidity requirements. On the asset side, banks responded to the ILG by increasing the pool of high quality liquid assets to total assets by approximately 12%. The increase in high quality liquid assets was associated by an almost equal decrease in interbank loans. On the liability side, British banks sourced more funding from stable sources such as retail deposits and decreased their dependence on unstable wholesale funds and non-resident deposits. On the impact of the ILG on bank lending channel, consistent with Bonner (2012) Banerjee and Mio did not find evidence to support the claim that banks increased their lending rates to the private sector. In addition, although banks significantly increased their funding from retail deposits, surprisingly, results of this study indicated that banks in the United Kingdom did not increase their deposit rates. Since Banerjee and Mio found that the ILG had a considerable impact on banks' balance sheet structures and limited impact on interest rates, they concluded that stricter liquidity requirements affect banks profitability through the substitution effect, that is, switch towards low yield high quality liquid assets and relatively expensive retail deposits.

3.6. CHAPTER SUMMARY

In this chapter, two principal theories that attempt to explain bank regulation, namely the public interest theory and economic theory of regulation were discussed. Banks like other private firms are regulated to protect depositors' funds, foster systemic stability, promote fairness and efficiency in financial markets, maintain monetary and financial stability, address moral hazard problems and to promote their safety and soundness. The study went on to discuss the main forms of bank regulation. Literature pointed out that there are two forms of bank regulation: micro and macroprudential. The former is concerned with regulating firm specific risks while the latter attends to system wide risks. Nowadays, regulators are more focused on macroprudential regulation which seeks to prevent the built up of systemic risk in the banking and financial system at large. In this chapter, the study also traced the evolution of the Basel Accords. Extant

literature revealed that the Basel Accords grew out of the need to create a competitive playing field among internationally active banks and to minimize bank failures in member states by harmonizing banks' capital requirements. Despite their novelty, the Basel capital standards proved to be inadequate in preventing bank crisis, no wonder why the Basel Accords have been revised several times and continue to be revised to date. The evolution of liquidity regulations and key obstacles in the harmonization of liquidity regulations was explored in this chapter. Inadequate supervisory momentum, the belief that capital requirements address liquidity risk and differences in the ways central banks conduct their monetary policy were identified as the key obstacles which delayed the establishment of global liquidity regulations for banks. Lastly, the chapter examined theoretical as well as empirical literature on possible behavioral response of banks to harmonized liquidity charges. The study identified that banks can improve their liquidity ratios by either increasing the stock of liquid assets and/or reducing expected cash outflows. However, to date, there are no studies that have explored the interaction between liquidity regulations and liquidity management behavior of banks in emerging markets. This study attempts to fill this knowledge gap by examining the impact and behavioral response of banks in emerging market economies to Basel III LCR regulation. Moreover, this study utilizes a dynamic panel modeling to examine the interplay between liquidity regulations and bank behavior which is absent in extant literature. The ensuing chapter describes methods of the study.

CHAPTER IV

RESEARCH METHODOLOGY

4.0. INTRODUCTION

This chapter seeks to explain and justify methods employed in the study to answer the study objectives. For each objective, the empirical model is formulated followed by a description of the variables used. Then, for all the study objectives, the estimation technique, unit root test approach, sample and data sources as well as post estimation techniques to be applied are highlighted. Accordingly, this chapter covers five aspects: sample and data, study period, estimation technique, stationarity tests and post estimation diagnostic tests.

4.1. SAMPLE AND DATA

4.1.1. Sample selection and data screening

The starting point for sample selection is a population of commercial banks operating in twenty-three (23) emerging market economies listed in Table 4.1 below derived from Morgan Stanley Capital Index list of emerging market countries.

Table 4.1: MSCI Emerging Markets Index

MSCI EMERGING MARKETS INDEX		
AMERICAS	EUROPE, MIDDLE EAST & AFRICA	ASIA
Brazil Chile Colombia Mexico Peru	Czech Republic Egypt Greece Hungary Poland Qatar Russia South Africa Turkey United Arab Emirates	China India Indonesia Korea Malaysia Philippines Taiwan Thailand

Source: <https://www.msci.com/market-classification>

Next, the study only considers countries that have fully implemented the liquidity coverage ratio rule as of 31 December 2016. To do that, the study chooses countries that have largely or fully complied with the regulation based on Basel Committee's Assessment of Basel III LCR Regulations consistency under its Regulatory Consistency Assessment Programme. As of December 2016, eleven (11) countries presented in Table 4.2 below have been assessed and found to be compliant or largely compliant with the LCR specification. The sample population is thus made up of ninety one (91) banks operating in eleven (11) countries.

To ensure that the sample is comprised of 'pure' commercial banks, the study follows Berger and Bouwman (2009) and Bruno *et al.* (2016) screening procedure. The study removes banks with the following features from the sample that were perceived to reflect a non-commercial bank:

- ❖ Have zero deposits.
- ❖ Have no outstanding loans.
- ❖ Do not have commercial real estate or commercial and industrial loans outstanding.
- ❖ Have zero or negative equity capital.
- ❖ Resemble a building society (with home loans exceeding 50% of gross total loans).

In addition, the study removes banks in bankruptcy, liquidated or in liquidation, dissolved and banks that no longer have accounts on Orbis Bank focus database. This screening process results in a sample of forty (40) banks from eleven (11) countries which was employed in this study. The sample is unbalanced because some of the banks used in the study have missing values in some periods.

Table 4.2: List of countries assessed for Basel III LCR consistency as of 31 December 2016

Country	Overall assessment grade	Assessment period
Hong Kong	Compliant	March 2015
India	Largely Compliant	June 2015
Mexico	Compliant	March 2015
Saudi Arabia	Largely Compliant	September 2015
South Africa	Compliant	June 2015

Argentina	Compliant	September 2016
Indonesia	Compliant	December 2016
Korea	Compliant	September 2016
Russia	Compliant	March 2016
Singapore	Compliant	December 2016
Turkey	Compliant	March 2016

Source: <http://www.bis.org/bcbs/publications.htm?a=1&mp=any&pi=title&bv=list&page=1>

4.1.2. The data and data sources

Data of individual banks were obtained from Income Statements and Balance Sheets. The data were retrieved from Bankscope, a databank containing financial statements for banks (Matejasak and Teply, 2007); and is widely used by academic researchers to obtain banks data, for instance Jokipii and Milne (2011) and Ashraf *et al.* (2016). The main advantages of Bankscope database is that it is fairly comprehensive and it presents financial data in standardized formats, that is, after adjusting for differences in accounting and reporting standards across jurisdictions (Vazquez and Federico, 2015). However, the disadvantage of this database is that it does not provide a concise breakdown of some asset and liabilities elements; therefore, extrapolation and interpolation techniques may have to be applied to obtain missing values. Similar to previous researchers such as Oura *et al.* (2013) and others, macro financial data were sourced from World Bank database. Moreover, due to data availability constrains for banks in emerging markets and for the sake of minimizing missing values as far as possible, the study uses year-end data. Year-end data also seems reasonable in that bank portfolios are slow to change (Berger and Bouwman, 2009). Furthermore, to minimize gaps, missing data were obtained from individual banks financial statements from their websites. Likewise, consolidated financial statements were utilized in order to show the total liquidity position of individual banks. The study utilized consolidated data that were converted to a common currency, United States of America dollar (USD). For analysis, Stata econometric software version 13 was used.

4.2. STUDY PERIOD

The sampling window for this research covers the period January 2011 to December 2016. The choice of this period is based on event study concept. Basically, event studies analyze

the reaction of firms' share prices to corporate announcements (Kothari and Warner, 2004). As such, the study presumes that banks started to adjust their balance sheets soon after the announcement of Basel III liquidity requirements in December 2010, such that by January 2015 they would have complied with minimum LCR requirements. For this reason, the study period is limited to the period January 2011 to December 2016. Consequently, the study considers a “pure” Basel III period like Abreu and Gulamhussen (2013) who examined the influence of risk-based capital requirements on banks centering on a “pure” Basel I period. Furthermore, the sampling window is post the global financial crisis which eliminates the global financial crisis structural breaks.

4.3. ESTIMATION TECHNIQUE

Panel regression equations can be estimated using the pooled Ordinary Least Squares (OLS), Fixed Effect (FE) or Random Effect (RE) estimator. In order to apply the OLS, explanatory variables must not be correlated with both individual effects (v_{it}) and the idiosyncratic error term (ε_{it}) (Wooldridge, 2002). Nevertheless, as pointed out by Wooldridge (2015), most econometric models include unobserved fixed effects to address potential heterogeneity issues which may lead to endogeneity problems because explanatory variables tend to be correlated with fixed effects (v_{it}) that are concealed in the error term ($v_{it} + \varepsilon_{it}$). This study envisages that one or more of the explanatory variables in regression equations may be correlated with unobserved fixed effects (v_{it}). For instance, managerial skills may be influenced by bank size whereby large banks due to their financial muscle may be able to attract and retain more experienced and qualified managers relative to smaller banks. Thus, regressing empirical models with the OLS estimator may produce biased and inconsistent estimates since one or more regressors may be correlated with the error term due to the inclusion of fixed effects (Baltagi, 2008; Larcker and Rusticus, 2010). Another problem with OLS estimator is that the lagged dependent variable that is included as a regressor tends to be correlated with the error term (Baltagi, 2005). According to Baltagi (2008) this correlation arises from the fact that the dependent variable is influenced by the error term hence the lagged value of the dependent variable is also influenced by the unobserved error term. Furthermore, this correlation remains even if the sample size was increased and the error term was not serially correlated (Bond, 2002).

Therefore, to address potential endogeneity issues in OLS estimator the study considers an estimating technique that can eliminate the fixed effect element in the disturbance term.

Baltagi (2005) submits that one can eliminate fixed effects by carrying out mean deviation within transformation (demeaning) of all the variables in the model. After this demeaning (within transformation) process, a Fixed Effect (FE) estimator is obtained. However, mean deviation transformation though it wipes out fixed effects, it produces another source of potential endogeneity. Demeaning causes the transformed lagged dependent variable to be correlated with the idiosyncratic error term (Anderson and Hsiao, 1982; Baltagi, 2011). To be precise, the lagged dependent variable ($\Delta Y_{ic,t-1}$) is inversely related with the mean of the error term (ε_{it}), since (ε_{it-1}) is incorporated in the transformed error term. As a result, the Fixed Effect estimator produces downward bias estimates in dynamic panel models (Nickell, 1981). Besides mean deviation within transformation (demeaning), another method that can be used for transformation is Random Effect transformation. Instead of subtracting the whole unit specific mean, the Random Effect estimator subtracts only a portion of the mean. Still, similar to the Fixed Effect estimator, the Random Effect estimator produces inconsistent estimates because in order to use Generalized Least Squares, Random Effect estimator quasi transformation is conducted which results in endogeneity - that is correlation of the lagged dependent variable with the error term (Baltagi, 2008). To deal with the short comings of fixed effect and random effect estimators in dynamic panel models, Anderson and Hsiao (1982) suggest the use of instrumental variables. An instrument variable is a variable that is uncorrelated with the error term, but correlated with the exogenous variable that needs to be removed (Wooldridge, 2015). The instrument variable estimator is consistent as long as it meets these two conditions: uncorrelated with the error term, but correlated with the exogenous variable that needs to be removed. On the other hand, Ahn and Schmidt (1995) argue that although the instrument variable estimator may be consistent, it may not be necessarily efficient because it does not encapsulate all available moment conditions. In addition, Baltagi (2008) maintains that the instrument variable approach excludes the differenced structure on the residual error terms which compromise its efficiency.

Thus, Arellano and Bond (1991) proposed that additional instruments can be obtained in dynamic panel models by using orthogonality conditions that are present among the lagged dependent variable and error terms to achieve efficient estimators. Based on this concept of

additional instruments, Arellano and Bond proposed a Generalized Method of Moments (GMM) estimator. Arellano and Bond formulated a first difference GMM estimator for dynamic panel models by making use of existing lagged dependent variable levels as instruments for the first differenced lag. The estimator transforms the covariates through first differencing and then employs generalized method of moments to fit the model. However, Blundell and Bond (1998) and Hujer *et al.* (2005) argue that first difference GMM suffers from large finite sample bias and poor precision in the event that the endogenous variable is highly persistent. Thus, lagged values are considered to be weak instruments for first differenced variables (Blundell and Bond, 1998). Furthermore, Klomp and de Haan (2014) maintain that differencing removes long term cross country information that is in levels of the variables and if the dependent variables are persistent, their lagged values are poor instruments of their differences. In order to address weak instrument problems in first difference GMM, Ahn and Schmidt (1995) and Blundell and Bond (1998) suggest the use of additional instruments to the GMM specification to improve the efficiency of the estimator based on the assumption that first differenced instruments are not correlated with fixed effects.

Similarly, Arellano and Bover (1995) argue that additional moment conditions can be established if one assumes that the exogenous variables are uncorrelated with firm fixed effects. In this framework, lagged differences of the explanatory variables and dependent variables are regarded as valid instruments for the levels equation. This results in an estimator that is known as system GMM proposed by (Blundell and Bond, 1998). The estimator integrates the collection of moment conditions derived from first difference equation and the additional moment conditions available in levels. Blundell and Bond (1998) uphold that system GMM is preferable to difference GMM when the explanatory variables are persistent. Accordingly, this study employs system GMM estimator for analysis proposed by (Blundell and Bond, 1998). The strength of system GMM is that it accounts for persistence in dependent variables, weak instrument problem in difference GMM and endogeneity issues in static panel model estimators (OLS, FE and RE) highlighted above. Furthermore, Roodman (2006) points out that system GMM is the most appropriate estimator if these conditions hold:

- ❖ The data is collected over a small timeframe (small T) and contains many panels (large N).
- ❖ A linear functional relationship is considered.

- ❖ One dependent variable that is dynamic, that is its value depends on its past realizations.
- ❖ Endogenous explanatory variables.
- ❖ Presence of fixed effects.
- ❖ Heteroscedasticity and autocorrelation within individuals but not across.

Since the empirical data used in this study portray these features system GMM estimation technique is chosen over other estimators. Besides, system GMM is widely employed in academic researches. For example, Berger *et al.* (2008), Ayaydin and Karakaya (2014), Ashraf *et al.* (2016) and Giordana and Schumacher (2017) employed system GMM in their studies. The study employed the two-step system GMM estimator that is presumed to be more efficient than the one-step system GMM (Blundell and Bond, 1998).

4.4. STATIONARITY TEST

In order to avoid spurious regression, panel data used in regression analysis must be stationary (Gujarati and Porter 1999). Stationarity can be checked by conducting unit root tests. There are several unit root tests that can be employed to check for the presence of unit roots in panel data such as Levin and Lin (1992), Harris and Tzavalis (1999), Im, Pesaran and Shin (1999), Maddala and Wu (1999), Choi (1999) and Levin, Lin and Chu (2002). Similar to Ramirez (2007), Gomes and Franchini (2009) and Shen and Chen (2014) the present study uses the Maddala and Wu test to carry out unit root testing for two reasons. First, unlike other unit root tests, the Maddala and Wu test does not require a balanced panel (Baltagi, 2005). Since the study's dataset is unbalanced, the Maddala and Wu test is regarded as the most appropriate unit root test. Second, Maddala and Wu (1999) found that the Fisher test with bootstrap based critical values used in their test performs better than other unit root test approaches. Therefore, the Maddala and Wu test is regarded as the most preferred method for examining nonstationarity because it performs better than other unit root test approaches (Maddala and Wu, 1999; Wang, 2010). This motivated this study to adopt the Maddala and Wu test over other unit root tests.

4.4.1. Maddala and Wu unit root test

The Maddala and Wu test integrate p-values from independent Augmented Dickey-Fuller (ADF) unit root test to get a test of the joint hypothesis pertaining to all units of the panels. The

null hypothesis that all panels contain unit roots is tested against the alternative hypothesis that at least one panel is stationary and is tested using the following test statistic:

$$p = -2 \sum_{i=1}^N \ln P_i \sim \chi^2(2N) \quad (4.14)$$

P is taken to be distributed as χ^2 with $2N$ degrees of freedom as T approaches infinity. When P is close to zero the null hypothesis is rejected in favor of the alternative. Rejection of the null hypothesis implies that the data is stationary.

4.5. POSTESTIMATION DIAGNOSTIC TESTS

For an instrumental variable to be considered valid it must meet two conditions: it must be correlated with the endogenous explanatory variable(s) and uncorrelated with the error term (Baum *et al.*, 2003; Larcker and Rusticus, 2010). The study checks for the existence of the first condition by testing for the presence of autocorrelation in first differenced residuals using the Arrelano and Bond (1991) autocorrelation test. The latter condition is assessed by performing the standard diagnostic test of over identified restrictions using the Sargan (1958) test.

4.5.1. Autocorrelation test

For instruments to be considered valid, the first order serial correlation of the differenced residuals should be negative and the second order test should be significant (Arellano and Bond 1991). In other words, the instruments must be exogenous. The study verifies existence of this condition by testing for the presence of autocorrelation in first differenced residuals using the Arrelano and Bond (1991) AR (2) test for second order serial correlation test. If a p-value that is greater than 5% (0.05) is obtained, the test results would indicate absence of second order autocorrelation (Baum, 2006); therefore, system GMM can be used without altering the set of instruments.

4.5.2. Test for over identifying restrictions

The Sargan test is performed to check for over identification of instruments, by examining whether instruments variables used are not correlated with the residuals. The null hypothesis is that instruments are valid, that is, not correlated with residuals. To accept or reject this null hypothesis one compares the value of the test statistic nR_μ^2 (r squared of residuals

regressed on all exogenous variables) against the critical value $\chi^2(r)$ (chi square statistic obtained from the chi square distribution table, with r over identifying restrictions). If the test statistic nR_μ^2 value is less than the critical value $\chi^2(r)$ statistic, the null hypothesis cannot be rejected implying that instruments used are valid (Baum *et al.*, 2003; Wooldridge, 2010).

4.6. METHODS OF STUDY

4.6.1. Objective 1

The first objective of the study seeks to examine liquidity management practices pursued by banks operating in emerging market economies. Liquidity management at banking institutions can be examined in the context of the trade-off theory which is mainly used in corporate finance studies. The theory states that firms target an optimal amount of liquid securities for precautionary reasons that balance the benefits and costs of maintaining liquid assets (Kim, 1998). The benefits of holding liquid assets are two-fold: transaction and speculative purposes. The transactions motive suggests that firms maintain liquidity buffers to avoid transaction costs that are related to sourcing external funding and the need to liquidate assets to pay off debts (Bruinshoofd and Kool, 2004). The speculative motive submits that firms keep liquid assets to exploit new investment opportunities that may arise since external funding may not be available as and when need or costly (Owolabi and Obida, 2012). All in all, the benefit of liquid assets holdings is reduction in the need to source costly external funding. On the other hand, the costs associated with liquidity buffers is interest income that is forgone as a result of investing in low yield earning liquid assets (Bordeleau and Graham, 2010).

This optimization problem arises from capital market imperfections. In a perfect capital market, firms have no incentives to maintain liquidity buffers. They can raise funding from capital markets when the need arises since there are no transaction costs and funds can be obtained at fair prices as the markets are fully informed about individual firms' prospects (Servaes and Tufano, 2006). This means that the transaction and precautionary motives of liquid assets holdings is less compelling in a perfect capital market. However, relaxation of the perfect capital market assumption suggests that frictions in capital markets create strong incentives for firms to maintain liquidity buffers (Karpuz *et al.*, 2016). This is because transaction costs related to equity issuance can be very substantial (Gilson, 1997). Besides high costs, raising funding in capital markets is also time consuming (Phelan, 2016). Therefore, firms may not be able to

quickly obtain funding from capital markets as and when needed. Moreover, in practice, insiders (managers) tend to hold more information than outside investors. This leads to asymmetric information problems between managers and investors which may result in financing constraints for firms because investors may refuse to provide funding at all or provide it at high cost (Myers and Majluf, 1984). Thus, in an imperfect capital market, firms maintain liquid assets to avoid sourcing funding from external markets when they either face unexpected contingencies or desire to fund new projects.

To achieve the first objective, the study first assumed that banks have an unobservable internal target liquidity ratio which they consider to be the optimal level of liquidity which balances the benefits and costs of maintaining liquid assets (Kim, 1998). The study further assumes that the internal target liquidity ratio is driven by a set of observable characteristics. Thus, each bank's desired liquidity ratio (LIQ_{ict}^*) is modeled as a function of the bank's observable characteristics as follows:

$$LIQ_{ict}^* = \beta X_{ict} + \eta_t + v_{it} + \varepsilon_{it} \quad (4.1)$$

where;

LIQ_{ict}^* : target liquidity ratio for i at time t in country c , which is perceived to vary across banks and over time.

β : vector of coefficients to be determined.

X_{ict-1} : vector of bank specific characteristics as well as macroeconomic fundamentals that influence the liquidity ratio setting.

η_t : time effects.

v_{it} : bank fixed effects.

ε_{it} : idiosyncratic error term.

In the process of pursuing the target liquidity ratio, banks face market frictions and adjustment costs which make it costly, if not impossible for banks to instantaneously adjust their balance sheets, when confronted with liquidity shocks that move them away from their target ratio (Kochubey and Kowalczyk, 2014; DeYoung and Jang, 2016). Market frictions refer to costs such as asymmetric information, transaction costs and agency costs that preclude investors to hold optimal portfolios (DeGennaro and Robotti, 2007). This adjustment process is captured by

assuming that banks adjust a constant proportion (λ) of the gap between the actual liquidity ratio (LIQ_{ict}) and target liquidity ratio (LIQ_{ict}^*) in each period:

$$LIQ_{ict} - LIQ_{ic,t-1} = \lambda(LIQ_{ict}^* - LIQ_{ic,t-1}) + \eta_t + v_{it} + \varepsilon_{it} \quad (4.2)$$

The speed of adjustment (λ) in each period will be high if adjustment costs are low and vice versa (Pereira and Saito, 2011). Integrating equation (4.1) into (4.2) and the following equation is obtained:

$$LIQ_{ict} - LIQ_{ic,t-1} = \lambda(\beta X_{ic,t-1} - LIQ_{ic,t-1}) + \eta_t + v_{it} + \varepsilon_{it} \quad (4.3)$$

Given that it is difficult to estimate λ and β from this non-linear equation, Equation (4.3) is rearranged to yield:

$$LIQ_{ict} = (1 - \lambda)LIQ_{ic,t-1} + \lambda\beta X_{ic,t-1} + \eta_t + v_{it} + \varepsilon_{it} \quad (4.4)$$

Equation (4.4) enables the study to estimate banks' adjustment speed towards their desired liquidity ratio and to establish the cross sectional variables that influence banks' liquidity.

4.6.1.1. Variables description

a. Dependent Variable: Liquidity ratio (LAR)

Valla *et al.* (2008) and Vento and La Ganga (2009) point out that bank liquidity can be measured from two dimensions: the stock or flow perspective. The stock approach views liquidity as inventory, whereby a bank's liquidity position is measured by the value of its liquid assets that can be easily turned into cash to meet short term obligations. The former approach employs several balance sheet ratios to identify banks liquidity trends such as the loan to deposit ratio, liquid asset ratio, interbank ratio and liquid assets to total deposits ratio. On the other hand, the flow approach is based on cash flows. Using this metric, the liquidity position of a bank is assessed by analyzing liquidity gaps, that is, net cash flows in each time band. Positive gaps indicate liquidity while negative gaps portray liquidity constraints. While both methods are appealing, Moore (2010) contends that the flow approach demand a lot of data and there is no standard method of predicting cash inflows and cash outflows. For this reason, stock approaches are widely employed in academic studies, for example Aspachs *et al* (2005), Vodova (2013) and Bonner *et al.* (2015). Besides, there is limited detailed data to apply flow approaches in this

study. Similar to Kashyap and Stein (2000), Aspachs *et al* (2005) and Vodova (2013) the study measures bank liquidity using the liquid asset ratio, herein (LAR). In addition, the ratio of liquid assets to total assets was chosen ahead of other metrics because unlike other liquidity ratios, the liquid asset ratio informs us about the ability of a bank to absorb liquidity shocks (Vodova, 2013); therefore, what it informs is in line with the objectives of Basel III LCR liquidity regulation. Basel III LCR rule requires banks to hold ample liquid assets that can cushion them against short term liquidity shocks. As a rule of thumb, the higher the ratio, the greater the resilience of a bank to liquidity shocks. Nevertheless, the shortcoming of this ratio is that it ignores the magnitude of liquidity mismatches in the bank's balance sheet (Aspachs, 2005; Moore, 2010).

b. Conditioning variables (X_{ict})

Bank specific factors

(i) Past levels of liquidity ($LAR_{ic, t-1}$)

Studies by Delechat *et al.* (2012), DeYoung and Jang (2016) and Mashamba and Kwenda (2017) established that banks' liquidity ratios are persistent. A variable is said to be persistent if its current value is driven by its past values (Louzis and Vouldis, 2015). In light of this, Louzis and Vouldis (2015) suggest that if current values of a particular variable are influenced by its past values, the appropriate methodology for regression analysis is a dynamic error component panel model (partial adjustment model) that can capture persistence in the dependent variable. For this reason, the study included the lagged dependent variable among the set of explanatory variable to account for persistence in liquidity ratios. Furthermore, when modeling panel data models, exclusion of the lagged dependent variable among the explanatory variables may lead to endogeneity problems (Wooldridge, 2015). Endogeneity refers to potential correlation between explanatory variables and fixed effects that are concealed in the error term. The study controls for potential endogeneity by incorporating the past levels of liquidity into the regression model. Moreover, as pointed out by Bond (2002) even though one is not interested in the coefficients of lagged dependent variables, dynamic models may produce consistent estimates of population parameters; hence, the consideration of a partial adjustment model in this study. Most importantly, as discussed earlier, adjustment costs arising from capital market imperfections

impedes banks to instantly adjust their liquidity, thereby enticing them to hold excess liquidity (liquidity buffers). Therefore, the study hypothesizes that adjustments costs create incentives for banks to maintain liquidity buffers.

H₁: Adjustment costs create incentives for banks to maintain liquidity buffers.

(ii) Bank capital (CAP)

Two competing theories attempt to explain the relationship between bank capital and liquidity, namely the financial fragility and risk absorption theory. The risk absorption theory is based on the literature of Repullo (2004) and Von Thadden (2004). Repullo (2004) and Von Thadden (2004) argue that since capital absorbs losses, it increases the bank's capacity to bear risk which entices it to create more liquidity (lend); therefore, banks with high levels of capital may target low levels of liquidity. Furthermore, Carney (2013) argues that capital buffers instill confidence in depositors and investors who are the main providers of funding liquidity to banks. In that regard, highly capitalized banks can safely carry fewer liquid assets as they are assured of a steady inflow of liquidity. In addition, Bonner and Hilbers (2015) argue that adequately capitalized banks have better access to funding markets due to their perceived low default risk; hence, they can operate with low levels of liquid assets. To that end, this study hypothesizes that capital negatively influences banks' liquidity.

On the other hand, the financial fragility theory postulated by Diamond and Rajan (2000) and Diamond and Rajan (2001) predicts a positive relationship between bank capital and liquidity. Their view point is based on the intuition that bank capital may inhibit liquidity transformation (lending) since it makes a bank's capital structure to be fragile. A fragile capital structure arises when a bank attempts to build customer confidence by maintaining a large share of its deposits in liquid assets (Diamond and Rajan, 2000). Thus, a fragile capital structure is associated with increased investments in liquid assets. Likewise, Alger and Alger (1999) claim that banks with more capital at stake have strong incentives to invest more in liquid securities for precautionary reasons. Based on the financial fragility theory a positive association is predicted between bank capital and liquidity.

From these discussions, the relationship between bank capital and liquidity is ambiguous; hence, the study expects either a positive or negative coefficient term. The study measures bank capital using total common equity, that is Tier 1 plus Tier 2 capital ratio since it is the most widely used ratio to represent bank capital (Yan *et al.*, 2012).

H₂: Higher levels of capital entice banks to keep low levels of liquid assets.

(iii) Bank Size (SIZE)

The “too big to fail” theory states that regulators are unlikely to permit large banks to fail out of fear that their closure would trigger widespread failure of other banks (Fonseca and Gonzalez, 2010). As a result, mega banks may target low liquidity on the belief that they will be bailed out. Moreover, large banks are characterized by stable cash flows, better access to capital markets, investment opportunities and business diversification and their loan portfolios are highly likely to contain liquid assets like syndicated loans (Kochubey and Kowalczyk, 2014; DeYoung and Jang, 2016). In addition, big banks tend to command a large market share and market power (Gautam, 2016). Consequently, large banks may be enticed to carry low levels of liquid assets; hence, size is hypothesized to inversely influence bank liquidity. Similar to previous studies, bank size is measured by the natural logarithm of total assets, $\ln(\text{Total Assets})$ (Bonner and Eijffinger, 2013; Shen and Chen, 2014; Wojcik-Mazur and Szajt, 2015). The use natural log of assets instead of absolute values is to control possible specification distortions (Berger and Bouwman, 2009).

H₃: Large banks have great incentives to maintain low levels of liquidity.

(iv) Profitability (ROE)

Profits represent a ready source of liquidity to a bank since huge business profits improve a firm’s cash holdings which in turn boosts its liquidity (Deans and Stewart, 2012; Debelle, 2012). This implies that profitable banks may hold significant amounts of liquidity. On the contrary, Bonner and Eijffinger (2013) contend that profitability reduces banks incentives to maintain large liquidity buffers. Their argument is based on the fact that profitable banks can easily fund themselves with debt (due to their ability to service debts) when confronted with liquidity shocks which makes them to be less liquidity constrained. Based on these arguments,

the relationship between profitability and banks liquid assets holdings is ambiguous; hence, the study expects either a positive or negative coefficient term. Following previous work of Rauch *et al.* (2009), Al-Khouri (2012) and Shen and Chen (2014) bank profitability is measured using return on equity (ROE) ratio.

H₄: A significant rise in profits can boost a bank's liquidity level through increased cash holdings (H_{4A}: $\beta_4 > 0$). Yet, abundant profits can create incentives for the bank to lower its liquidity level because it can now borrow from debt markets owing to its ability to settle debt obligations (H_{4B}: $\beta_4 < 0$).

(v) Loan growth (LG)

Lending is the principal activity of commercial banks. As such, the amount of liquid assets maintained by a bank is significantly influenced by loan demand (Alger and Alger, 1999). If loan demand is weak (strong), banks tend to hold more (less) liquid assets. The study therefore predicts that loan growth negatively affects bank liquidity. In this study, loan growth was estimated as the difference between current year gross loans minus previous year gross loans divided by previous gross year loans as shown below.

H₅: Banks respond to rising loan demand by reducing investments in liquid securities.

(vi) Loan loss reserves ratio (LLOSS)

Based on the asset quality signaling hypothesis proposed by Lucas and McDonald (1992) asset quality may determine bank liquidity dynamics. Loan loss reserves indicate the perceived riskiness of a bank's loan portfolio. Lucas and McDonald (1992) state that an increase in loan loss reserves is interpreted as a sign of potential distress by funds providers which leads to reduced funding. This means that banks experiencing asset quality deterioration may suffer significant decrease in external liquidity support. Similarly, Tabak *et al.* (2013) assert that a rise in loan defaults decreases the amount of liquidity that a bank can generate from loan repayments. Thus, banks expecting high loan losses should maintain high levels of liquidity to ameliorate liquidity risk. In this study, the loan loss reserves ratio which is expressed as the proportion of loan loss reserves to gross loans is used to measure asset quality. Apriori, the study expects a positive association between loan loss provisions and banks' liquid assets holdings.

H₆: Banks anticipating an increase in loan losses have a tendency of holding more liquidity to cushion themselves against potential liquidity shocks emanating from loan losses.

(vii) Deposit-loan synergy (DLS)

Banks offer liquidity services to both depositors and borrowers by offering checking accounts to depositors and loan commitments (credit lines) to borrowers. In the course of providing these services, banks expose themselves to liquidity risk. Banks can hedge this risk by combining transaction/demand deposits and loan demand (Kashyap *et al.*, 2002). As long as cash demand from depositors is uncorrelated with credit line draw-downs by borrowers, banks can use cash inflows from demand deposits to satisfy loan commitment requests thereby enabling them to reduce cash holdings while serving both clients (Gatev *et al.*, 2007). This strategy is known as the deposit-loan synergy, and it reduces a bank's impetus to maintain large liquidity buffers for precautionary reasons. This study predicts that the deposit-loan synergy is negatively associated with banks' liquidity buffers. Following Kashyap *et al.* (2002), Gatev *et al.* (2007) and Chen and Phuong (2014) the variable deposit loan synergy (DLS) is obtained by multiplying loan commitments by demand deposits.

H₇: Banks employing the deposit-loan synergy target low levels of liquidity.

(viii) Transaction deposits (TD)

One of the primary roles of commercial banks in an economy is to offer maturity transformation services to economic agents, that is, to accept short term deposits and issue long term loans (Al-Khouri, 2012). Consequently, the principal source of liquidity to commercial banks tends to be transaction (demand) deposits. As such, banks with high levels of demand deposits are expected to be highly liquid. Likewise, given that withdrawal of transaction deposits is unpredictable, demand deposits carry a high risk of unexpected withdrawals; hence, as transaction deposits increase, banks should invest more in liquid assets to ameliorate liquidity risk (Chen and Phuong, 2014). This study therefore predicts that banks with large transaction deposits target low liquidity.

H₈: Banks with large transaction deposits have high liquid securities.

(ix) Deposit Insurance (DEPINS)

Besides bank specific characteristics discussed above that were perceived to significantly influence banks' liquidity buffers, the study also considered deposit insurance to be a significant factor that explains bank liquidity holdings. The presence of deposit insurance removes incentives for depositors to run on an institution thereby reducing the bank's liquidity risk and ultimately its liquidity buffers (Diamond and Dybvig, 1983; Tarullo, 2014; Ngo *et al.*, 2016). Thus, banks operating in countries with explicit deposit insurance schemes may be less worried about excessive withdrawals or bank runs; hence, they can carry fewer liquid assets. Apriori, the study predicts an inverse relationship between deposit insurance and banks liquidity buffers. Deposit insurance was captured by a dummy variable (DEPINS) that equals one for a country with deposit insurance coverage and zero otherwise. Data on countries deposit insurance status were obtained from a comprehensive database on deposit insurance schemes created by Demirguc-Kunt *et al.* (2014) as at end of 2013.

DEPINS = 1, for a country with a deposit insurance protection scheme.

DEPINS = 0, for a country without a deposit insurance protection scheme.

H₉: Presence of a deposit insurance scheme removes incentives for banks to maintain large stocks of liquidity.

(x) Business Cycles (GDP)

In a world characterized by capital market imperfections, banks' liquidity buffers tend to be countercyclical (Aspachs *et al.*, 2005; Delechat *et al.*, 2012). Countercyclical behavior refers to a scenario whereby banks tend to accumulate liquidity reserves (hoard liquidity) in times of weak economic prospects, perhaps due to high default risk and weak loan demand and draw down their buffers (lend) in times of economic booms, probably due to increased lending opportunities and low default risk (Aspachs *et al.*, 2005). Accordingly, this study hypothesizes that business cycles negatively influence banks' liquidity buffers. Similar to Distinguin *et al.*, (2013), Ahmad and Matemilola (2013) and Plakalovic and Alihodzic (2015) the study uses annual growth in real gross domestic product (GDP) as a proxy for business cycles.

H₁₀: Banks react to economic booms by lending aggressively, thereby reducing their level of liquidity (H_{10A}: $\gamma_1 > 0$).

Conversely, when the economy moves into a recession, banks respond to the economic meltdown by hoarding liquidity (H_{10B}: $\gamma_1 < 0$).

(xi) Savings (SR)

In general, corporate and household savings find their way to banks either through direct deposits or investments in banks' debt products (Athukorala and Tsai, 2003; Suppakitjarak and Krishnamra, 2015). As such, banks operating in countries with high level of savings should be associated with high levels of bank liquidity. Therefore, the study expects savings to positively influence bank liquidity adjustments. Following Ma and Yi (2010) the study employs the savings ratio which is expressed as the proportion of gross national saving to total Gross National Product (GDP) to measure the level of savings in an economy.

H₁₁: Flow of liquidity to banks increases as the level of savings in an economy rises.

(xii) Monetary Policy (CBR)

In many jurisdictions, central banks attempt to influence economic activity using various tools such as adjusting short term interest rates (the central bank rate or policy rate). Their intervention is likely to affect banks' liquidity management since monetary policies are transmitted via banks. When the central bank cuts (hike) interest rates, banks tend to respond to this policy change by maintaining few (large) amounts of liquid securities relative to total assets (Aspachs *et al.*, 2005). Stated differently, monetary policy tightening tends to be associated with low liquid assets holdings while monetary policy loosening results in increased liquid assets holdings by commercial banks. Therefore, this study hypothesizes that bank liquidity is negatively related to policy rates. Consistent with Aspachs *et al.*, (2005) and Chen and Phuong (2014) this study used central bank rate as a proxy for monetary policy.

H₁₂: Banks respond to increase in short term policy rates by reducing liquidity buffers.

4.6.1.2. Complete model for Objective 1

After adding all the conditioning variables to Equation 4.4 the complete model for Objective 1 can be specified as follows:

$$LAR_{ict} = \alpha + \lambda LAR_{ic,t-1} + \beta_1 CAP_{ict} + \beta_2 SIZE_{ict} + \beta_3 LG_{ict} + \beta_4 LLOSS_{ict} + \beta_5 ROE_{ict} + \beta_6 DLS_{ict} + \beta_7 TD_{ict} + \theta DEPINS_{ct} + \gamma_1 GDP_{ct} + \gamma_2 SR_{ct} + \gamma_3 CBR_{ct} + \eta_t + v_{it} + \varepsilon_{it} \quad (4.5)$$

The summary of variables used to test various theoretical relationships outlined above are displayed in Table 4.3.

4.6.1.3. Summary of hypotheses

From Equation (4.5) a summary of hypotheses that provides some insights into how banks manage their liquidity can be drawn as shown below.

a) Banks' internal liquidity management practices

H₁: Adjustment costs create incentives for banks to maintain liquidity buffers.

H₂: Higher levels of capital entice banks to keep low levels of liquid assets.

H₃: Large banks have great incentives to maintain low levels of liquidity.

H₄: A significant rise in profits can boost a bank's liquidity level through increased cash holdings (H_{4A}: $\beta_4 > 0$). Yet, abundant profits can create incentives for the bank to lower its liquidity level because it can now borrow from debt markets owing to its ability to settle debt obligations (H_{4B}: $\beta_4 < 0$).

H₅: Banks respond to rising loan demand by reducing investments in liquid securities.

H₆: Banks anticipating an increase in loan losses have a tendency of holding more liquidity to cushion themselves against potential liquidity shocks emanating from loan losses.

H₇: Banks employing the deposit-loan synergy target low levels of liquidity.

H₈: Banks with large transaction deposits have high liquid securities.

H₉: The presence of a deposit insurance scheme removes incentives for banks to maintain large stocks of liquidity.

b) Probable impact of macroeconomic fundamentals on banks liquidity management decisions

H₁₀: Banks react to economic booms by lending aggressively, thereby reducing their level of liquidity (H_{10A}: $\gamma_1 > 0$).

Conversely, when the economy moves into a recession banks respond to the economic meltdown by hoarding liquidity (H_{10B}: $\gamma_1 < 0$).

H₁₁: The flow of liquidity to banks increases as the level of savings in an economy rises.

H₁₂: Banks respond to increase in short term policy rates by reducing liquidity buffers.

Table 4.3: Summary of variables used for Objective 1

Variable	Description	Expected Sign
LaR	Liquid assets ¹⁴ to total assets	Regressand
LaR_{t-1}	Lagged liquid assets ratio (LaR _{t-1})	+
SIZE	Natural logarithm of total asset, Ln(Total Assets)	-
CAP	Tier 1 + Tier 2 capital to Total Risk Weighted Assets	+/-
LG	Current year gross loans minus previous year gross loans divided by previous gross year loans	-
LLOSS	Loan Loss Provisions to Gross Loans	+
ROE	Return on Equity	+/-
DLS	Transaction Deposits*Loan Commitments	-
TD	Transaction Deposits	+
DEPINS	Deposit Insurance Coverage	+
GDP	Current year real Gross Domestic Product minus previous year real Gross Domestic Product divided by previous year real Gross Domestic Product	-
SR	Gross National Savings to Gross Domestic Product	+
CBR	Central Bank Rate	-

Source: Own design

¹⁴ Sum of liquid assets specified under the LCR regulation, namely vault cash (coins and notes); claims on sovereigns, central banks, public sector utilities and multilateral development banks; central bank reserves; high grade corporate debt securities; covered bonds; residential mortgage backed securities and common equity shares.

4.6.2. Objective 2

The LCR rule requires banks to maintain a pool of high quality liquid assets of at least 100% in proportion to their projected total net cash outflows over a 30-day period (Basel Committee on Banking Supervision, 2013). Banks with LCR above the minimum regulatory requirement may be subject to less regulatory pressure as they hold ample liquidity to withstand short term liquidity shocks. This suggests that banks with an LCR above the minimum regulatory requirement, that is, LCR above 100%, have few incentives to improve their LCR. On the contrary, banks with an LCR below the regulatory minimum may be subject to more regulatory pressure; hence, they might have strong incentives to adjust their balance sheets to improve their LCR lest they suffer regulatory penalties/sanctions. In this context, regulatory pressure is presumed to be more pronounced in banks with an LCR shortfall, that is, banks with LCR below 100%, relative to banks with LCR above 100%. Thus, the LCR charge may have a direct impact on banks' liquidity decisions. Accordingly, the study hypothesizes that LCR shortfall banks have strong incentives to adjust their liquidity buffers.

Based on previous studies that examined the effects of regulatory pressure on banks' capital management practices, such as Ediz (1998), Rime (2001) and Akinsoyinu (2015) this study assessed the impact of regulatory pressure on banks' liquidity decisions using the probabilistic approach. The probabilistic approach assumes that a bank's liquidity decisions are influenced by regulatory pressure once its liquidity falls below the minimum LCR requirement of 100%. Similar to Heid *et al* (2004), Berger *et al* (2008), Van Roy (2008) and Ashraf *et al.* (2016) the study defines regulatory pressure by a regulatory dummy variable, REGPRESS. The variable REGPRESS takes the value of 1 for banks with LCR below 100% and zero for banks with an LCR above 100%. To capture the potential impact of regulatory pressure on banks' liquidity decisions, the study re-estimated Equation 4.5 after incorporating the regulatory dummy variable REGPRESS. After adding the regulatory dummy variable REGPRESS the empirical model appears as follows:

$$\begin{aligned} LAR_{ict} = & \alpha + \lambda LAR_{ic,t-1} + \beta_1 CAP_{ict} + \beta_2 SIZE_{ict} + \beta_3 LG_{ict} + \beta_4 LLOSS_{ict} + \\ & \beta_5 ROE_{ict} + \beta_6 DLS_{ict} + \beta_7 TD_{ict} + \theta DEPIN_{ct} + \varphi REGPRESS_{ict} + \gamma_1 GDP_{ct} + \gamma_2 SR_{ct} + \\ & \gamma_3 CBR_{ct} + \eta_t + \nu_{it} + \varepsilon_{it} \end{aligned} \quad (4.6)$$

Next, following De Haan and Van Den End (2013a), Bonner *et al.* (2015) and DeYoung and Jang (2016) the study examines the extent to which the LCR requirement has affected liquidity decisions of banks in emerging markets by assessing whether banks' liquidity management behavior differs between the baseline model (Equation 4.5) and re-estimated model (Equation 4.6). If results of Equation 4.5 are consistent with estimates of Equation 4.6, then it can be inferred that Basel III LCR regulation has been ineffective in changing liquidity management behavior of banks in emerging market economies. Put differently, if results of Equation 4.5 and Equation 4.6 are similar in terms of coefficient signs and statistical significance, then it can be concluded that Basel III LCR requirement complement existing liquidity management strategies of banks in emerging markets. On the other hand, if results of the baseline regression model (Equation 4.5) differ remarkably from the empirical results of (Equation 4.6), then it can be concluded that Basel III LCR has been effective in altering liquidity management decisions of banks in emerging markets. In other words, if regression coefficients of Equations 4.5 and 4.6 differ significantly, in terms of coefficient sign and statistical significance, then it can be inferred that the LCR rule substituted existing liquidity management strategies of banks in emerging markets.

4.6.3. Objective 3

The recent global financial crisis had a significant impact on funding structures of banks, especially internationally active ones (Gambacorta *et al.*, 2017). In the period preceding the crisis, banks experienced difficulties in attracting core deposits (Le Lesle, 2012). As a result, they supplemented stable retail deposits with volatile short term wholesale funding instruments, like Repos and Asset Backed Commercial Paper (ABCP), to satisfy rising demand for credit in the course of the credit boom (Huang and Ratnovsky, 2008). Moreover, changes in banks funding structures were propelled by financial innovation, in particular asset securitization and prolific growth in over the counter derivatives trading. In fact, financial innovation triggered banks to shift their business models from the “originate to hold” to “originate to distribute” structure (Brunnermeier, 2009). As a result of these changes, banks increasingly funded themselves with volatile short term wholesale funds such as Repos and Asset Backed Commercial Paper (ABCP) and invested heavily in mortgage-based securities (MBS) (Kowalik,

2013). However, growing dependence of banks on wholesale funding resulted in significant vulnerabilities for banks through currency and maturity mismatches leading to greater liquidity risk exposure (Ghosh, 2013; Van Rixtel and Gasperini, 2013).

As the global financial turmoil unfolded, funding markets experienced severe stress and market liquidity became very expensive or completely evaporated in some segments (Nagel, 2012). By and large, the global financial crisis was characterized by funding liquidity shortages worldwide and increased mayhem in interbank funding markets. Babihuga and Spaltro (2014) points out that interbank interest rates rose abruptly, interbank lending fell drastically, wholesale funding markets froze, investors shunned bank debt and new debt issues dropped sharply. Yet, banks that depended on stable retail deposits fared better during the crisis than banks that relied on wholesale funding (Vazquez and Frederico, 2015; Ritz and Walther, 2015). Upon this observation, the Basel Committee on Banking Supervision introduced global liquidity regulations in December 2010 to enhance banks' resilience to liquidity risk.

Although liquidity regulations are intended to foster the resilience of banking organizations to short term liquidity shocks by encouraging them to fund their business activities with stable funding sources and to maintain a diversified portfolio of high quality liquid assets, banks may not react to regulations as expected by regulators for two reasons. First, if the regulations are not binding enough to induce behavioral change in banks, that is to say, if the penalties/sanctions are not deterrent enough to provoke non-compliant banks to act (Calem and Rob, 1996; Berben, 2010). Second, considering that the goal of bank managers is to maximize value for common stock holders, if regulatory costs far outweigh the benefits of complying with the regulations banks may be complacent to implement the regulatory reforms (Wall and Peterson, 1996). However, in the event that banks respond and given that the LCR liquidity requirement is given as a ratio; banks can improve their LCR by altering either the numerator and/or the denominator of the metric.

That said, the third objective of this research sought to assess how banks have adjusted their assets and liabilities items to comply with the LCR rule, which is now binding. An analysis of the impact of liquidity regulations on banks' balance sheet structures may enable regulators and economic policy makers to assess whether liquidity standards are producing the desired

effects. Based on the LCR calibration methodology, some balance sheet items seem more favorable to adjust than others because different weights are assigned to the numerator and denominator items of the ratio (see Appendix 2 for detailed weights). For instance, numerator items comprised of Level 1 and Level 2 assets carry factors (weights) of 100% and 85% respectively. Likewise, denominator items like stable retail deposits and term deposits carry factors of 5% and 0% respectively. Therefore, asset (liabilities) items that receive large runoff factors/weights significantly influence the numerator (denominator) of the LCR. Furthermore, some balance sheet items are easier or less costly to modify. For example, Giordana and Schumacher (2011) assert that banks are likely to first increase their stock of high quality liquid assets since this item is easier to adjust relative to sticky funding structures like retail deposits.

Aronsen *et al.* (2014) and Banerjee and Mio (2015) point out that banks have a number of strategies that they can employ to satisfy the LCR requirement. In light of various adjustment strategies at the disposal of banks discussed in Chapter III (section 3.5.1), this study examined whether the LCR liquidity regulation provoked banks to change the following balance sheet items: high quality liquid assets, non- high quality liquid assets, retail deposits, short term wholesale funding, long term wholesale funding, equity capital and asset securitization. Each balance sheet item is expressed as a proportion of either total assets or total liabilities based on the side of the balance sheet the item appear in order to assess balance sheet items adjustment as a proportion of overall bank size. The study intended to examine all balance sheet items listed above, however, due to dearth of granular data on non-high quality liquid assets, short term wholesale funding and asset securitization as well as inability to get appropriate proxies for these variables, the study was confined to the following items: high quality liquid assets, retail deposits, long term wholesale funding and equity capital. Consequently, the study regressed four different models to assess the behavioral response of banks to LCR liquidity regulation, where the dependent variable (Z_{ict}) took one of the above mentioned items, scaled by total assets or liabilities depending on the side of the balance sheet it appears. In light of these considerations, the study develops the following hypotheses.

H₁₃: Banks increased the volume of their high quality liquid assets in order to satisfy the LCR specification.

H₁₄: Banks raised the volume of stable retail deposits in order to comply with the LCR rule.

H₁₅: Banks issued more long term debt instruments in order to meet the LCR standard.

H₁₆: Banks raised more equity capital in order to satisfy the LCR rule.

4.6.3.1. Empirical model for Objective 3

Pursuant to the hypotheses developed above, the study specified the following empirical model:

$$\Delta Z_{ict} = \rho + \lambda Z_{ic,t-1} + \gamma X_{ict} + \theta REGPRESS + \psi MACFIN_{ct} + v_{it} + \varepsilon_{it} \quad (4.7)$$

$$\varepsilon_{ict} \sim \text{IID}(0, \sigma_{\varepsilon}^2)$$

$$v_{it} \sim \text{IID}(0, \sigma_v^2)$$

where: subscripts i, c, t refer to bank i, in country c, in time period t.

IID means independently and identically distributed random variable with a mean of zero and variance of sigma squared.

ΔZ_{ict} :	change in a given balance sheet item.
ρ :	constant coefficient.
X_{ict} :	vector of bank specific conditioning variables.
$MACFIN$:	vector of macroeconomic variables.
$\lambda; \gamma; \theta; \psi$:	coefficients to be estimated.
v_{it} :	unobservable time invariant bank fixed effects.
ε_{it} :	idiosyncratic error term.

4.6.3.2. Variables description

a) Dependent variable (ΔZ_{ict})

The dependent variable for objective 3 is described as a set of balance sheet items that banks can manipulate in order to meet the LCR specification. The balance sheet items are displayed in Table 4.4. Accordingly, the study ran Equation (4.7) on four balance sheet items indicated in Table 4.4 below.

Table 4.4: Balance sheet items

Balance sheet item	Description
Assets	
HQLA/Total Assets	Proportion of HQLA to Total Assets.
Liabilities	
Retail deposits/Total Liabilities	Share of stable deposits to Total Liabilities
Long term Funding/Total Liabilities	Share of long term funding to Total Liabilities
Tier 1 Capital/Total Liabilities	Banks' core capital

Source: Own Construction

b) Independent variables

(i) Lagged dependent variable

In line with Oura *et al.* (2013) the study adds the lagged dependent variable among covariates in order to account for slow adjustment towards the target (desired) funding structure as well as to address potential endogeneity that may arise from the correlation of explanatory variables and firm fixed effects.

(ii) Liquidity regulation (REGPRESS)

Since the study is interested in examining the behavioral response of banks to the LCR standard, regulatory pressure emanating the LCR is considered to be the key variable of interest. Regulatory pressure was proxied by the dummy variable (REGPRESS) discussed earlier. The study hypothesizes that banks with an LCR deficit have more pressure to adjust their asset and liability structures to satisfy the LCR standard. Therefore, the dummy variable REGPRESS was assumed to capture the impact of regulatory pressure stemming from the LCR regulation on changes in banks asset and liabilities structures. The variable REGPRESS takes the value of one for banks with a LCR below 100% and zero for banks with a LCR above 100%.

(iii) Conditioning variables

To prevent spurious regression, a set of control variables is incorporated in the regression models. Since there are no studies to date (to the researcher's best knowledge) that have explored the determinants of banks' assets and liabilities adjustments, the study considers the following variables to have significant influence on banks' ability to adjust their balance sheets: bank size, profitability, income diversification, gross domestic product, financial sector development and financial sector openness. These variables are described below.

Asset structure adjustment model (Asset side adjustment model)

The study considers the following variables to significantly explain changes in high quality liquid assets: bank capital, bank size, bank profitability, asset quality, income diversification, GDP, financial sector development and financial sector openness. Since most of the variables that influence changes in banks' liquid assets have already been described, this subsection attends to three variables that may explain bank liquid assets adjustments: income diversification, financial sector openness and financial sector development.

a. Income diversification (ID)

A well-diversified asset portfolio enables a bank to have a steady flow of revenue. In other words, banks with diversified income streams tend to have stable cash flows (Gurbuz *et al.*, 2013). Such banks might find it easy to adjust their balance sheet as they can invest more in liquid securities. Accordingly, the study predicts that banks with well diversified incomes have greater flexibility in adjusting their asset structures.

b. Financial sector openness (FSD)

The effect of financial sector openness on banks' asset adjustments can be examined in context of cross border flows. Cross border flows can be described as funding obtained from international banks (Gambacorta *et al.*, 2017). A country with an open financial system can source significant funding from foreign banks which in turn boosts its funding and investments (McCauley *et al.*, 2010). Thus, the study predicts that the financial sector's openness positively influences asset adjustments.

c. Financial sector development (FSD)

Financial sector development determines the ability of firms to access external financing. Economies with low levels of financial sector development impose financial constraints on banks (Bonner *et al.*, 2015); hence, financially constrained firms tend to hold more liquid assets for precautionary reasons (Almeida *et al.*, 2004). Therefore, the study hypothesizes that low levels of financial sector development create financial constraints for banks, thereby impeding balance sheet adjustment.

Funding structures adjustment model (Liability side adjustment)

The following variables were included in funding structures adjustment models as conditioning variables: bank capital, bank size, bank profitability, asset quality, income diversification, deposits, bank liquidity, assets growth, business model, GDP, financial sector development, monetary policy and financial sector openness. Their potential impact on banks' funding structures adjustment is discussed herein.

a. Bank capital (CAR)

It may be necessary to also include other Basel III requirements as control variables because in the process of complying with the LCR, banks also have to simultaneously meet certain capital charges that also rely on LCR items. For instance, the risk weighted assets (RWA) value that is used in the determination of capital ratios comprises both liquid and illiquid assets. In addition, since it is difficult to distinguish insolvent banks from illiquid banks, it is prudent to link required capital to liquidity instead of examining the aspects separately. This view is supported by Goodhart (2008) who argues that liquidity and solvency are intertwined facets; an illiquid bank can quickly turn insolvent while a solvent bank can quickly become illiquid. For this reason, core equity Tier 1 ratio (CAR) is included among covariates in funding (liability items) regression models.

b. Bank size (SIZE)

Bank size (SIZE) was assumed to significantly influence banks' balance sheet modification. Large banks, due to their balance sheet strength can easily tap funding from capital markets and raise more deposits due to their perceived safety (Lastuvkova, 2017). Therefore, big

banks may have more adjustment options at their disposal, which permits them to easily alter their liability structures.

c. Profitability (PROF)

Bank profitability may also influence the ability of banks to alter their balance sheet structures based on the following two reasons. First, profitable banks may have easier access to external financing because they are able to service debts (Delechat *et al.*, 2012). Second, retained earnings are counted as capital in banks' financial statements (Basel Committee of Banking Supervision, 2010b). This suggests that high profit banks are able to plough back more into their businesses, which makes it easier for them to adjust their funding structures. Therefore, this study hypothesizes that profitability enhances banks' funding adjustment.

d. Asset quality (NPL)

Asset quality as measured by the ratio of non-performing loans to total loans might also determine banks' ability to alter their balance sheets. Debt funding, deposit sourcing as well as equity issuances are likely to be controlled by the quality of a bank's asset portfolio. Banks with deteriorating asset portfolio may find it difficult to issue debt securities or equity and to attract deposits as they are perceived to be risky (Babihuga and Spaltro, 2014). As such, the study predicts that asset quality adversely affects banks' liabilities dynamics.

e. Income diversification (ID)

As highlighted by Gurbuz *et al.* (2013) banks with diversified income streams tend to have stable cash flows. As such, banks with broad income streams are expected to have great flexibility in modifying their liabilities.

f. Bank deposits (DEP) and Liquidity (LIQ)

Traditionally, banks rely on core/retail deposits for funding (Vazquez, 2012). However, when confronted by deposit supply constraints, banks can alter their funding structure by issuing more debt (Diamond and Rajan, 2001). Therefore, this study hypothesizes that debt or equity issuance is negatively related to changes in bank deposits. A similar relationship is likely to hold for liquidity: deposit constrained banks may change their funding strategy by issuing more debt

securities or equity to alleviate liquidity gaps (Van Rixtel *et al.*, 2016). Likewise, the study hypothesizes that debt or equity issuance increases as bank liquidity decreases.

g. Assets growth (AG)

Loans constitute the largest share of a commercial bank's asset portfolio. If loan growth outpaces deposits growth, commercial banks have to borrow to cover this funding gap (Harvey and Spong, 2001). Therefore, as a bank's loan book grows its funding composition may also change if it uses debt to fund assets growth. Besides, financing constraints that impede firms to finance investment projects with internal funds create liquidity needs that results in incentives for firms to seek external funding or to make rights issues (Tsoukas *et al.*, 2008). Accordingly, this study predicts that banks issue more debt and equity to fund loan book growth.

h. Economic conditions (GDP)

Banks funding structures may fluctuate in response to changes in economic conditions. For instance, prior to the global financial mayhem, there was a steady flow of wholesale funding but this trend was significantly reversed at the onset and during the crisis (Basel Committee on Banking Supervision, 2010a). Similarly, deposit flows are connected to changes in economic conditions. When the economy is doing well, demand for bank savings products and debt instruments tend to increase which leads to considerable changes in banks funding composition (European Central Bank Economic Bulletin, 2016). Consequently, the study expects a positive association between changes in real GDP growth and changes in banks funding structures.

i. Financial sector openness (OPENNESS)

Openness of the financial sector determines the extent to which a particular country can tap into foreign markets. Countries with open financial systems can be associated with increased foreign portfolio investments which positively influence banks' ability to restructure their liabilities (Nakagawa and Psalida, 2007). For this reason, the study expects a positive relationship between openness and changes in banks' funding structures. Similar to Oura *et al.* (2013) the financial sector's openness is measured as the ratio of current account surplus/deficit to GDP.

j. Financial sector development (FSD)

As discussed earlier, low levels of financial sector development create financial constraints for banks (Bonner *et al.*, 2015). Therefore, banks operating in less developed markets may experience difficulties in adjusting their liabilities since their ability to raise external funding from capital markets tends to be constrained.

k. Monetary policy (CBR)

Monetary policy may influence banks' funding structures. A soft monetary policy stance in the form of low policy rates may entice commercial banks to take more risk by increasing leverage/debt issuance (Altunbas *et al.*, 2014; Van Rixtel *et al.*, 2016). This study therefore predicts that monetary policy easing incentivizes banks to issue more debt.

l. Market timing (IR)

Another variable that may affect banks' ability to alter their funding structures is interest rates. This intuition is based on the market timing theory proposed by Van Rixtel *et al.* (2016). The market timing theory suggests that bank increase bond issuance when they expect a downward sloping yield curve. Thus, this study hypothesizes that banks' issuance of long term funding instruments is negatively related to interest rates.

4.6.3.3. Complete models for Objectives 3 and 4

The complete models for Objectives 3 and 4 are specified as follows:

$$\Delta \frac{HQLA_{ict}}{TA_{ict}} = \rho + \lambda(HQLA/TA_{ic,t-1}) + \gamma_1 CAR_{ict} + \gamma_2 SIZE_{ict} + \gamma_3 NIM_{ict} + \gamma_4 NPL_{ict} + \gamma_5 ID_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 FSD_{ct} + \psi_3 OPENNESS_{ct} + v_{it} + \varepsilon_{it} \quad (4.8)$$

$$\Delta \frac{DEP_{ict}}{TL_{ict}} = \rho + \lambda(DEP/TL_{ic,t-1}) + \gamma_1 CAR_{ict} + \gamma_2 SIZE_{ict} + \gamma_3 NIM_{ict} + \gamma_3 NPL_{ict} + \gamma_1 ID_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 FSD_{ct} + \psi_3 OPENNESS_{ct} + v_{it} + \varepsilon_{it} \quad (4.9)$$

$$\Delta \frac{LTWF_{ict}}{TL_{ict}} = \rho + \lambda \left(\frac{LTWF}{TL_{ic,t-1}} \right) + \gamma_1 CAR_{ict} + \gamma_2 SIZE_{ict} + \gamma_3 NIM_{ict} + \gamma_3 NPL_{ict} + \gamma_1 AG_{ict} + \gamma_1 DEPOSITS_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 CBR_{ct} + \psi_3 IR_{ct} + v_{it} + \varepsilon_{it} \quad (4.10)$$

$$\Delta \frac{EQ}{TL_{ict}} = \rho + \lambda \left(\frac{EQ}{TL_{ic,t-1}} \right) + \gamma_1 SIZE_{ict} + \gamma_3 ROE_{ict} + \gamma_3 NPL_{ict} + \gamma_5 ID_{ict} + \gamma_6 LIQ_{ict} + \gamma_7 DEPOSITS_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + v_{it} + \varepsilon_{it} \quad (4.11)$$

4.6.4. Objective 4

The fourth objective of the study examines the extent to which Basel III liquidity requirements have altered funding structures of banks in emerging market economies. Banks have diverse funding structures that comprise deposit funding, short term wholesale funding, long term wholesale funding, asset securitization and equity capital (Fabbro and Hack, 2011; Wong 2012, Beau *et al.*, 2014). The study intended to examine how liquidity regulations have impacted these funding structures; however, due to non-availability of data on short term wholesale funding and asset securitization, the study was restricted to examining the effects of liquidity regulations on deposit funding, long term wholesale funding and equity funding. Consequently, the study ran three different models, where the dependent variable (Z_{ict}) took one of the above mentioned funding instruments, scaled by total liabilities. Since this exercise was done under Objective 3, results of Models 4.9; 4.10 and 4.11 were used to assess the extent to which LCR liquidity requirement has influenced changes in funding structures of banks operating in emerging markets.

4.6.5. Objective 5

One of the main concerns raised about liquidity standards is their possible adverse effects on banks profitability. Both academics and practitioners in the banking industry envisage that the LCR is likely to diminish banks' profitability as it compels banks to invest more in low yield earning liquid assets (Macro Assessment Group, 2010; Giordana and Schumacher, 2017). Moreover, banks may reduce lending in pursuit of the regulations which in turn may weigh down their earnings since banks' profits are mainly drawn from loans (Liang, 2012). To that end, the

fifth objective of this study sought to investigate the effects of the LCR regulation on the profitability of banks in emerging markets.

4.6.5.1. Empirical model for Objective 5

In order to investigate the impact of the LCR on banks' profitability, a dynamic panel regression model which takes the following form is formulated:

$$ROA_{ict} = \alpha + \lambda ROA_{ic,t-1} + \beta X_{ict} + \phi REGPRESS + \rho MACFIN_{ct} + v_{it} + \varepsilon_{ict} \quad (4.12)$$

$$\varepsilon_{ict} \sim \text{IID}(0, \sigma_{\varepsilon}^2)$$

$$v_{it} \sim \text{IID}(0, \sigma_v^2)$$

where: subscripts i,c,t refers to banks i, in country c, at time period t.

IID means independently and identically distributed random variable with a mean of zero and variance of sigma squared.

ROA_{ict} : Return on assets for bank i, in country c, at time period t.

α : Constant coefficient.

ROA_{ict-1} : Lagged return on assets.

X_{ict} : Vector of banks specific characteristics.

$MACFIN_{ct}$: Vector of macro financial factors.

v_{it} : Unobservable time invariant bank fixed effects.

ε_{it} : Idiosyncratic error term.

4.6.5.2. Variables description

a) Dependent variable (ROA)

There are two main ratios commonly used to measure firm profitability: return on assets (ROA) and return on equity (ROE). The former is expressed as net profit after tax to total assets while the latter is given as the ratio of net profit after tax to shareholders' equity. Similar to

Athanasoglou *et al.* (2006) and Said and Tumin (2011) this study uses return on assets (ROA) to assess bank profitability. The choice of ROA over the usual ROE metric is based on the fact that ROE disregard financial leverage and risks associated with it (Athanasoglou *et al.*, 2006, European Central Bank, 2010). In other words, ROE is risk insensitive.

The weakness of ROE can be revealed by decomposing the ratio. ROE can be decomposed by multiplying ROA with the equity multiplier, that is $ROE = ROA * \frac{TotalAssets}{Equity}$.

The equity multiplier $\left(\frac{TotalAssets}{Equity} \right)$ measures financial leverage. This leverage component can significantly boost ROE, yet, other risk elements such as the ratio of risky assets and solvency position of the institution are missing in the indicator (European Central Bank, 2010). Thus, ROE is considered to be a dependent metric. In that regard, Rivard and Thomas (1997) and European Central Bank (2010) suggest that ROA is a more reliable measure than ROE with respect to efficiency performance since it is adjusted for leverage. Besides, as further pointed out by the European Central Bank (2010) ROE is a point-in-time indicator since it lacks forward looking. Before the crisis, ROE figures showed homogeneity in bank returns; however, some of the banks with high ROEs before the crisis were hard hit by the global financial crisis. This demonstrates that ROE is a short term indicator that may fail to accurately reveal the true performance of a firm especially in times of crisis.

Nevertheless, ROA may be biased since it ignores revenue generated from off-balance sheet activities (Flamini *et al.*, 2009). In the present study, this bias was assumed to be negligible since banks in emerging market economies are generally less involved in complex off-balance sheet activities; hence, income from off balance sheet activities for banks in the sample was presumed to be small. Likewise, risk connected to leverage may not be high for banks in emerging markets as they tend to be less leveraged because they depend less on debt funding.

b) Independent variables

Bank Specific Characteristics

(i) Lagged dependent variable ($ROA_{ic,t-1}$)

The study adopted a dynamic panel regression model on the assumption that bank profits are persistent over time due to market structure imperfections (Fama and French, 2000; Goddard *et al.*, 2004). To capture persistence in bank profits, the variable lagged return on assets ($ROA_{ic,t-1}$) was included among covariates.

(ii) Liquidity Regulation (REGPRESS)

The key variable of interest in this study is regulatory pressure dummy variable (REGPRESS). This variable was presumed to capture the impact of regulatory pressure on the profitability of banks in emerging markets. As already discussed, low LCR banks, that is, banks with LCR below the regulatory benchmark may have more pressure to improve their LCR. However, as banks hold more liquid assets to elevate their LCR, increased investments in liquid assets may diminish banks' profitability (Bordeleau and Graham, 2010). The study is therefore motivated to investigate the effects of regulatory pressure stemming from the LCR rule. The variable REGPRESS takes the value of one for banks with LCR below 100% and zero for banks with an LCR above 100%. To capture the potential impact of regulatory pressure on banks' profitability, the study incorporated the regulatory dummy variable REGPRESS into the baseline regression model.

(iii) Bank size (SIZE)

The modern financial intermediation theory suggests that there are efficiency gains related to size as a result of economies of scale (Goddard *et al.*, 2004). Economies of scale can be described as the reduction in cost of production associated with increasing quantity of production (Kovner *et al.*, 2015). Due to economies of scale, large banks are expected to be more profitable as they can spread their costs among many units resulting in low operating costs. Based on the economies of scale theory, the study predicts that size positively influences bank performance.

(iv) Bank capital (CAP)

Bank capital is another bank specific variable that is predicted to have a significant influence on bank profitability. Modigliani and Miller (1958) argue that in a perfect capital market world, without bankruptcy costs and asymmetric information, the capital structure of a

firm does not affect its value, rather its value is driven by the firm's earning power. Nevertheless, when the perfect market assumption is relaxed, an increase in capital would lower costs associated with financial distress and bankruptcy, and in turn lead to higher earnings (Flamini *et al.*, 2009). Similarly, in a world characterized by asymmetric information, banks expecting better performance transmit this information to the market by holding high capital (Berger, 1995). Besides, equity capital provides a source of funding to banking institutions. Hence, banks with high levels of equity capital have more funds to invest which allows them to reap more profits. In addition, highly capitalized banks are assumed to have a low default risk and this improves their creditworthiness (Rao and Lakew, 2012). Consequently, banks with large capital face low cost of funding which positively affects their earnings. Based on this discussion, this study hypothesizes that equity capital positively influences bank profitability.

(v) Operational efficiency (Cost_INC)

Another factor that is likely to affect bank performance is operational/management efficiency. Following Mathuva (2009) and Kovner *et al.* (2015) the study measures management efficiency using the traditional cost-to-income ratio metric. The ratio is expressed as the ratio of operating expenses (costs) to operating income. As a rule of thumb, the lower the ratio, the more profitable the bank is and vice versa. Thus, the metric informs about management's efficacy in controlling operating costs. Besides highlighting how efficiently a bank is being run, the cost to income ratio may also indicate potential problems. If the ratio is increasing from one period to the next, it shows that costs are increasing at a higher rate than income which may lead to reduced profitability (Hussain 2014). From this discussion, the study predicts that a high cost to income ratio is associated with low profitability.

(vi) Credit risk (NPL)

Lending is the principal source of revenue for commercial banks. However, high loan defaults may decrease a bank's profitability (Sarat, 2010). This study therefore predicts that credit risk measured by the ratio of non-performing loans to total loans negatively affects bank profitability. This claim is reinforced by empirical findings of Freedman and Click (2006) that credit risk is high in emerging markets due to weak contract enforcement laws and legal environment as well as asymmetric information.

(vii) Bank liquidity (LIQ)

As aforementioned, liquidity refers to the ability of a bank to settle its short term obligations timeously at minimal costs. In that regard, the more liquid a bank is, the greater its ability to pay off maturing obligations. One way a bank can enhance its liquidity is by investing more funds in liquid securities. This pool of liquid assets is used as a buffer against unexpected cash outflows (Carney, 2011; Elliot, 2014). In this study, bank liquidity was measured by the liquid asset ratio. This ratio expresses a bank's holdings of liquid assets as a proportion of total assets. Nevertheless, the amount of liquidity maintained by a bank (in terms of liquid assets holdings) may influence its profitability since liquid securities earn low returns (Bordeleau and Graham, 2010). Therefore, banks with high levels of liquid assets holdings are predicted to be less profitable. Accordingly, the present study claims that bank profitability decreases as they invest more in liquid securities.

(viii) Bank Deposits (DEPOSITS)

Traditionally, commercial banks make money by accepting low cost short term deposits and issuing out long term loans at higher rates (De Young and Rice, 2004). It follows that banks with large deposits can be more profitable since they have more funds to loan out. Therefore, this study hypothesizes that deposits positively influence bank profitability.

(ix) Specialization (SPEC)

The main source of commercial banks revenue is loans since they are the main players in traditional financial intermediation (Borio *et al.*, 2017). As such, this study hypothesizes that banks that specialize in lending are able reap high profits from the loans, provided loan defaults are very low.

Macroeconomic factors

(i) Economic activity (GDP)

Real Gross Domestic Product is a primary indicator of a country's overall economic health status (Rao and Lakew, 2012). Moreover, extant literature, such as Levine (2005) demonstrated that a positive relationship exists between finance and economic growth. Hence,

this study hypothesizes that growth in real Gross Domestic Product positively influences the profitability of banks in emerging markets.

(ii) Monetary policy (MP)

Monetary policy is a tool used by central banks to control overall banking sector liquidity. When the central banks set a low policy rate, to stimulate economic activity, bank lending tend to rise leading to reduced bank liquidity, all else equal (Rauch *et al.*, 2008). Since lending is the principal source of bank profitability, this study predicts that monetary policy easing enhances bank profitability.

4.6.5.3. Complete model for Objective 5

After incorporating all the conditioning variables to Equation (4.12) the complete model for Objective 5 can be specified as follows:

$$ROA_{ict} = \alpha + \lambda ROA_{ic,t-1} + \beta_1 LIQ_{ict} + \beta_2 LIQ_{ict}^2 + \beta_3 SIZE_{ict} + \beta_4 CAP_{ict} + \beta_5 COST_INC_{ict} + \beta_6 CR_{ict} + \beta_7 SPEC_{ict} + \beta_8 DEPOSITS_{ict} + \phi REGPRESS + \rho_1 GDP_{ct} + \rho_2 MP_{ct} + v_{it} + \varepsilon_{ict} \quad (4.13)$$

4.7. CHAPTER SUMMARY

This chapter discussed the methodology adopted for this study. For each objective, a set of hypotheses to be tested as well as the empirical model were outlined. The hypotheses provide insights into the possible implications of liquidity regulations on liquidity management practices of banks in emerging markets. The Maddala and Wu unit root test was chosen for stationarity tests since it can handle unbalanced panels. A dynamic panel regression model that accounts for persistence, heterogeneity and endogeneity was developed for each research objective. System GMM estimator was chosen for regression analysis due to its strengths over other estimation methods. For post estimation, the Arrelano and Bond serial correlation test and Sargan test of over identifying restrictions will be employed to check for autocorrelation and validity of instruments used in each model respectively. After data cleaning, the sample of the study comprises of forty (40) commercial banks operating in eleven (11) emerging market economies. Data for the study were sourced from Bloomberg and World Bank databases. The next chapter presents, analyzes and discusses empirical estimates obtained from System GMM estimation.

CHAPTER V

BANKS' LIQUIDITY MANAGEMENT PRACTICES

5.0. INTRODUCTION

The aim of this study is to examine the impact of Basel III liquidity regulations on liquidity management practices of banks operating in emerging market economies. This chapter presents empirical results for Objectives 1 and 2 and proceeds to analyze and discuss the research findings. The two-step GMM estimator which accounts for persistence, dynamic panel bias, endogeneity, heteroscedasticity and autocorrelation was employed in estimating the regression models. Before presenting, analyzing and discussing the results, unit root test and instrument validity tests results are presented.

5.1. DESCRIPTIVE STATISTICS

Before conducting statistical inference, it is important to provide descriptive statistics. Descriptive statistics help to describe and summarize data. The descriptive statistics were calculated as mean, standard deviation, minimum and maximum values as well as 10th and 90th percentile values. Mean values indicate the average value of a given variable over the sampling window. The standard deviation measures the magnitude of dispersion of a given variable from its mean value while the minimum and maximum values highlight the least and highest value of a variable reported over the sample period respectively. Percentiles indicate percentage of scores that are equal or less than a specified score. The descriptive statistics are displayed in Table 5.1 below.

Table 5.1: Banks' liquidity management practices descriptive statistics

Variable name	Mean	Standard deviation	10th Percentile	90th Percentile	Minimum	Maximum
Liquid asset ratio (LAR)	34.27	23.71	6.48	69.14	2.43	76.34
Bank size (SIZE)	19.23	3.51	15.69	24.49	10.36	26.24
Bank capital (CAP)	16.11	4.67	11.78	18.9	9.41	45.75
Loan Growth (LG)	13.4	25.63	-7.83	28.64	-29.53	196.35
Asset quality (LLOSS)	2.33	2.10	0.45	5.87	0.08	18.56
Profitability (ROE)	9.81	13.08	2.27	20.38	-86.75	32.58
Deposit-loan synergy (DLS)	49.76	27.39	13.61	93.89	0.00	113.08
Transaction Deposits (TD)	7.37	1.57	5.39	9.81	4.01	10.47
Deposit insurance coverage (DEPINS)	0.90	0.30	-	-	0.00	1.00
Business cycle (GDP)	4.20	2.28	1.63	6.64	-3.77	8.77
Savings ratio (SR)	27.76	6.96	18.34	34.81	14.10	35.55
Monetary Policy (CBR)	5.65	2.93	0.5	8	0.50	12.75

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

Results in Table 5.1 show that liquid asset ratios for sampled banks averaged 34.27% for the period January 2011 to December 2016. This value means that sampled banks invested about 34% of total assets in liquid assets during the study period. The average liquid asset ratio of 34% suggests that banks in emerging market economies are highly liquid. These results are consistent with earlier findings of Otker-Robe *et al.* (2010) and Basso *et al.* (2012). Three reasons can be offered that attempt to explain why liquid asset ratios in emerging market economies are high. First, the high ratio of liquid assets to total assets in emerging market economies can be ascribed to regulatory reforms instituted in Asia in the wake of the 1997 Asian financial crisis that triggered banks to revise their liquidity and risk management practices (Angklomkliew, 2009; Packer and Zhu, 2012). In the wake of the 1997 Asian financial crisis, most regulators in emerging market economies instituted regulations that compel their banks to hold large liquidity buffers. For instance, the Korean bank regulator (Financial Supervisory Service) introduced a minimum won liquidity ratio of 100% that Korean banks had to maintain on an ongoing basis (Kim, 2010). Second, as pointed out by Freedman and Click (2006), high liquid asset ratios in emerging countries could be attributed to high liquidity reserve requirements and inefficient credit markets which constrain bank lending (investment in illiquid assets). Third, the high levels of liquidity in banks operating in emerging market economies could be ascribed to high level of household savings which give banks a large pool of savings deposits. As evidence, summary statistics indicate that the ratio of National Savings to Gross Domestic Product is quite high in emerging markets as it averaged 28% over the period of study. This evidence is consistent with the findings of Ferrucci and Miralles (2007) and Bijapurkar (2011). Ferrucci and Miralles (2007) found that household savings account for more than 40% of GDP in emerging markets and such high savings level were attributed to widening current account surpluses in emerging market economies. Likewise, Bijapurkar (2011) documents that savings rates are very high in India because the top 40% income earners save significantly.

Bank size which was measured by the natural logarithm of assets had an average value of 19.23 with a standard deviation of 3.51%. Considering that natural logarithm was employed to limit the variation of maximum and minimum bank size values, descriptive statistics show that bank size dispersion is small. This suggests that banks used in the sample do not have significant differences in their sizes. Banks used in the sample are fairly homogenous based on the small sample size dispersion. This evidence suggests that banks used in the sample are concentrated. A

concentrated banking system is characterized by a few large banks that control the market with a long tail of small banks. These results concur with Ernst and Young (2013) finding that five largest banks in emerging markets hold about 70% of each respective country's total banking system assets.

The 10th percentile for Tier 1 and Tier 2 capital scaled by total risk weighted assets was 11.78%. This means 10% of banks in the sample had capital adequacy ratios equal to 11.78% or less. Alternatively, 90% of the banks had capital adequacy ratios of 11.78% or more. Since 90% of the banks had a minimum capital requirement of 8% prescribed under Basel II¹⁵, these statistics suggest that most banks in the sample are adequately capitalized. The high level of capitalization in banks used in the sample can be attributed to major regulatory reforms instituted in Asian economies in the wake of the 1997 Asian financial crisis (Angklomkiew, 2009).

Results highlight that loan books of banks operating in emerging market economies grew by approximately 13% on average over the period January 2011 to December 2016, implying that bank lending in emerging market economies has been on an upward trend in the period succeeding the global financial crisis. This trend can be attributed to high capital ratios held by banks in emerging market economies in the period preceding the global financial crisis. International Monetary Fund (2009), observed that bank lending in emerging markets, although it fell during the crisis, has been growing at 10% largely because of the financial strength of banks in emerging markets. The International Monetary Fund (2009) ascribed sound financial positions of banks operating in emerging market economies to a legacy of lessons they learned from the 1997 crisis which provoked them to prudently manage their capital. Nevertheless, there is a large dispersion in loan book growth. This is signified by a standard deviation of 25.63%. The minimum and maximum values of -29.53% and 196.35% respectively, entailing that some banks significantly cut back lending while others aggressively lent during the study period.

Loan loss reserves as a proportion of gross loans was used to measure riskiness of banks loan portfolios. The variable has an average value of 2.33 with a standard deviation of 2.1. This means on average banks set aside an amount equivalent to 2.33% of gross loans to cater for bad

¹⁵ Since the study used total capital ratio, that is Tier 1 and Tier 2 capital, which is different from Basel III Core Equity Tier 1 ratio requirement of 4.5%, analysis was therefore made in context of Basel II minimum capital requirement.

and doubtful debts. This behavior demonstrates conservative loan loss provisioning standards which can be attributed to robust risk management and cautious loan loss provisioning adopted by Asian banks¹⁶ used in the study in response to the 1997 Asian financial crisis (Angklomkiew 2009). The standard deviation of 2.1% highlights that there is a small dispersion in the amounts set aside by banks to cater for bad and doubtful debts.

Bank profitability was measured by return on equity (ROE). ROE is calculated as net profit after tax divided by shareholders capital and measures the returns/profits earned to shareholders on the funds they have supplied. The average return on equity reported for sampled banks over the period 2011 to 2016 was 9.81%, meaning on average bank executives managed to generate a positive return for their shareholders. Analyzing the minimum value of -86.75% and maximum of 32.58%, it appears some banks in the sample made significant losses while some reported healthy profits over the sample period. Concomitantly, the standard deviation for ROE was 13.08% indicating that profit variation among the selected banks over the period January 2011 to December 2016 was large.

Transaction deposits averaged US\$7.37 million for the selected banks over the study period. The 90th percentile was US\$9.81 million. It can be inferred that 90% of commercial banks in the study had transaction deposits of US\$9.81 million or less. Stated differently, 10% of the banks had demand deposits of US\$9.81 million or more on their balance sheets during the period of study. The low standard deviation value of 1.57 suggests that deposit funding in emerging market economies is fairly homogenous across banks, lending support to the assertion that banks in emerging market economies are widely funded by deposits (Bonner *et al.*, 2015).

The variable deposit loan synergy reported an average value of \$US49.76 with a standard deviation of roughly 27%. The value of standard deviation highlights that there is a large variation in deposit loan synergy practice over the sampling window. This evidence is supported by the minimum and maximum values of 0.00 and 113.08 respectively, which offer that some banks did not employ this strategy at all while some of the banks heavily use it.

¹⁶ Asian banks constitute 50% of the final sample; therefore, their behavior was assumed to have a significant influence on study findings.

The average value of deposit insurance coverage in emerging markets was estimated to be about 90%, suggesting that most of the countries used in the sample have a deposit insurance scheme in place. These statistics substantiate the argument that deposit insurance minimizes bank runs since it seems that most of the countries used in the sample have either an explicit or implicit deposit insurance scheme in place.

The study used real gross domestic product growth (GDP) as a proxy for business cycles. From Table 5.1 the GDP has a mean value of 4.2 with a standard deviation of 2.28 and a minimum and maximum value of -3.77 and 8.77 respectively. The average GDP is positive showing that countries used in the sample reported positive economic growth over the period 2011 to 2016. In addition, the magnitude of GDP dispersion is relatively low (2.28%) suggesting that economic growth among emerging market economies for the period 2011 to 2016 is not widely dispersed. Notwithstanding this, the minimum value of (-3.77) suggests that some of the countries used in the sample experienced negative growth in economic output during the period under investigation.

Savings ratio measured as gross national savings to gross domestic product was another variable employed to assess the impact of macroeconomic fundamentals on banks' liquidity management. The variable shows an average value of 27.76% with a minimum value of 14.1% and a maximum of 35.55%. The mean value of 27.76% demonstrates that the rate of household savings for countries used in this study is quite high. Furthermore, the high value of domestic savings in emerging market economies could imply that households and individuals place a significant part of their savings in savings deposits at banks. The standard deviation value of roughly 7% means that there is small variation the level of savings among the sampled countries.

Lastly, the central bank rate was used to reflect the impact of monetary policy on banks' liquidity holdings. Central bank rates averaged 5.65% during the study period. The 10th percentile was 0.50% while the 90th percentile was 8%. The standard deviation reported is 2.93%, which suggests that there is small variation in policy rates set by central banks in the sample.

5.2. CORRELATION MATRIX

Correlation analysis is used to determine the degree of association between variables under consideration and the size of the correlation coefficient informs about the strength of the relationship between two variables (Greene 2008). A correlation coefficient value that is greater than zero implies positive correlation while a correlation coefficient that is below zero implies negative correlation. Results of pairwise correlation are presented in Table 5.2 below.

The study found a significant positive correlation between loan loss provisions and liquid asset ratio. This finding implies that commercial banks in emerging market economies are risk averse; they increase liquidity buffers when they anticipate significant loan losses (Delechat *et al.*, 2012). The association between savings ratio and liquid asset ratio is negative and statistically significant; suggesting that growth in household savings increases banks liquidity through increased savings deposits.

There is a strong positive correlation between transaction deposits, deposit loan synergy and bank size suggesting that banks with high levels of demand deposits tend to be more liquid. The positive relationship between deposit loan synergy and bank liquidity indicates that banks employing the deposit loan synergy strategy maintain a large stock of liquid assets. Bank size and liquidity are positively correlated, suggesting that liquid asset holdings increase as banks grow in size. In other words, the bigger the bank the more liquidity it maintains.

The study found a positive correlation between bank capital and size. This suggests that large banks in emerging market economies maintain large capital buffers contrary to the “too big to fail” theory which was found to hold in developed markets (Berger and Bouwman, 2009). The theory argues that highly capitalized banks operate with low levels of capital because they believe they will be bailed out when they face a crisis due to their systemic importance. This evidence may be demonstrating that moral hazard challenges associated with safety nets are weak in emerging markets and strong in developed markets. This analysis may be supported by Aspachs *et al.*, (2005) finding that the liquidity moral hazard effect is strong in banks in United Kingdom.

Table 5.2: Banks' liquidity management practices correlation matrix

	LAR	SIZE	CAP	LG	LLOSS	ROE	DLS	TD	DEPINS	REGPRESS	GDP	SR	CBR
LAR	1.0000												
SIZE	0.0459	1.0000											
CAP	0.0441	0.1837**	1.0000										
LG	0.0767	0.1297	0.0788	1.0000									
LLOSS	0.2050***	-0.2156***	-0.0986	-0.0819	1.0000								
ROE	-0.0341	0.0228	0.0615	0.0640	-0.1809**	1.0000							
DLS	0.1851***	0.7887***	0.1090	0.1096	-0.2222***	-0.0139	1.0000						
TD	0.0675	0.5340***	0.2211***	0.1194	-0.2315***	0.0601	0.5374***	1.0000					
DEPINS	-0.0181	0.0878	0.0605	0.0707	0.0330	-0.1918***	-0.0223	-0.0224	1.0000				
REGPRES S	0.0610	-0.1691***	0.2853***	-0.0842	-0.2147***	0.0388	-0.1374*	-0.1502**	0.1222*	1.0000			
GDP	-0.0930	0.1746**	-0.0708	0.0903	-0.1182	-0.1989***	0.1696**	0.1100	0.3085***	-0.1563**	1.0000		
SR	-0.1079***	0.6388***	0.1091	0.1599**	-0.3167***	-0.2453***	0.5519***	0.6024	0.4210***	-0.0928	0.6769***	1.0000	
CBR	0.0978	0.0462	-0.0152	0.1433*	0.3441***	0.0407	-0.0581	-0.0220	0.0177	-0.5079***	0.0907	-0.0424	1.0000

Source: Own construction based on data obtained from Bankscope.

***, **, * denotes 1%, 5% and 10% significance level respectively.

The correlation between GDP and bank size is positive and statistically significant. This indicates that bank size measured by the natural logarithm of total assets is procyclical, that is, banks grow (shrink) their balance sheets when economic output increases (decreases). Since loans tend to constitute a large proportion of bank assets, these findings could also imply that bank lending is procyclical. This analysis may be supported by the positive correlation between loan growth and GDP.

Bank capital has a positive and statistically significant correlation with transaction deposits. Since deposits are fragile and prone to runs, it appears banks in the sample attempt to mitigate the risk of bank runs by increasing their solvency, that is, holding more capital. Loan growth is positively correlated with the macroeconomic variables savings ratio and central bank rate and the correlations are statistically significant. It seems household savings positively influence bank lending, probably because savings deposits increase banks funding. The positive and significant correlation between central bank rate and loan growth submits that monetary policy influences bank lending. Therefore, the study found evidence to support the intuition that monetary policy affects the bank lending channel.

Another interesting result is the positive and significant relationship between deposit loan synergy and transaction deposits. This association shows that the deposit loan synergy is determined by transaction deposits, suggesting that banks with high demand deposits inflows employ the deposit loan synergy to manage liquidity risk. Likewise, the positive correlation between deposit loan synergy and savings ratio implies that increased savings reinforce the deposit loan synergy, probably through increased savings deposits.

The key variable of interest in objective two analysis REGPRESS is positively correlated with liquid assets ratio; however, the correlation is not statistically significant. Its sign indicates that regulatory pressure positively affects banks' liquidity buffers. Although the variables bank size, capital, loan growth, return on equity, transaction deposits, deposit insurance, real gross domestic product and central bank rate have insignificant correlation with the dependent variable (liquidity asset ratio); most of their signs are in line with expectations.

5.3. UNIT ROOT TEST RESULTS

In order avoid spurious regression, data were first checked for the presence of unit roots using the Maddala and Wu unit root test, in particular the Fisher type unit root test based on Augmented Dickey-Fuller tests. The null hypothesis predicts that all panels contain unit roots whereas the alternative maintains that at least one panel is stationary. Table 5.3 below displays the results of unit root tests. The results presented in Table 5.3 shows that all variables are stationary at 1% level and integrated in levels which means that data used in this study did not contain unit roots hence the alternative hypothesis which states that at least one panel is stationary is upheld.

Table 5:3 Banks' liquidity management practices unit root test results

Variable name	Measurement	Chi-square value	Order of Integration
Liquid asset ratio (LAR)	Liquid Assets/Total Assets	192.6386***	0
Bank size (SIZE)	Ln (Total Assets)	256.1203***	0
Bank capital (CAP)	Tier 1 + Tier 2 capital / Total Risk Weighted Assets	110.1419***	0
Loan Growth (LG)	$\left(\frac{\text{Total loans in current year} - \text{Total loans in previous year}}{\text{Total loans in previous year}} \right)$	408.3699***	0
Asset quality (LLOSS)	Loan Loss Provisions / Gross Loans	277.0622***	0
Profitability (ROE)	Net Profit after Tax / Total Equity	255.4466***	0
Deposit-loan synergy (DLS)	Ln (Transaction Deposits*Loan Commitments)	254.9454***	0
Transaction Deposits (TD)	Ln (Total demand deposits)	130.8111***	0
Business cycle (GDP)	$\left(\frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \right)$	417.6138***	0
Savings ratio (SR)	Gross National Savings/Gross Domestic Product	281.0243***	0
Monetary Policy (CBR)	Central Bank Rate	277.5196***	0

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

5.4. RESULTS OF BANKS' LIQUIDITY MANAGEMENT PRACTICES

The appropriateness of system GMM procedure depends on the validity of instruments used and absence of autocorrelation in differenced errors. The Sargan test of instruments validity and Arellano and Bond test for zero autocorrelation in differenced errors were employed to check for the existence of these two conditions. Results in Table 5.4 show that instruments used are not over identified and the residuals exhibit only first order autocorrelation hence the estimation procedure employed in the study is substantiated. Moreover, these results confirm consistency of GMM estimator. The Wald test of joint significance reported a p-value of 0.000, demonstrating that the empirical model is properly fitted.

The first objective of the study attempts to ascertain liquidity management strategies pursued by banks in emerging market economies. This objective was achieved by examining whether banks operating in emerging market economies have optimal liquidity they pursue as well as to determine factors that influence liquidity adjustments of banks in emerging markets. This study hypothesizes that banks set and manage a certain level of liquidity that enables them to prudently and optimally manage their liquidity in order to insulate themselves against liquidity shocks. Consequently, bank managers are believed to have strong incentives to adjust their liquidity so as to reach their desired (target) ratio over time. Since banks' target liquidity levels are unobservable, actual liquidity was regressed on bank specific characteristics as well as macroeconomic factors that were assumed to significantly influence banks' liquidity adjustments. The results of estimating Equation 4.5 with system GMM estimator are presented in Table 5.4. In order to control for time fixed effects Equation 4.5 was re-estimated after incorporating time dummies into the regression equation. The results displayed in Model 1 relates to regression estimates without time dummies whereas results presented in Model 2 reports empirical estimates controlled for time fixed effects. Their expected influence on banks' liquidity dynamics are discussed herein. Moreover, the study also reports economic significance¹⁷ calculated at sample mean by dividing the product of standard deviation of explanatory variable and regression coefficient by the standard deviation of dependent variable.

¹⁷

$$\text{Economic impact} = \frac{\text{Standard Deviation}_{\text{independent variable}} \times \text{Regression Coefficient}}{\text{Standard Deviation}_{\text{dependent variable}}}$$

Economic significance of coefficients enable one to examine the economic impact of changes in the independent variable on the dependent variable (Miller and Rodgers, 2008).

Table 5:4: Banks liquidity management practices results

	Model 1		Model 2	
Variable	Coefficient Sign (1)	Economic impact (2)	Coefficient Sign (3)	Economic impact (4)
LAR _{ic,t-1}	0.5467*** (0.1508)	-	0.6681*** (0.1212)	-
SIZE	5.8783** (2.9607)	0.8702	2.0368 (2.6470)	0.3015
CAP	-0.0917 (0.2373)	-0.0181	-0.2147 (0.2667)	-0.0423
LG	0.0513*** (0.0148)	0.0555	0.0899*** (0.0168)	0.0971
LLOSS	-2.283*** (0.5783)	-0.2022	-1.8096*** (0.5237)	-0.1603
ROE	-0.1947*** (0.0286)	-0.1074	-0.1382*** (0.0294)	-0.0762
DLS	-0.2321*** (0.0390)	-0.2681	-0.2014*** (0.0435)	-0.2327
TD	11.9923** (5.6294)	0.7941	12.7741* (7.7582)	0.8459
DEPINS	63.4001 (97.4963)	0.8022	9.9682 (96.7466)	0.1261
GDP	1.8842** (0.8626)	0.1812	1.4419 (0.9295)	0.1387
SR	-1.3611*** (0.4114)	-0.3995	-1.7993*** (0.5144)	-0.3400
CBR	-0.4843 (0.5559)	-0.0598	-0.8904 (0.5925)	-0.1100
Time fixed effects	No	No	Yes	Yes
Arellano-Bond (2) test	0.6190		0.6273	
Sargan test	0.5911		0.4704	
Wald test	914.68***		2516.42***	

Source: Own construction based on data from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

Standard errors in the parenthesis (brackets).

5.4.1. Past level of liquidity ($LAR_{ic,t-1}$)

The coefficient of the lagged dependent variable is positive and statistically significant at 1% significance level. Therefore, the adoption of a dynamic panel model in this study is substantiated. Consistent with the trade-off theory, the positive and significant coefficient of the lagged dependent variable suggests that banks in emerging market economies have target liquidity levels and they partially adjust their liquidity to reach their desired liquidity level. Moreover, this evidence suggests that liquidity ratios banks in emerging market economies are persistent and banks in emerging markets actively managed their liquidity over the period of study. This finding is consistent with Delechat *et al.*, (2012) finding that liquidity ratios of banks in Central America are persistent. Without time dummies, the speed at which banks adjust their liquidity to revert to their target level is estimated to be 0.4533 (that is, 1 minus coefficient of lagged liquidity ratio (1-0.5467)). These results imply that banks close about 45% of deviation from their desired liquidity level within a year. At this speed of adjustment it would take roughly 2.27 years $\left(\text{that is, } \left(\frac{1}{\lambda}\right) = \left(\frac{1}{0.44}\right)\right)$ to reach their target. After controlling for time fixed effects, the speed at which banks in emerging market economies adjust their liquidity decreases to 0.3319, which is (1-0.6681). The speed at which banks in emerging market economies adjust their liquidity appears to be slow. This slow adjustment speed is consistent with the proposition that adjustment costs preclude banks to immediately revert to their target liquidity level, thereby confirming the hypothesis that adjustment costs create incentives for banks to maintain liquidity buffers.

Clark *et al.* (2009) highlighted that the adjustment process depends on two aspects: costs of adjusting towards the target level and costs of deviating from the desired liquidity level. Therefore, in the process of adjusting bank managers weigh the costs of adjusting and costs of being off target. If costs of being off target are lower than costs of adjusting, banks tend to adjust slowly their liquidity and vice-versa. From the empirical results, it seems costs of adjusting outweigh costs of being off target because banks in emerging market economies slowly adjust their liquidity level when they move away from their optimal level. Some of the factors that influence adjustment costs are market frictions such as asymmetric information, transaction costs and agency costs. These market frictions create strong incentives for banks to minimize adjustment costs by holding higher levels of liquidity. This evidence concur with Drobetz *et al.*,

(2014) finding that adjustment costs tend to be high in bank-based (emerging) economies relative to market-based (developed) economies because advanced economies have well-developed and vibrant capital markets which make it relatively easy for banks to adjust their liquidity. This analysis is also consistent with Ernst and Young (2013b) who reported that stock market capitalization as a proportion of GDP is about four times higher in advanced economies compared to emerging markets economies. Moreover, Ernst and Young (2013b) found that developed economies bond market size is almost $2\frac{1}{2}$ times greater than established emerging market economies like Malaysia and South Africa. Park and Mercado (2014) add that the size of bond issues is smaller in emerging market economies than mature markets like United States of America and United Kingdom. In support of this argument, the International Organization of Securities Commission (2011) highlights that the combined size of bond markets in emerging markets is almost 23% of the United States of America and 50% of Japanese bond markets. Individually, the United States of America bond market size is about 175% of GDP while Japanese bond market is roughly 198% of GDP compared to 43% and 70% for South Africa and Brazil respectively. Bond issues in emerging market economies are constrained by several factors. Chief among them country risks (such as political instability, capital and exchange controls), weak regulatory frameworks, low secondary market liquidity and narrow investor base (Erb *et al.*, 2000; Presbitero *et al.*, 2015). Furthermore, Goswami and Sharma (2011) observed that domestic bond issues in emerging market economies is still costly and cumbersome. This explains why most firms in emerging markets financing via bond issuance prefer private placements because regulatory costs of public listing are very high.

A comparative analysis of adjustment speeds of banks in bank based economies and market based economies may offer additional evidence to this analysis. In their study on liquidity management practices of banks in United States of America, De Young and Jang (2016) found that banks in United States of America adjust their liquidity by 27.15% per annum, meaning that they close 27% of the gap between their target and desired liquidity in a year's time. Their results demonstrate that banks in United States of America target and actively manage their liquidity. Comparing the findings of De Young and Jang (2016) and present study's empirical results, the proposition that adjustment costs are higher in bank based economies relative to market based

economies is supported. Consequently, difficulties in assessing external funding explain why banks in emerging market economies hold excess liquidity (Lastuvkova, 2017).

5.4.2. Bank Size (SIZE)

The coefficient of parameter is positive and very significantly different from zero (5.8783) in Model 1 (without time dummies). In terms of economic impact the coefficient elasticity evaluated at sample mean is 0.8702. This means a one standard deviation change in bank size contributes to 87% changes in bank liquid assets holdings, indicating that size significantly explains the size of liquidity buffer maintained by banks. This evidence refutes the hypothesis that big banks maintain low levels of liquidity and lend support to the conjecture that small banks depend more on themselves in liquidity management by keeping large liquidity buffers probably because they have limited access to external funding. These results concur with the findings of (Lastuvkova, 2014). Lastuvkova (2014), examined liquidity management strategies of banks in Czechoslovakia and found that small banks invest more in liquid assets compared to large banks, for precautionary reasons as they have limited external financing. In the context of this, Dinger (2009) highlights that size can significantly affect banks' liquidity holdings when refinancing costs are taken into account. Mega banks have better access to external liquidity compared to small banks as they are relatively known and creditors consider them to be less risky (Kosmidou, 2008). As a result, large banks have strong incentives to keep low levels of liquidity. Yet, small banks are assumed to be very risky which restricts their ability to access external liquidity support. This forces small banks to maintain large stocks of liquidity assets for precautionary reasons.

Alternatively, empirical results could be demonstrating that there is a paradigm shift in the way banks manage their liquidity in the Basel III era. Before the crisis, large banks maintained low levels of liquidity because they over relied on wholesale funding to manage their liquidity. Nevertheless, the crisis revealed the dangers of over dependence on volatile funding sources. In light of liquidity problems that caused pandemonium at large banks, the Basel Committee introduced liquidity standards to encourage banks to elevate their liquidity buffers especially systemically important ones (large banks). Since empirical results show that the influence of size on banks' desire to hold liquid assets is positive and statistically significant, research findings could be signifying that Basel III coerced large banks to increase their large

liquidity buffers. These results appear to be logical given that both regulators and the market expect large banks to change their liquidity management practices.

Another possible interpretation of these results could be that banks of all sizes are rebuilding their asset bases that could have been depleted by the global financial crisis (Berrospide, 2011). Berrospide (2011), points out that during the global financial crisis several banks suffered significant asset losses due to massive asset write-downs. To compensate for these asset losses banks, irrespective of their size, began to accumulate liquidity assets post the crisis and the period that banks have been repairing their asset bases corresponds with the study period of this thesis. Furthermore, Berrospide (2011) highlighted that liquidity hoarding in the aftermath of a severe crisis is not a new phenomenon. To substantiate this claim, Berrospide (2011) noted that in the aftermath of the 1933 Great Depression in United States of America, banks in United States of America built up significant amounts of liquidity reserves. Ramos (1996) documents that commercial banks build up their liquidity buffers following a crisis for two reasons: precautionary measures and to signal their solvency to the market in order to restore lost investors' and depositors' confidence. Thus, it can be inferred that banks of all sizes are rebuilding their liquidity reserves during the period of study that may have been eroded by the global financial crisis.

However, when time dummies are taken into account size turns out to be an indeterminate factor. The possible explanation of these results is provided by Alger and Alger (1999). Alger and Alger (1999), pointed out that if all balance sheet entries, including deposits and equity, are endogenized (regarded as securities) then the amount of liquid assets carried by a bank is independent of its size. This can be explained by the fact that any multiple of an optimal portfolio that is optimal for a given amount of equity and deposits is also optimal. In that case, the size of a bank is considered to be a random variable. Hence, the amount of liquid assets scaled by total assets is independent of bank size.

5.4.3. Bank capital (CAP)

The impact of bank capital on banks' liquidity assets holdings is negative, suggesting that banks with higher levels of capital tend to keep low liquidity since ample capital mitigates solvency risk which normally triggers bank runs. This interpretation is in line with Berger and

Bouwman (2005). Berger and Bouwman (2005), argue that a bank with significant capital tend to engage more in liquidity transformation since it can absorb significant losses. As a result, increased liquidity transformation causes a bank's liquidity to decrease. However, the coefficient of parameter is insignificant in both models (model with and without time fixed effects); thus, the hypothesis that banks with higher levels of capital maintain low liquidity could not be verified by empirical results. Consistent with the findings of Bonner *et al.* (2015), the implication of these findings is that capital has no significant impact on the size of liquidity buffer maintained by banks in emerging market economies. One plausible explanation to these findings could be that although capital creates incentives for banks to keep low liquidity its impact could have been affected by Basel III capital requirements. Basel III package requires banks to maintain both large liquidity and capital ratios. The joint management of liquidity and capital requirements might have reduced the influence of capital on banks' liquidity adjustments.

5.4.4. Asset quality (LLOSS)

The study expected that banks anticipating large credit losses maintain large liquidity buffers. However, contrary to expectations, the point estimate of loan loss reserves to gross loans variable which was used to proxy asset quality is negative with a coefficient of (-2.283) and it is statistically significant at 1% significance level in the absence of time dummies. In terms of economic significance, a one standard deviation increase in loan loss reserves causes liquid assets ratio to decrease by 20.22%, all else equal. These findings seem to support the asset quality signaling hypothesis proposed by Lucas and McDonald (1992). Lucas and McDonald (1992) suggest that an increase in loan loss reserves is interpreted as a sign of potential distress by creditors/funds suppliers which triggers them to cut liquidity supply to banks experiencing rising loan defaults (deteriorating asset quality). This means that banks facing asset quality deterioration may suffer significant withdrawals or decrease in external liquidity support. As evidence, Imbierowicz and Rauch (2014) observed that during the 2007 to 2009 financial crisis, several banks failed to roll over or obtain new funding from the interbank market due to increased riskiness of their asset portfolios. This evidence is consistent with Berrospide (2012) who stated that banks stopped lending among themselves and decided to hoard liquidity due to increased riskiness in their asset portfolios in the course of the recent global financial crisis. Similarly, Sarkar (2009) reports that during the crisis, investors became uncertain about the

credit risk underlying banks' structured products causing them to stop investing in banks' debt products thereby cutting funding to banks. In addition, Gale and Yorulmazer (2011) points out that counterparty risk arising from widespread exposure of banks to toxic sub-prime securities caused banks to stop lending to each other. Based on this analysis it can be argued that asset quality adversely affects the behavior of funds providers; hence, the study confirms the asset quality signaling hypothesis which maintains that growth in loan loss provisions (asset quality deterioration) diminishes banks liquidity.

5.4.5. Profitability (ROE)

The coefficient of Return on Equity (ROE) in Model 1 (Column 1, Table 5.4) is negative and significantly different from zero (-0.1947) at 1% level. The elasticity of bank profitability computed at sample mean is -0.1074. A 19.47% increase in bank profits causes banks in emerging markets to reduce their liquid assets holdings by roughly 11%, all things constant. It appears profitable banks in emerging market economies are less financially constrained in that they can easily raise external funding when the need arises. This decreases their need to maintain large liquidity reserves. Put differently, it seems profitable banks have a tendency of maintaining low liquidity because they experience less financial constraints when borrowing from funding markets, possibly because they are able to service debts. Similar results were obtained by Delechat *et al.* (2012) who found that profitable banks in Central America tend to keep low liquidity because they can easily obtain external funding from capital markets when they face liquidity shocks. This evidence is consistent with empirical evidence from advanced economies. For example, Bonner and Eijffinger's (2013) study conducted on a dataset of banks in the Netherlands found that profitable banks operate with low levels of liquidity because they can easily access funding from capital markets as they have the cash to service debts.

5.4.6. Loan growth (LG)

Loans are the principal source of revenue to banks. Since loans are illiquid assets, an increase in lending causes a bank's liquid asset holdings to decrease, *ceteris paribus*. As such, the amount of liquidity held by a bank is significantly influenced by loan demand. Therefore, banks tend to adjust their liquidity in response to existing lending opportunities, increasing liquidity when loan demand is weak and decreasing liquidity when lending opportunities grow

(Kashyap and Stein 2000). The study predicted that banks experiencing significant growth in lending maintain low levels of liquidity as most of their funds are tied in illiquid assets (loans). Thus, a negative relation between loan growth and bank liquidity was expected. However, empirical results show that the relationship between bank liquidity and loan growth is positive and statistically significant in both models, that is, model that is controlled for and not controlled for time fixed effects. In terms of economic significance, a one standard deviation change in loan growth leads to about 6% increase in bank liquidity (Model 1 results). Contrary to empirical evidence from developed markets, for example, Kochubey and Kowalczyk (2014); the study could not find evidence at conventional levels to support the conjecture that banks in emerging markets experiencing high loan growth maintain low liquidity. Research findings may be suggesting that banks in emerging markets increase liquid assets holdings as their loan business grows. This practice appears to be prudent since maturity transformation exposes banks to liquidity risk (Diamond and Dybvig 1983). This analysis concurs with the assertion of Mankart *et al*'s (2014) that banks can use liquidity assets to hedge liquidity risk emanating from the provision of long term loans that are funded by short term deposits. Moreover, this behavior could have been motivated by liquidity regulations imposed on banks in emerging market economies that require them to carry large liquidity buffers.

5.4.7. Transaction Deposits (TD)

The point estimate of the variable transaction deposits is positive and statistically significant (11.9923) at 5% level in the baseline model (model without time dummies). Its elasticity computed at sample mean in the baseline model is 0.7941. When transaction deposits increase by about 12 units banks' investments in liquid securities grow by about 0.79 units, all else equal. These findings suggest that bank deposits and liquidity increase (decrease) jointly in emerging markets, supporting the claim that banks with large demand deposits have a tendency of keeping large liquidity buffers. This evidence is consistent with empirical findings from developed economies. For instance, De Haan and Van den End (2013) conducted a study in Netherlands established that demand deposits positively impact banks liquid assets holdings. Kashyap *et al.* (2002) argues that an institution that provides liquidity on demand must invest in costly "overhead" in order to carry out this duty effectively. The "overhead" is described as a pool of cash and marketable securities that a depository institution must keep to cover short term

liquidity shocks. The buffer is necessary in a world of imperfect capital markets, which makes it difficult for banks to immediately source short term funding in financial markets. When capital markets are imperfect, commercial banks respond to market imperfection by accumulating liquidity reserves to hedge liquidity risk that may arise from the asset side of their balance sheets or their inability to borrow from the interbank market (Allen and Gale, 2004). Retail deposits therefore provide a reliable source of funding that contributes to the accumulation of liquidity buffers (Berrospide, 2011). Based on this interpretation, this study can conclude that commercial banks in emerging market economies use deposits to build up liquidity buffers for precautionary reasons. This finding is worth noting since it sheds light on the relationship between bank deposits and bank liquidity in the context of Basel III. The study has established that banks in emerging market economies use retail deposits to accumulate liquidity reserves. This behavior is consistent with LCR expectations. The rule requires banks to invest more in liquid securities and banks in emerging markets seem to be using funds sourced from stable retail deposits to elevate their liquid asset bases.

On the other hand, Le Lesle (2012) and Bonner *et al* (2015) contends that the positive impact of deposits on banks liquidity may imply that banks in emerging market economies have limited funding options. In other words, these results possibly lend support to the view that banks in emerging market economies have concentrated funding structures which are skewed towards retail deposits due to underdeveloped capital markets (Buehler *et al.*, 2013). An underdeveloped or rudimentary capital markets causes banks to have limited funding options which compels them to rely more on deposit funding. Besides holding liquid assets for precautionary reasons, banks may also maintain liquid assets for strategic reasons. Banks may accumulate liquidity reserves to capitalise on fire sales during a crisis, by buying assets at depressed values and reselling them later when conditions improve at higher prices (Gale and Yorulmazer, 2011).

5.4.8. Deposit – Loan Synergy (DLS)

The point estimate of the variable DLS has a negative sign (-0.2321) and is statistically significant at 1% level in the baseline model (Model 1). In terms of economic significance, a one standard deviation increase in deposit-loan synergy practice triggers banks in emerging markets to reduce liquid assets holdings by roughly 27%, *ceteris paribus*. Consistent with evidence from advanced economies Kashyap *et al.* (2002) and Gatev *et al.* (2004), empirical results substantiate

the proposition that commercial banks hedge liquidity risk through deposit-loan synergies. Kashyap *et al.* (2002) demonstrated that depository institutions can use a combination of transaction deposits and unused loan commitments to ameliorate liquidity risk. Under this strategy, banks would use cash inflows from depositors to satisfy loan requests from borrowers as long as cash demands of depositors are uncorrelated with borrowers' loan demands. This diversification synergy reduces the need for banks to maintain large liquidity reserves. As a result, banks that employ the deposit-loan synergy tend to operate with low liquidity as shown by empirical results. As evidence, Kashyap *et al.* (2002) highlighted that banks with a high proportion of transaction deposits scaled by total deposits have a tendency of offering more loan commitments. The results of Kashyap *et al.* (2002) were extended by Gatev *et al.* (2004) who examined in great detail the behavior of banks' deposits in a financial crisis by analyzing the response of bank deposits to the 1998 liquidity crisis that was triggered by the failure of Long Term Capital Management. The principal argument of their paper was that the deposit-loan synergy proposed by Kashyap *et al.* (2002) becomes more powerful in times of financial crisis since investors normally switch their funds from capital markets to banks in search of safe havens. To prove this, Gatev *et al.* (2004) tested how funding behaved during the first weeks of October 1998 when banks faced an unprecedented demand for funds from companies that failed to roll over their debt instruments. They found that depository institutions with more transaction deposits in the period just before the start of the crisis had significant deposit inflows which were mainly concentrated in transaction deposits relative to other types of deposits. Contemporary evidence offers support to Gatev *et al.*'s (2004) argument. For instance, the American Bankers Association (2017) established that banks in the United States of America actually received deposits to the tune of \$813 billion between 2007 and 2009, demonstrating that savers move their funds to banks in times of crisis. Likewise, the study established that diversification benefits can be derived by combining demand deposits and loan commitments.

Gatev and Strahan (2006) further extended the work of Kashyap *et al.* (2002) to demonstrate the unique aptitude of banks to mitigate systematic liquidity risk by using the deposit-loan strategy. Their study argued that because of their sole ability to use deposit inflows to provide funding to non-financial entities when they experience liquidity shocks in the commercial paper market, banks can insulate firms against liquidity shocks by providing funding at a cost that is relatively lower than other lenders. Gatev and Strahan (2006) demonstrated that

when liquidity evaporates and commercial paper spreads increases, banks actually experience heightened deposits inflows. These flows enable them to satisfy loan demand from firms drawing down their credit line facilities without running down their liquidity buffers. This study offers that banks in emerging markets with withdrawal requests that are uncorrelated with borrowers' loan demand can maximize their profits by investing less in liquid securities that earn low returns using the deposit-loan synergy.

5.4.9. Deposit insurance (DEPINS)

Deposit insurance schemes were mainly enacted to reduce bank runs (Diamond and Dybvig, 1983; Pennachi, 2006). They result in increased deposits taking because they build depositors confidence (Chernykh and Cole, 2011). However, its presence may create incentives for banks to invest in risky assets leading to low investments in liquid assets (Barth *et al.*, 2004). Consequently, an inverse relationship between deposit insurance coverage and bank liquidity was predicted. Contrary to expectations, results show that the point estimate of deposit insurance on banks liquidity is positive, but not significantly different from zero (p value is 0.516¹⁸ in Model 1). Therefore, the hypothesis that deposit insurance coverage incentivizes banks in emerging market economies to keep low levels of liquidity is not confirmed. Although the coefficient is statistically insignificant, its sign may warrant analysis. The strong positive point estimate on the variable DEPINS may be demonstrating that deposit insurance positively influences liquidity positions of banks in emerging markets as it stems bank runs (Diamond and Dybvig, 1983). This view is in line with observations made by Subhanij (2010) that banks in emerging markets managed to weather liquidity shocks during the 2007 to 2009 financial turmoil due to deposit insurance.

5.4.10. Business cycles (GDP)

Business cycles seem to influence banks decisions to maintain liquidity buffers. The coefficient of real GDP growth is positive and statistically significant at 1% significance level. The estimated coefficient of 1.8842 in the model without time dummies corresponds to a sensitivity value of 0.1812. A one unit increase in real GDP growth contributes to 0.1812 unit increase in banks liquidity, all things constant. The positive association between business cycles

¹⁸ Not reported for brevity.

and bank liquidity implies that bank liquidity in emerging market economies is procyclical. This evidence conveys that banks operating in emerging market economies build-up their liquidity holdings when the economy is doing well and run down their buffers when the economy enters into a recession. A plausible explanation to these findings is provided by Vodova (2013). Vodova (2013) argues that banks tend to increase their liquid assets holdings during economic booms because households and firms are awash with liquidity from higher income and higher business profits respectively. Consequently, households and firms may prefer to depend more on internal funding when the economy is booming which reduces demand for bank loans. In the same vein, during recessions, demand for bank credit may rise as households and firms seek external funding to smooth out the effects of falling household incomes and business profits. Therefore, as banks invest more in loans their liquidity holdings tend to decrease.

On the other hand, this evidence may be demonstrating that there are differences in liquidity behavior of banks in advanced economies. Aspachs *et al.* (2005) found that liquidity of banks in United Kingdom is countercyclical, meaning that banks in the United Kingdom accumulate liquidity buffers in times of crisis and lend more in times of good economic prospects. Yet, empirical results suggest that bank liquidity in emerging markets is procyclical. One factor that may explain why banks in mature economies hoard liquidity in periods of crisis and banks in emerging markets lend in times of crisis is the difference in funding structures between the two markets. Banks in emerging markets tend to rely more on retail deposits that are stable, permitting them to lend even in times of crisis while banks in developed economies tend to depend more on volatile short term wholesale funding which constrains their ability to lend in times of crisis as it suddenly evaporates.

5.4.11. Savings level (SR)

High levels of household savings give banks a large pool of savings deposits which in turn improves their liquidity (Sabunwala, 2012). Accordingly, the present study expected savings to positively affect liquidity adjustment dynamics of banks in emerging markets. Contrary to expectations, regression results in Column 1, Table 5.4, indicate that savings negatively affect bank liquidity. A 1.36 unit increase in savings motivates banks to decrease investments in liquid assets by about 0.40 units, all else equal. Consequently, the hypothesis that an increase in savings improve the liquidity of banks in emerging markets could not be supported. These results could

imply that banks in emerging market economies invest less national savings in liquid securities, rather it seems they channel most of the savings towards productive investments aimed at spurring economic growth and job creation (Gaytan and Ranciere, 2006). This evidence may render support to the notion that firms in emerging market economies mainly rely on banks for long term funding since banks appear to be investing most of their savings deposits in loans. This view is in line with Financial Stability Board (2011) assertion that emerging markets are characterized by concentrated and less complex financial systems and banks play a large role in financial intermediation because capital markets and other financial institutions are still underdeveloped.

5.4.12. Monetary policy (CBR)

Throughout the world, central banks control aggregate financial system liquidity using several monetary policy tools. This intervention is aimed at stimulating aggregate economic activity. This study used the central bank rate to proxy monetary policy. When the central bank tightens (loosens) monetary policy by rising (decreasing) the central bank rate aggregate liquidity decreases (increases). The estimated coefficient of central bank rate is negative in both models (model with and without time fixed effects), suggesting that banks in emerging markets respond to policy rates hikes by reducing their liquid assets holdings. However, consistent with International Monetary Fund (2009), the study could not find enough statistical evidence at conventional levels to support the hypothesis that monetary policy affects banks liquidity adjustments because the coefficient of CBR is statistically insignificant in both models. The insignificant impact of monetary policy changes on banks' liquidity adjustments may be demonstrating that banks in emerging market economies respond to monetary policy tightening by reducing their liquidity buffers, but the impact is not large enough to yield significant effect. Moreover, the International Monetary Fund (2009) suggests that the ineffectiveness of monetary policy in emerging markets may be attributed to global financial crisis strains that might have buckled monetary policy transmission in emerging market economies. Furthermore, the interplay between monetary policy and banks' liquidity buffers could be attributed to high liquidity carried by banks in emerging markets. Subhanij (2010) documents that banks in emerging markets operate with large liquidity buffers; therefore, the fact that banks in emerging market economies maintain high liquidity means that monetary policy tightening may not entice banks to

significantly lower their liquidity. Moreover, fiscal policies adopted in emerging markets may also deter monetary policy pass through. An expansionary monetary policy leads to a large fiscal deficit, *ceteris paribus*, which may result in increased monetary financing by the central bank through seignorage or domestic borrowing. Literature suggests that there is high government borrowing to finance budget deficits or infrastructure projects in emerging markets. For example, the study of Emran and Farazi (2008) attempted to estimate the extent of government borrowing in emerging markets and found that there is considerable crowding out in emerging markets. In particular, their paper shows that an increase in government domestic borrowing by US\$1 reduces private sector credit by US\$0.80. This evidence may lend support to the principal argument of this study that fiscal policies in emerging market economies from domestic markets impedes monetary policy pass through.

5.5. MODEL EXTENSIONS

5.5.1. Test for financial frictions

Empirical results presented in Section 5.4.1 (above) suggested that banks in emerging market economies partially adjust due to financial frictions. Therefore, in this section the study attempts to investigate whether banks in emerging markets are financially constrained as suggested by empirical results. The concept of financial frictions and firm investment has been studied widely in corporate finance. Researches by Almeida *et al.* (2004), Denis and Sibilkov (2009) and Kwenda (2017) examined capital market frictions faced by non-financial firms by hypothesizing that firm investment is determined by cash flows. In other words, these studies tried to ascertain whether frictions in capital markets impede firms' investments, by interpreting a positive nexus between cash flow and investment as an indication of financial constraints. Following previous studies that examined the cash flow-investment nexus in corporate finance the present study investigates whether banks in emerging markets are financially constrained as a result of frictions in credit markets. Following Jayaratne and Morgan (1997) the study used loan growth as a proxy for firm investment and deposits growth as a proxy for cash flow and interprets a strong positive association between loan growth and deposits growth as evidence that banks in emerging market economies face financial constraints in funding markets that preclude them to adjust instantly. For investigation, the following empirical model is formulated.

$$LG_{ict} = \beta_0 + \lambda LG_{ic,t-1} + \beta_1 DG_{ict} + \beta_2 X_{ict} + \varepsilon_{it} \quad (5.1)$$

where: subscripts i, c, t refers to bank i in country c at time t .

LG_{ict} : Loan growth which is given as gross loans in the current period minus gross loans in the previous period divided by gross loans in the previous period used to proxy firm investment.

DG_{ict} : Deposits growth which is expressed as the difference between current year deposits minus previous year deposits divided by previous year deposits used to proxy Cash flows.

X_{ict} : Set of control variables.

λ : Speed of adjustment.

$\beta_0; \beta_1$ and β_3 : Coefficients to be estimated.

ε_{it} : Error term

a. Financial frictions and banks' investment results presentation and discussion

The results for estimating Model 5.1 with system GMM are presented in Table 5.5, Column 1 (page 169). The coefficient of interest in this model is β_1 . If frictions in credit markets engender banks to rely on deposits, the study expects $\beta_1 > 0$, meaning that reduction in bank deposits causes banks to reduce lending. The coefficient for deposits growth, proxy of cash flow, is 21.83 and it is precisely defined. These findings demonstrate that bank lending, proxy for firm investment, is strongly sensitive to cash flows. The cash flow elasticity computed at sample mean by dividing the product of standard deviation of explanatory variable and regression coefficient by standard deviation of dependent variable is 0.10. A 21.83 unit increase in cash flow contributes to a 10 unit growth in bank lending. The sign and economic impact of deposits growth coefficient can be interpreted as evidence that banks in emerging markets are financially constrained due to frictions in funding markets. It seems financing frictions inhibits banks in emerging market economies to raise external financing when lending opportunities grow. The positive coefficient of deposits growth (cash flow) is consistent with empirical evidence from advanced economies. For instance, Jayaratne and Morgan (1997) obtained an elasticity of 0.37 for banks in United States of America. A comparative analysis of Jayaratne and Morgan (1997)

and this study's results shows that bank lending (investment) sensitivity varies between emerging and advanced economies. Bank lending is more responsive to deposits growth in advanced countries than emerging countries probably because banks in developed countries quickly adjust their loan books in reaction to growth in deposits than banks in emerging markets. Moreover, this analysis attempts to justify initial results that suggested that banks in emerging market economies partially adjust their liquidity because they face significant costs to source external funding liquidity.

b. Extension

Extant literature argues that both small and lowly capitalized (highly leveraged) banks tend to be more financially constrained than large and well-capitalized banks (Kashyap and Stein, 1995, Jayaratne and Morgan 1997, Berger and Bouwman 2009). This can be attributed to the fact that small and highly leveraged banks generally have low credit ratings and high probability of default which affects their external fund raising efforts. In light of this, the study extends Model 5.1 in order to check whether financing frictions are more pronounced at small and highly leveraged (low capital) banks as suggested in literature. To test these hypotheses the study creates two dummy variables LOW CAPITAL and HIGH CAPITAL to identify highly geared and lowly leveraged banks respectively. Similarly, two dummy variables SMALL and LARGE are created to split the sample between small and large commercial banks respectively. The dummy variables are interacted with the variable CF (cash flow) to investigate the sensitivity of investment (bank lending) to cash flows (deposits growth) for small and large banks as well as lowly and highly capitalized banks. Similar to Giordana and Schumacher (2017) small and large banks are differentiated based on sample median (50th percentile). Banks below the 50th percentile with respect to size are considered to be small while those above the median are regarded as big banks. Likewise, banks with a capital ratio below the median capital ratio are taken as highly geared (lowly capitalized) banks while banks with capital ratios above the 50th percentile are considered to be highly capitalized.

Equations 5.2 and 5.3 indicate the sensitivity of bank lending (investment) to bank deposits growth (cash flows) after separating low and high capital banks as well as small and large banks respectively.

$$INV_{ict} = \beta_0 + \lambda INV_{ic,t-1} + \beta_1 LOW\ CAPITAL + \beta_2 CF_{ict} * LOW\ CAPITAL + \beta_3 HIGH\ CAPITAL + \beta_4 INV_{ict} * HIGH\ CAPITAL + \beta_5 X_{ict} + \varepsilon_{it} \quad (5.2)$$

$$INV_{ict} = \beta_0 + \lambda INV_{ic,t-1} + \beta_1 SMALL + \beta_2 CF_{ict} * SMALL + \beta_3 LARGE + \beta_4 INV_{ict} * LARGE + \beta_5 X_{ict} + \varepsilon_{it} \quad (5.3)$$

The results of estimating Models 5.2 and 5.3 with system GMM estimator are displayed in Table 5.5, Columns 2 to 5 below. Regression results in Columns 2 and 3, Table 5.5 shows that the coefficient of highly leveraged and lowly geared banks is strongly negative and statistically significant at 5% and 1% respectively. The cash flow elasticity for low and high capital banks determined by dividing the product of standard deviation of the independent variable and regression coefficient by standard deviation of dependent variable is -138.9802 and -367.2842 for highly leveraged and lowly leveraged banks respectively. These results indicate that the sensitivity of bank lending (investment) to deposit growth (cash flow) is significant for both low and highly capitalized banks. The sensitivity of investments to cash flows for banks with high capital is lower than the sensitivity of banks with low capital. These results suggest that reduction in deposits funding adversely affects lending activities of highly geared firms than well capitalized firms, consistent with the intuition that financial frictions are more pronounced at highly geared than lowly geared banking institutions. Possible explanation of these results could be that a decrease in deposits causes lowly capitalized banks to reduce their lending than highly capitalized banks because they have limited access to external financing. Highly capitalized banks can mitigate deposits constraints by borrowing while highly geared firms face difficulties to maintain or increase their lending when faced with deposit funding shocks because they cannot easily raise external funding due to their high leverage.

Table 5.5: Financial constraints results

Variable	Baseline model (1)	Low Capital banks (2)	High Capital banks (3)	Small banks (4)	Large banks (5)
Cash flow (CF)	21.8291** (11.1315)	26.7327*** (10.3884)	21.2259** (10.2401)	-7.9575 (11.2168)	17.3513 (12.7002)
CF*Low Capital	-	-138.9802** (57.1527)	-	-	-
CF*High Capital	-	-	-367.2842*** (96.1651)	-	-
CF*Small	-	-	-	38.5662** (10.0807)	-
CF*Large	-	-	-	-	1.7405* (2.2052)
Sargan test	0.4121	0.2932	0.3260	0.1644	0.3866
Arellano Bond (2) test	0.3649	0.3163	0.3693	0.3554	0.3716

Source: Own construction based on Bankscope data

***, **, * indicates statistical significance at 1%, 5% and 10% respectively.

Standard errors are shown in parenthesis ().

Control variables coefficients are not reported to control brevity.

The results for the sensitivity of bank lending to deposit funding for small and large banks are displayed in Columns 4 and 5, Table 5.5. The elasticity of bank lending to deposits growth for small and large banks calculated at sample mean by dividing the product of standard deviation of the explanatory variable and regression coefficient by standard deviation of dependent variable is 38.5662 and 1.7405 respectively. Consistent with Kashyap and Stein (1995) and other previous studies carried out in advanced economies, empirical results seems to suggest that large banks in emerging markets are less financially constrained than small banks since the sensitivity of small banks to deposits' changes is higher than that of big banks. Jayaratne and Morgan (1997), provides two reasons that attempt to explain why large banks may be less financially constrained than small banks. First, large banks may be old institutions which are well-known and have built good reputation in funding markets which in turn enables them to easily obtain debt funding. This opinion is in line with literature on bond issue determinants. Mizen *et al.* (2008) concluded that bond issuance is determined by previous history of bond issuance of the concerned firm. Old firms that have issued bonds before tend to have greater changes of receiving good subscriptions on their bond issues than to new comers. Moreover, Jayaratne and Morgan (1997) suggests that large banks might have more transparent assets because they lend to less monitoring intensive loans like loans to small to medium enterprises. Such loan books enhance their chances of obtaining funding in capital markets.

Overall, empirical results have demonstrated banks loan growth (investment) is positively and significantly driven by deposits' growth (cash flow). Thus, the study found evidence to substantiate the claim that banks in emerging markets are financially constrained, which inhibits them to instantly adjust their liquidity. Besides explaining financial frictions, this evidence may also be useful in analyzing the bank lending channel for banks in emerging markets. Specifically, these results may provide insights into the reaction of banks of different sizes to monetary policy contraction. Kashyap and Stein (1995), argues that if the bank lending channel view is correct, then small and large bank would react differently to monetary policy tightening. Research findings suggest that the bank lending channel of monetary policy implementation works more effectively via small and lowly capitalized banks in emerging market economies. This is consistent with evidence from advanced markets. For example, Aspachs *et al.* (2005) found that monetary policy tightening is more effective in small and less liquid banks in United Kingdom.

Kashyap and Stein (1995) went on to highlight that small banks tend to cut back lending more than large banks when confronted with monetary policy shocks as they are more financially constrained than big banks. By and large, these results contribute to extant literature that examines cash flow constraints in non-financial firms by offering empirical evidence from banks' perspective and most importantly from emerging markets context.

5.5.2. Test for size effect

Lastuvkova (2014) and other scholars assert that banks have different characteristics and are affected by different factors. As such, banks of different sizes are likely to employ different liquidity management strategies. For example, large banks may target low liquidity buffers because they rely more of wholesale funding. This behavior is consistent with the “too big to fail” theory which states that big banks tend to target low liquidity because they know that they are highly likely to be bailed out in the event that they face acute liquidity problems as a result of their systemic importance to prevent systemic risk. On the other hand, small banks may target large liquidity buffers as they have limited access to liquidity support. This suggests that large banks tend to depend on capital markets for liquidity management while small banks may depend on themselves for liquidity management. By and large, large banks are likely to pursue a wholesale oriented business model while small banks may pursue a retail business model focused on traditional financial intermediation.

Moreover, the literature of Berger and Bouwman (2009) suggest that liquidity creation differs among banks of different sizes. In particular, their study found that capital positively (negatively) affects liquidity positions of large (small) banks consistent with the risk absorption and financial fragility-crowding out effect respectively. Accordingly, this study hypothesizes that liquidity management practices of banks in emerging market economies are likely to vary depending on their size. To test this hypothesis the study splits the sample into two: small and large banks. The former relates to banks with a size median value below the sample size median value (50th percentile) while the latter describes banks with a size median value above the sample size median value (50th percentile). Thus, two dummy variables SMALL and LARGE which identify small and large banks respectively were separately added to Equation 4.5 to yield Equation 5.4 and 5.5.

$$LaR_{ict} = \alpha + \lambda LaR_{ic,t-1} + \beta_1 CAP_{ict} + \beta_2 SMALL_{ict} + \beta_3 LG_{ict} + \beta_4 LLOSS_{ict} + \beta_5 ROE_{ict} + \beta_6 DLS_{ict} + \beta_7 TD_{ict} + \theta DEPINS_{ct} + \gamma_1 GDP_{ct} + \gamma_2 SR_{ct} + \gamma_3 CBR_{ct} + \eta_t + v_{it} + \varepsilon_{it} \quad (5.4)$$

$$LaR_{ict} = \alpha + \lambda LaR_{ic,t-1} + \beta_1 CAP_{ict} + \beta_2 LARGE_{ict} + \beta_3 LG_{ict} + \beta_4 LLOSS_{ict} + \beta_5 ROE_{ict} + \beta_6 DLS_{ict} + \beta_7 TD_{ict} + \theta DEPINS_{ct} + \gamma_1 GDP_{ct} + \gamma_2 SR_{ct} + \gamma_3 CBR_{ct} + \eta_t + v_{it} + \varepsilon_{it} \quad (5.5)$$

Equations 5.4 and 5.5 allow the study to ascertain whether liquidity management strategies differ according to bank size. The results of estimating Equations 5.4 and 5.5 using the two-step GMM estimator are presented in Table 5.6 and discussed herein.

Table 5.6: Size effect results

Variable description	Variable measurement	Whole Sample (1)	Small Banks (2)	Large Banks (3)
Lagged liquid asset ratio (LaR _{ic, t-1})	Liquid asset ratio in the t is equal to previous period liquid asset ratio	0.5467*** (0.1508)	0.8382*** (0.2721)	0.6927*** (0.1660)
Bank capital (CAP)	Tier 1 + Tier 2 Capital / Total Risk Weighted Assets	5.8783** (2.9607)	2.2815*** (0.4931)	-0.1588 (0.3139)
Bank size (SIZE)	Ln (Total Assets)	-0.0917 (0.2373)	-	-
Loan Growth (LG)	$\left(\frac{\text{Total loans in current year} - \text{Total loans in previous year}}{\text{Total loans in previous year}} \right)$	0.0513*** (0.0148)	0.0433** (0.0222)	0.0584*** (0.1135)
Asset quality (LLOSS)	Loan Loss Provisions / Gross Loans	-2.283*** (0.5783)	2.0690 (1.4027)	-2.1115** (0.8373)
Profitability (ROE)	Net Profit after Tax / Total Equity	-0.1947*** (0.0286)	0.1952*** (0.0603)	-0.1760*** (0.0452)
Deposit-loan synergy (DLS)	Ln (Transaction Deposits*Loan Commitments)	-0.2321*** (0.0390)	0.1834*** (0.0521)	-0.0623 (0.0679)
Transaction Deposits (TD)	Ln (Total demand deposits)	11.9923** (5.6294)	4.0565 (3.5735)	17.3825*** (5.7208)
Deposit insurance coverage (DEPINS)	Dummy variable = 1 for country with deposit insurance scheme and zero otherwise.	63.4001 (97.4963)	95.3926** (40.2759)	-205.1127*** (48.7456)
Business cycle (GDP)	$\left(\frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \right)$	1.8842** (0.8626)	-2.4793*** (0.8361)	1.9277** (0.8473)
Savings ratio (SR)	Gross National Savings/Gross Domestic Product	-1.3611*** (0.4114)	0.0407 (0.5627)	-0.9750 (0.4493)
Monetary Policy (CBR)	Central Bank Rate	-0.4843 (0.5559)	-0.4296 (0.2744)	0.4642 (0.4262)
Sargan test Arellano Bond test Wald test			0.5345	0.3492
			0.8638	0.4713
			11800.63***	6043.16***

Source: Own construction based on Bankscope data
***, **, * indicate statistical significance at 1%, 5% and 10% respectively.
Standard errors are shown in parenthesis (brackets).

5.5.2.1. Lagged dependent variable (LaR_{ic,t-1})

The point estimate for the lagged liquidity ratio variable is positive and statistically significant for both small and large banks, meaning the adoption of a partial adjustment model in this study is substantiated. Of interest in this analysis is the rate at which small and large banks in emerging market economies adjust their liquidity. The speed of adjustment calculated as 1 minus the coefficient of the lagged liquidity ratio is 0.1618 for small banks and 0.3073 for large banks.

At this rate, it would take small banks roughly 6.18 years, that is $\left(\frac{1}{\lambda}\right) = \left(\frac{1}{0.1618}\right)$ to close their

liquidity gap and 3.25 years that is $\left(\frac{1}{\lambda}\right) = \left(\frac{1}{0.3073}\right)$ for large banks to revert to their target

liquidity ratio. Overall, in line with earlier findings, these results demonstrate that banks in emerging market economies adjust their liquidity slowly. Moreover, this evidence highlights that large banks in emerging markets adjust their liquidity at a rate that is higher than small banks. This difference in adjustment speeds can be attributed to financial frictions faced by banks in capital markets. Consistent with previous findings and extant literature, small banks tend to face higher adjustment costs than large banks because they are considered to be risky and relatively unknown than big banks in funding markets (Alger and Alger, 1999). This may explain why small banks adjust their liquidity at a slower rate than big banks.

5.5.2.2. Bank capital (CAP)

The positive coefficient of the variable Bank Capital (CAP) shows that capital positively influences liquidity adjustments in small banks. On the other hand, although statistically insignificant, the point estimate for the variable CAP indicates that growth in capital motivates large banks to lower their liquidity buffers. Empirical results seem to suggest that the risk absorption effect holds for large banks while the financial fragility effect is strong for small banks. The risk absorption theory states that increases in capital entice banks to create more liquidity (to lend more) as they can absorb more risk (Repullo, 2004; Berger and Bouwman, 2009); thereby reducing their liquidity buffers. Since the study established a negative relationship between changes in capital and liquidity for large banks, it can be inferred that growth in capital creates incentives for large banks to invest more in risky assets (loans) than liquid securities but this behavior appears not to be strong as the coefficient of CAP on large

banks is statistically insignificant. Likewise, in line with the financial fragility theory, it seems a fragile capital structure entices small banks to hold more liquid assets. Another reason that may explain exhibited differences in liquidity management practices of small and large banks could be the role played by capital when borrowing. Capital enhances the creditworthiness of a borrower; therefore, as a bank's equity capital grows, its ability to tap capital markets is enhanced. Moreover, high equity capital enables a bank to borrow at favorable rates. As such, large and well-capitalized banks in emerging markets seem to have strong incentives to carry low liquid as they can cover liquidity gaps with wholesale funding. This behavior is consistent with empirical evidence from advanced markets, for instance Berger and Bouwman (2009) and Kochubey and Kowalczyk (2014). These studies document that large banks maintain low liquid as they constantly tap funding from debt markets. All in all, empirical findings suggest that capital growth motivates large (small) banks to maintain low (high) levels of liquidity.

5.5.2.3. Loan growth (LG)

Loan growth positively influences liquidity holdings of small and large banks in emerging markets as the coefficient of parameter is both positive and statistically significant in both estimates. The coefficient for small banks is 0.0433 while the coefficient for large banks is 0.0584. It seems the impact of loan growth has is similar effect (in terms of statistical and economic significance) on liquidity adjustments for banks of all sizes in emerging markets since the coefficients are not significantly different. In concurrence with previous findings, this evidence may be demonstrating that both small and mega banks in emerging market economies reduce their liquidity buffers when confronted with rising loan demand. In other words, it seems both small and large banks invest less in liquid assets when they are experiencing growing loan demand. From these results, it can be inferred that banks in emerging markets (of all sizes) respond to growing loan demand by decreasing their investments in liquid securities. This management style may be motivated by profit desire: banks could be reducing their investments in low yielding liquid assets when they experience booming loan business so as to maximize profits. This evidence is worth noting as it reveals that there is need for regulators in emerging markets to implement risk sensitive capital requirements that compel banks to hold capital in proportion to their risk exposure so as to engender banking sector stability. In view of these

results, the study advocates for the application of Basel III capital requirements in emerging market economies.

5.5.2.4. Asset quality (LLOSS)

Initial results for the whole sample presented in Column 1, Table 5.6, revealed that banks experiencing deteriorating asset quality tend to experience reductions in their liquidity positions. The explanation given for this behavior was that funders shun banks with raising loan defaults. This behavior appears to be prevalent in large banks since the coefficient of LLOSS is positive and statistically significant for large banks regression estimates. This means that the signaling hypothesis of asset quality proposed by Lucas and McDonald (1992) appears to be strong in big banks. The implication of these results is that mega banks in emerging markets experiencing waning asset quality suffer large liquidity losses possibly because fund providers cut back or withdraw their money. The point estimate for LLOSS in Column 2, Table 5.6, although it is not significantly different from zero, may suggest that growth in expected loan losses motivates small banks to increase their liquidity buffers. It seems small banks are conservative than large banks in that they increase their liquidity buffers when they anticipate large credit losses consistent with the notion that banks expecting rising loan loss reserves to gross loans to maintain large liquidity buffers (Delechat *et al.*, 2012). One factor that could explain the behavior of small banks is that they tend to more rely on themselves for liquidity management (Lastuvkova 2017); hence, they tend to be very conservative in their liquidity management.

5.5.2.5. Profitability (ROE)

The results in Column 2, and 3 Table 5.6, show that profitability positively affects liquidity adjustments of small banks while negatively affecting liquidity changes at large banks. These results suggest that small banks invest part of their profits in liquid securities to build their liquidity reserves. On the other hand, similar to previous whole sample results, it appears a surge in profits motivates large banks to invest less in liquid assets. The behavior of large banks could be motivated by the fact that high profits enable a bank to service debts; therefore, large banks in emerging market economies appear to invest less in liquid securities as they can tap external funding easily.

5.5.2.6. Deposit loan synergy (DLS)

The deposit loan – synergy postulates that banks can use cash from deposits to meet its committed credit line drawdowns. This strategy permits banks to carry low liquid assets. Empirical results presented in Columns 2, and 3 Table 5.6, show that DLS is negatively (positively) related to liquid assets ratio for large (small) banks. Despite the fact that the point estimate for DLS is statistically insignificant in the large banks model, its sign may provide insights into liquidity management strategies of large banks. The negative coefficient suggests that large banks employ the deposit loan synergy to manage liquidity risk. The positive point estimate in the small banks model may be demonstrating that the deposit-loan synergy does not incentivize small banks in emerging markets to carry low liquidity. All in all, it seems small banks in emerging market economies maintain large liquidity buffers than large banks probably for precautionary reasons as they have limited access to external funding.

5.5.2.7. Transaction deposits (TD)

The coefficient of parameter transaction deposits is positive in all models and statistically significant in the large banks model. The statistically significant positive association between changes in transaction deposits and changes in liquidity ratios for large banks in emerging markets demonstrates that deposits matter for liquidity in large banks. Likewise, the statistically insignificant impact of demand deposits on liquidity holdings for small banks suggests that deposits do not determine liquidity positions of small banks. As argued by Alger and Alger (1999), large banks have more at stake to lose in the event of failure; hence, they may have strong incentives to invest more deposits in liquid assets to mitigate liquidity risk. On the other hand, the insignificant impact of transaction deposits on changes in small banks liquidity implies that small banks do not significantly use deposits to build up their liquidity buffers. They could be using capital and profits to augment their liquidity reserves as shown by significant positive signs on the variables capital and return on equity.

5.5.2.8. Deposit insurance (DEPINS)

The main reason for the creation of deposit insurance schemes is to prevent bank runs triggered by loss of depositor confidence (Diamond and Dybvig, 1983). The assurance that depositors will be reimbursed their money upon the failure of their bank is expected to build

depositors confidence and reduce panic withdrawals that may lead to bank runs. As such, deposit insurance coverage is expected to positively influence bank liquidity. Empirical results show that this effect appears to be popular at small banks since the coefficient of DEPINS is positive and significantly different from zero in small banks model. In contrast, the point estimate of DEPINS is negative and statistically significant in the large banks model. It seems the moral hazard effect associated with deposit insurance is also prevalent in large banks operating in emerging market economies consistent with the behavior of banks in advanced economies. The moral hazard effect of deposit insurance states that, due to deposit insurance that guarantees reimbursement of depositors by a third party, banks tend to invest more in risky assets than liquid securities (McCoy 2006). Large banks behavior seems to be motivated by profit desires. The fact that depositors are insured may be enticing them to invest in risky assets thereby carrying low liquid assets.

5.5.2.9. Business cycle (GDP)

Empirical results show that growth in real domestic output creates incentives for small (large) banks to keep low (high) liquidity. The negative coefficient on the variable GDP in the small banks model implies that liquidity buffers for small banks in emerging market economies is countercyclical. Small banks in emerging markets appear to build up their liquidity buffers in times of good economic prospects and drawing down their buffers in times of economic recession. Likewise, the positive impact of GDP on changes in large banks liquidity demonstrates that liquidity buffers for big banks in emerging market economies is procyclical. It seems large banks in emerging markets accumulate liquidity when economic prospects are good and reduce their buffers in times of economic recession. The reason for this behavior could be that, in times of economic booms, households and firms have more disposable income and business profits respectively, which reduce their demand for credit during economic booms, permitting banks to build their liquidity buffers (Vodova, 2013). Concomitantly, it appears large banks in emerging markets increase their lending in times of crisis thereby depleting their liquidity buffers. The behavior of large banks is worth noting because it is consistent with LCR expectations. The LCR requires banks to build up their buffers in good times and deplete them (by lending) in bad times to ease economic recession. The negative and statistically significant association between real GDP growth and liquidity asset ratio in Column 2, Table 5.6, suggests

that liquidity for small banks is countercyclical. This means small banks in emerging market economies hoard liquidity in times of economic recession and draw down their buffers in good times. It seems small banks in emerging market economies cut back lending in times of economic downturns probably because of increased default risk and weak loan demand and draw down their buffers when economic prospects are good. Succinctly, the study found that liquidity buffers for large (small) banks in emerging market economies appear to be procyclical (countercyclical).

5.5.2.10. Savings ratio (SR)

Consistent with whole sample results, model extension results show that growth in savings negatively impact liquidity positions of large banks. This evidence suggests that big banks channel most of their savings deposits towards risky loans than liquid securities. Conversely, the positive but statistically insignificant coefficient of savings ratio in the small banks model highlights that changes in savings do not significantly drive liquidity buffers of small banks in emerging market economies. In short, savings explain liquidity buffers in large banks and savings cannot explain changes in liquidity buffers of small banks operating in emerging markets.

5.5.2.11. Monetary policy (CBR)

In line with earlier results for the entire sample, it seems monetary policy does not explain changes in the liquidity ratios of banks operating in emerging markets. As explained earlier, these results could be attributed to global financial crisis tensions that might have buckled monetary policy transmission in emerging market economies or fiscal policies adopted in emerging markets that work against monetary policy transmission mechanisms.

5.6. ROBUSTNESS TESTS

The study used different estimation specifications to assess the robustness of Objective 1 main regression results. First, in line with Jokipii and Milne (2008), the study ignored the persistence assumption and therefore estimated a linear version of regression models by omitting the lagged dependent variable. Then, following Shen *et al.* (2009), Bordeleau and Graham

(2010) and Bonner and Eijffinger (2013) alternative explanatory variables were used in regression analysis. The results of the various robustness tests are presented in Appendix 3(a).

The results in Appendix 3(a) show that most previous results prevail in terms of coefficient sign and statistical significance. Firstly, estimation results of alternative dynamic models, Columns 2, 3, 4 and 5, Appendix 3(a), show that the coefficient of the lagged liquidity ratio is positive and statistically significant. This evidence supports the main argument of this study that banks' liquidity ratios are persistent and commercial banks in emerging market economies have target liquidity ratios they actively pursue. Furthermore, the coefficients on the variables loan growth (LG), loan loss reserves to gross loans (LLOSS), return on equity (ROE), deposit loan synergy (DLS), transaction deposits (TD) and deposit insurance (DEPINS) are similar to baseline model results in terms of sign and statistical significance. Similarly, the point estimate of the variable bank size (SIZE) is both positive and statistically significant, except in the model with non-performing loans as an alternative measure to bank profitability. Most linear GMM estimation results are consistent with the two-step GMM estimates in terms of both sign and statistical significance. Hence, the study can conclude that empirical findings are robust to alternative estimators.

A few differences between baseline model results and robust check results can however be noted. For instance, the point estimate sign on SIZE variable is negative and statistically significant under linear GMM estimation, suggesting that large banks maintain low levels of liquidity in line with the "too big to fail" theory. The theory maintains that big banks tend to operate with low levels of liquidity because they stand a better chance to be bailed out in crisis as a result of their systemic importance. In addition, the coefficient of GDP variable is both negative and statistically significant under the third alternative estimation, that is, the model with non-performing loans as a measure of asset quality instead of loan loss reserves. The meaning of these results is that banks tend to keep large (low) amounts of liquidity in times of weak (strong) economic growth. Alternatively, it appears banks build up their liquidity reserves during economic recessions and draw down their liquidity buffers in times of economic upturns. Another notable difference is the positive and significant impact of net interest margin, an alternative measure of bank profitability, on banks' liquid assets holdings. This association suggests that profitable banks maintain large stocks of liquid assets. The evidence is plausible in

that banks can reinvest their profits either in building their capital buffers or in liquid assets for precautionary measures.

5.7. IMPACT OF LIQUIDITY REGULATIONS ON BANKS' LIQUIDITY MANAGEMENT PRACTICES

This sub-section attempts to evaluate the effects of Basel III liquidity measures on liquidity management practices of banks in emerging market economies. This objective was achieved by adding a regulatory dummy variable (REGPRESS) to Equation 4.5, thereby creating Equation 4.6. The dummy variable (REGPRESS) captures the impact of regulatory pressure stemming from the LCR standard on liquidity management behaviors of banks in emerging markets thereby reflecting possible effects of binding liquidity standards on liquidity management practices of banks in emerging market economies. A comparison of empirical coefficients of Model 4.5 and Model 4.6 may shed some light into the possible influence of liquidity standards on liquidity management behavior of banks in emerging market economies. If results in Model 4.5 conform to results in Model 4.6, in terms of coefficient sign and statistical significance, then it can be inferred that Basel III LCR rule has trivial effects on liquidity management strategies of banks in emerging market economies. In other words, if empirical results of Model 4.5 and Model 4.6 are similar then it can be concluded that liquidity regulations complement existing liquidity management strategies of banks in emerging markets. On the other hand, if results reported in Model 4.5 do not correspond to results in Model 4.6, that is, differ remarkably with regard to sign and statistical significance, then it can be argued that Basel III liquidity standards have a significant influence on liquidity management behaviors of banks in emerging markets. That is to say, liquidity standards substitute liquidity management behavior of banks in emerging market economies.

5.7.1. Results of the impact of liquidity regulations on banks' liquidity management practices

The results of estimating Equation 4.6 using the two-step system GMM estimator are displayed in Columns 1 and 2, Table 5.7 below. In order to facilitate comparison, results for Model 4.5 are also presented in this sub-section (see Columns 3 and 4, Table 5.7). The results for

models without time fixed effects are reported in Columns 1 and 3, Table 5.7 while the results for models controlled for time effects are reported in Columns 2 and 4, Table 5.7.

Table 5.7: Impact of liquidity regulations on banks' liquidity results

	MODEL 1		MODEL 2	
	With regulatory pressure		Without regulatory pressure	
Variable name	Coefficient Sign (1)	Coefficient Sign (2)	Coefficient Sign (3)	Coefficient Sign (4)
Lagged liquid asset ratio (LAR _{ic, t-1})	0.5689*** (0.1407)	0.7400*** (0.1192)	0.5467*** (0.1508)	0.6681*** (0.1212)
Bank size (SIZE)	6.0447** (2.3401)	2.3779 (2.6904)	5.8783** (2.9607)	2.0368 (2.6470)
Bank capital (CAP)	-0.1129 (0.2366)	-0.3158 (0.2660)	-0.0917 (0.2373)	-0.2147 (0.2667)
Loan Growth (LG)	0.0479*** (0.0152)	0.0836*** (0.0176)	0.0513*** (0.0148)	0.0899*** (0.0168)
Asset quality (LLOSS)	-1.9012*** (0.6364)	-1.6257** (0.6395)	-2.283*** (0.5783)	-1.8096*** (0.5237)
Profitability (ROE)	-0.1639*** (0.0482)	-0.1249*** (0.0423)	-0.1947*** (0.0286)	-0.1382*** (0.0294)
Deposit-loan synergy (DLS)	-0.2212*** (0.0433)	-0.1777*** (0.0448)	-0.2321*** (0.0390)	-0.2014*** (0.0435)
Transaction Deposits (TD)	12.3567** (5.6905)	11.5116 (7.8596)	11.9923** (5.6294)	12.7741* (7.7582)
Deposit insurance coverage (DEPINS)	19.9213 (108.68)	-13.9478 (105.0451)	63.4001 (97.4963)	9.9682 (96.7466)
Regulatory pressure (REGPRESS)	6.8096** (2.4020)	7.3490*** (2.2584)	-	-
Business cycle (GDP)	2.0025** (0.9085)	1.1252 (0.9414)	1.8842** (0.8626)	1.4419 (0.9295)
Savings ratio (SR)	-1.2258** (0.4565)	-1.4512** (0.6022)	-1.3611*** (0.4114)	-1.7993*** (0.5144)
Monetary Policy (CBR)	-0.3236 (0.5959)	-0.8791 (0.6651)	-0.4843 (0.5559)	-0.8904 (0.5925)
Time fixed effects	NO	YES	NO	YES
Sargan test	0.7129	0.5607	0.6190	0.6273
Arellano Bond (2) test	0.7245	0.9327	0.5911	0.4704

Source: Own construction based on data from Bankscope.

***, **, * denote 1%, 5% and 10% significance level respectively.

Standard errors in the parenthesis (brackets).

Results presented in Table 5.7 above show that the point estimate of the lagged dependent variable (LAR_{t-1}) lies within the expected interval $[0; 1]$ and is statistically significant at 1% level. This justifies the use of the partial adjustment model in the study. The Sargan test as well as the Arrelano Bond autocorrelation test results highlight that instruments used in the model are properly identified and the model did not suffer from autocorrelation problems respectively. Similarly, the Wald test p-value of 0.000¹⁹ indicates that model coefficients are significantly different from zero hence they can be used to explain the dependent variable (liquid asset ratio).

5.7.1.1. Lagged dependent variable

By comparing results of Model 4.5 and Model 4.6 without time dummies (Columns 3 and 1 respectively), it can be noticed that the estimated adjustment speeds, given as 1 minus coefficient of dependent variable, under liquidity requirements (0.4311, that is $1-0.5689$) and independent of liquidity regulations (0.4533, that is $1-0.5467$) are similar and non-trivial in magnitude. This evidence suggests that the speed at which banks in emerging economies adjusted their balance sheet liquidity in a non-Basel III environment is not significantly different from Basel III era adjustments. The explanation for this behavior could be the fact that banks in emerging market economies on average maintain large stocks of liquid assets (Freedman and Click, 2006). Freedman and Click (2006) pointed out three factors that attempt to explain why banks in emerging market economies invest more in liquid assets: high reserve requirements, excessive borrowing by government which crowds out private investment and inefficient credit markets that result in reduced lending and increased investment in liquid assets. Regulators in emerging markets charge higher reserve requirements compared to regulators in developed economies largely because of high macroeconomic risks and volatility. Countries characterized by high macroeconomic instability tend to impose high reserve requirements to curb bank runs that could emanate from economic or financial crises. Heightened macroeconomic risk and volatility also increases the probability of panics and runs on banks hence regulators minimize this risk by imposing higher statutory reserves. Turning to the second factor, that is crowding out private investment, the literature of Freedman and Click (2006) asserts that a significant number of emerging market economies operate with large budget deficits and usually cover these budget

¹⁹ Not presented to save space.

deficits by borrowing from domestic markets. Such fiscal policies increase banks' investments in government securities at the expense of the private sector. On the last factor, Freedman and Click (2006) noted aspects like weaknesses in legal and regulatory environment which hamper contract enforcement and collateral foreclosure; high asymmetric information which prevents lenders to acquire all relevant information about potential borrowers and deficient skills to conduct proper risk assessment as some of the factors that leads to inefficient credit allocation resulting in increased liquid assets holdings of countries in emerging market economies.

In addition, Packer and Zhu (2012) point out that the reason why banks in emerging market economies tend to hold large liquidity buffers is revision of liquidity regulations and liquidity management practices of banks in these markets in response to lessons learnt from the 1997 Asian financial crisis. This analysis attempts to justify why liquidity adjustment of banks in an environment with and without liquidity regulations appears to be comparable.

5.7.1.2. Liquidity requirements and banks internal liquidity management

The study was interested in analyzing the influence of liquidity regulations on banks liquidity management by hypothesizing that Basel III liquidity requirements complement (substitute) prudent (bad) liquidity management behavior. In this study regulatory pressure was measured by the dummy variable REGPRESS which takes the value of 1 for banks with a LCR below 100% and zero for banks with an LCR above 100%. Regression results report that estimates of Model 4.6, that is, the model with regulatory pressure (Columns 1 and 2, Table 5.7) and Model 4.5, that is, the model without regulatory pressure (Columns 3 and 4, Table 5.7) are identical with respect to sign and statistical significance. These results suggest that the new Basel III LCR standard complemented existing liquidity management practices of banks in emerging markets. Another way of interpreting these results could be that Basel III LCR charge has not been effective in instituting significant changes in liquidity management practices of banks in emerging markets. This evidence concurs with suggestions made by DeYoung and Jang (2016) as well as De Haan and Van den End (2013b). DeYoung and Jang (2016), asserts that if banks manage their liquidity in a way that is consistent with new regulations, then phasing in of new regulatory requirements will not have significant impact on existing liquidity management practices of banks. To prove this, DeYoung and Jang (2016) investigated whether the coming NSFR requirement would alter liquidity behavior of United States of America banks by

estimating two models: one for loan to deposit ratio (that was traditionally used to evaluate liquidity positions of banks before Basel III) and the other for NSFR. They found that estimated adjustment speeds for both models were similar and had small variations. Taken as a whole, their study concluded that the way banks in United States of America managed their liquidity before Basel III was consistent with the upcoming NSFR requirement. Similarly, De Haan and Van den End (2013b) investigated liquidity management behavior of Dutch banks when subjected to a liquidity requirement that is structurally similar to Basel III LCR, that is, the Dutch liquidity coverage ratio. Their study established that most Dutch banks maintained a large stock of liquid assets against liquid liabilities than what is prescribed under the rule. As a result, the study concluded that implementation of the LCR requirement would not have significant impact on Dutch banks assets adjustment. Likewise, the similarity of empirical estimates of the model with and without regulatory pressure may suggest that banks in emerging markets already managed their liquidity in a manner that is consistent with the LCR hence the rule appears to have little effects on liquidity management practices of banks operating in emerging market economies.

Furthermore, borrowing from capital management studies, Heid *et al.* (2004) postulated that the response of banks to new capital requirements depends on the size of an individual bank's current capital buffer. Banks with high capital buffers would seek to maintain their capital buffers in a new regulatory regime while low capital buffer banks would aim at improving their capital buffers. Based on this view, Heid *et al.* (2004) suggested that the coefficient of regulatory pressure variable should be positive for high capital buffer banks and negative for low capital buffer banks. From empirical results, it can be inferred that the positive coefficient on REGPRESS variable suggests that banks in emerging market economies used in the study had high liquidity buffers before Basel III, hence they seek to maintain their high liquidity buffers in Basel III regime. To prove this argument, Delechat *et al.* (2012) and Basso *et al.* (2012) postulate that banks in emerging market economies already held large liquidity reserves before Basel III came into effect. Pursuant to this view, Subhanij (2010) highlighted that banks in South East Asian Central Banks (SEACEN) region²⁰ had loan to deposit ratios around 70% to 80%, excess reserves to required reserve ratios that hovered between 20% to 2 000% and liquid assets to short term liabilities ratios that ranged between 25% to 120% in the period antecedent to the global

²⁰ Asian countries constitute 50% of the study sample.

financial crisis. By and large, Subhanij (2010) states that most banks in Asia maintained liquidity ratios well above minimum regulatory requirements. This behavior was attributed to changes in liquidity regulations and banks' liquidity management practices necessitated by lessons learnt from the 1997 Asian financial crisis (Packer and Zhu, 2012). Likewise, Delechat *et al.* (2012) document that banks in Central America, Panama and the Dominican Republic (CAPDR) have liquidity buffers well above legal and prudential obligations. Their study established that liquid assets to total deposits ratios for banks in the CAPDR zone averaged 28% against reserve requirements of 17% in 2010. Based on this evidence, Delechat *et al.* (2012) concluded that Basel III liquidity rules are not likely to have considerable effects on the liquidity management behavior of banks in CAPDR region. Similarly, Basso *et al.* (2012) noted that liquidity ratios of banks in the CAPDR region already satisfy or exceed Basel III requirements. This existing evidence which advances that banks in emerging market economies operated and continue to maintain large liquidity buffers may explain the insignificant influence of liquidity standards on liquidity adjustment dynamics of banks in emerging market economies. Hence, it can be argued that Basel III did not significantly alter liquidity management practices of banks in emerging market economies. In other words, Basel III LCR standard complemented existing liquidity management practices of banks in emerging markets.

Additionally, this evidence may not be surprising when one considers the thrust of the LCR specification and differences in liquidity management strategies employed by banks in developed and emerging market economies in the pre Basel III era. The main aim of the LCR is to persuade banks to elevate their holdings of liquidity assets in order to strengthen their resilience to short term liquidity shocks. Extant literature documents that banks in emerging market economies entered the global financial crisis with high levels of liquidity (International Monetary Fund, 2009; Subhanij, 2010), while banks in developed economies maintained low levels of liquid assets (Basel Committee on Banking Supervision, 2013). Concomitantly, Kalemli-Ozcan *et al.* (2012) and Kowalik (2013) point out that banks in developed economies funded their assets growth with short term liabilities in the period preceding the crisis by using off balance sheet vehicles. Yet, banks in emerging markets remained retail deposit funding based (International Monetary Fund 2011). This practice exposed banks in developed markets to credit and liquidity risk since they offered credit facilities and guarantees to these off balance sheet vehicles. As a matter of fact, Brunnermeier (2009) argues that this behavior was the chief

amplification mechanism of the 2007 to 2009 global financial turmoil. Likewise, several banks in developed markets held structured credit instruments which increased their maturity mismatch between their balance sheets and funding liquidity risk (Kalemli-Ozcan *et al.*, 2012). On the contrary, banks in emerging markets depended more on retail deposits to finance their activities and held less complex financial instruments on their balance sheets. Given that one of the objectives of Basel III liquidity standards is to persuade banks to shift their funding sources from capital markets wholesale instruments to stable deposit funding; the impact of Basel III could have been more pronounced in developed economies which depended more on short term wholesale funding compared to emerging market economies that relied and continuous to rely on stable retail deposit funding as demonstrated by empirical results. This argument can be supported by extant literature. For example, research findings of Banerjee and Mio (2017) offer that banks in United Kingdom responded to tighter liquidity requirements by adjusting both their assets and liabilities. To be more precise, Banerjee and Mio (2017) found that United Kingdom banks increased their holdings of high grade securities and funding from non-financial entities while on the same time reduced short term interbank loans and short term funding. In addition, the study by Bonner *et al.* (2015) revealed that liquidity regulations substituted determinants of banks liquidity buffers of banks in the Organization of Economic Corporation and Development (OECD) region. Their evidence suggests that Basel III liquidity requirements effectively influenced liquidity management behavior of banks in OECD zone. As further evidence, in the absence of time dummies, empirical coefficients of the variable TD (transaction deposits) are strongly positive and statistically significant in all models, suggesting that banks in emerging market economies exhibit some prudent behavior in terms of their liquidity management. By and large, empirical evidence seems to suggest that Basel III LCR standard is less effective in emerging market economies.

5.8. ROBUSTNESS TESTS

The robustness tests results for Objective two are presented in Appendix 3(b). An examination of robustness test results presented in Appendix 3(b) indicates that estimates obtained under two-step GMM estimation are consistent with those obtained under different estimations. This suggests that empirical results are robust to alternative estimation. A few variations can be noted. Under linear GMM, bank size has a significant negative impact on

banks' liquidity adjustment. These results are consistent with the "too big to fail" hypothesis which states that large banks tend to maintain low levels of liquidity because they stand a better chance to be bailed out in crisis. Similarly, the coefficient on the variable savings ratio suggests that savings positively impact banks' liquidity. These results are not surprising in that households and small businesses can invest their savings and profits at banks by opening savings accounts. These deposits tend to boost banks' liquidity, all else equal. In addition, net interest margin (model with net interest margin rather than return on equity) has a positive and significant effect on bank liquidity unlike return on equity which exhibited a negative and statistically significant association with banks' liquid assets holdings. This evidence is reasonable in that banks can use retained earnings to increase their cash and liquid assets holdings (Deans and Stewart, 2012; Debelle, 2012). From these findings it can be inferred that banks use part of their profits to invest in liquid securities possibly for precautionary purposes.

5.9. CHAPTER SUMMARY

This chapter was aimed at examining liquidity management practices pursued by banks in emerging economies by investigating whether banks maintain target liquidity and adjust their balance sheets in pursuit of the desired liquidity level. In addition, the study investigated internal as well as external factors that influence banks' liquidity management decisions. After controlling for time effects, research findings revealed that banks in emerging markets have target liquidity levels and they partially adjust their liquidity to reach their desired liquidity level. The speed at which banks adjust their balance sheet liquidity was found to be slow, indicating that banks in emerging markets face substantial financial frictions that preclude them from instantly adjusting. Moreover, the present research established that liquidity ratios of banks in emerging markets are persistent.

In terms of factors that influence banks' liquidity management practices, the study found that internal factors, save for capital and size, have a significant effect on banks' liquidity decisions. From this evidence it can be inferred that banks' internal policies and decisions concerning sourcing and use of funds influence their liquidity choices. The study also found evidence to confirm the hypothesis that banks use the deposit loan synergy to manage liquidity risk. With regard to macroeconomic fundamentals, the study found that only the level of savings (measured by gross national savings to GDP) influence banks in emerging market economies

liquidity decisions. The study could not find evidence to support the claim that deposit insurance, business cycles and monetary policy influences liquidity adjustments of banks in emerging markets. Furthermore, the empirical model for objective 1 (Equation 4.5) was extended in order to investigate whether liquidity management strategies of banks in emerging market economies differ based on bank size. Among other findings, the study established that large banks adjust their liquidity at a higher rate than small banks. Capital was found to be a significant driver of liquidity holdings of large banks but an indeterminate factor in small banks. Another interesting finding was that deposit insurance positively influence changes in liquidity buffers of large banks and negatively affects liquidity adjustments of small banks. Moreover, liquidity buffers of small (large) banks were found to be countercyclical (procyclical). All in all, empirical findings suggest that liquidity management strategies of small and large banks in emerging market economic vary.

Moreover, in this section the study investigated the effects of regulatory pressure stemming from the LCR requirement on liquidity management behaviors of banks in emerging market economies. This objective was achieved by incorporating a regulatory pressure dummy variable, REGPRESS, into regression Equation 4.5 to yield Equation 4.6. Results estimates of Model 4.6 were then compared with estimates for Model 4.5. Research findings revealed that there are no significant differences between coefficients of the two models. In addition, the study established that banks' adjustment speeds in an environment with and without liquidity standards are identical; suggesting that the way banks in emerging market economies adjusted their liquidity in the pre and post Basel III regime is analogous. Taken as a whole, empirical results submit that Basel III liquidity regulations, in particular the LCR rule, has not been effective in altering existing liquidity behavior of banks in emerging markets. The subsequent chapter analyzes the behavioral response of banks to harmonized liquidity standards.

CHAPTER VI

BEHAVIORAL RESPONSE OF BANKS TO LIQUIDITY REGULATIONS

6.0. INTRODUCTION

Banks have several adjustment strategies they can pursue in order to fulfill the Basel III liquidity requirements. They can adjust the asset side or the liability side of their balance sheets. Asset side adjustments attend to the LCR numerator that is high quality liquid assets while liability side adjustment pays attention to the LCR denominator which is net cash outflows. In practice, banks are likely to adjust their LCR using a combination of assets and liabilities adjustments. Accordingly, the third objective of the study sought to examine adjustment strategies pursued by banks operating in emerging market economies to satisfy the LCR requirement. The study explored adjustment strategies employed by banks in emerging market economies by testing the following hypotheses:

H₁₈: Banks increase the volume of their high quality liquid assets in order to satisfy the LCR specification.

H₁₉: Banks increase the volume of stable retail deposits in order to comply with the LCR rule.

H₂₀: Banks issue more long term debt instruments in order to meet the LCR standard.

H₂₁: Banks raise more equity capital in order to satisfy the LCR rule.

The above hypotheses were tested by regressing yearly changes in selected balance sheet items against regulatory pressure dummy variables that capture the influence of liquidity standards on banks' behavior and a set of control variables. The balance sheet items of interest were high quality liquid assets/total assets; non-high quality liquid assets/total assets; retail deposits/total liabilities; long term wholesale funding/total liabilities; equity capital/total liabilities; short term wholesale funding/total liabilities and securitization/total liabilities. However, because of limited granular data on banks' assets and liabilities structures, the study was restricted to examine four balance sheet items that banks are likely to alter in order to

comply with the LCR, namely high quality liquid assets/total assets; retail deposits/total liabilities; long term wholesale funding/total liabilities and equity capital/total liabilities.

6.1. DESCRIPTIVE STATISTICS

Descriptive statistics for variables used to analyze balance sheet items adjusted by banks to meet the new LCR are displayed in Table 6.1 and analyzed in this section²¹. Of interest to note is the positive and negative skewness value for the variables long term wholesale funding/total liabilities and retail deposits/total liabilities. The positive skewness for the variable long term wholesale funding/total liabilities suggests that most of the banks in the sample depend less on long term wholesale funding while the negative skewness value of retail deposits to total liabilities ratio convey that most banks in the sample rely more on deposit funding. This analysis is consistent with extant literature (Bonner *et al.*, 2015; International Monetary Fund, 2014). These studies state that due to the under development of capital markets in emerging markets, most banks in these economies tend to rely on traditional retail deposits to finance their activities. Both variables have positive kurtosis values meaning that the data have heavier tails than normal distribution.

Equity funding scaled by total liabilities has a mean value of 2.57 with a standard deviation of 15.38. On average, for every \$100 bank liabilities, \$2.57 of the liabilities was funded by equity. The standard deviation value of 15.38 shows that there is great variability in equity funding for banks used in the study. The 10th and 90th percentiles were estimated at 0.06 and 0.17 and have negligible values.

Retail deposits averaged US\$0.66 million for the selected banks over the period 2011 to 2016 with a minimum and maximum value of US\$0.22 million and US\$0.89 million respectively²². The mean value of US\$0.66 million means that the average value of deposits held by banks in the sample was US\$0.66 million. The standard deviation of roughly 14% demonstrates that there is a large variation in the amount of deposits held by sampled banks over the sampling window.

²¹ All variables discussed in the preceding chapter were omitted to prevent repetition. Similarly, the variable HQLA/TA is not discussed since its statistics are more or less the same with those for liquid asset ratio.

²² Minimum and maximum values were not presented in order to save space.

The estimated average ratio of non-performing loans to gross loans is 4.36%. This ratio is within the acceptable international benchmark ratio of at most 5% and demonstrates effective credit risk management. The standard deviation value of 10.46% suggests that there is considerable variation in non-performing loans among banks in emerging market economies.

The estimated mean value of Retail Deposits to Total Liabilities is 82.48. This value suggests that banks in emerging market economies are largely funded by retail deposits. This finding concurs with Basel Consultative Group finding that deposit funding constitutes about 80% of funding for banks in Malaysia, Philippines and Saudi Arabia.

The average value of Long Term Wholesale Funding to Total Liabilities is 0.04. This trivial value may lend support to the principal argument of the study that banks in emerging markets depend less on capital markets for funding probably because the capital markets are underdeveloped.

Table 6.1: Behavioral response of banks descriptive statistics

Variable	Variable description	Mean	Standard deviation	10th percentile	90th percentile	Skewness	Kurtosis
HQLA/TA	High Quality Liquid Assets/Total Assets	34.14	23.70	6.48	69.14	0.30	1.55
LTWF/TF	Long Term Wholesale Funding /Total Liabilities	0.04	0.06	0.00	0.07	5.37	39.43
DEP/TF	Retail Deposit Funding/Total Liabilities	82.48	13.06	68.87	95.19	-1.67	6.13
EQ/TL	Tier 1 Capital/Total Liabilities	2.57	15.38	0.06	0.17	6.04	37.47
CAR	Tier 1 Capital/Total Risk Weighted Assets	10.20	4.42	5.97	15.79	1.81	7.20
SIZE	Ln(Total Assets)	19.23	3.51	15.69	24.49	-0.31	3.12
NIM	(Interest Income-Interest Expenses)/Total Interest Earning Assets	3.88	2.31	1.49	6.68	1.44	5.93
NPL	Non-Performing Loans/Outstanding Loans	4.36	10.46	0.33	6.06	8.45	77.42
DEPOSITS	Total Deposits	0.66	0.14	0.49	0.82	-0.85	3.55

Source: Own construction based on data obtained from Bankscope.

***, **, * denotes 1%, 5% and 10% significance level respectively.

6.2. CORRELATION MATRIX

Table 6.2 presents pairwise correlations of variables used to assess the behavioral response of banks to binding liquidity regulations. Pairwise correlation results in Table 6.2 highlight that the variable high-quality liquid assets to total assets is positively and significantly related to capital and profitability. This means that the amount of high grade securities held by a bank is positively influenced by the bank's level of capital and profitability. These results suggest that commercial banks with high levels of capital maintain large levels of liquid assets consistent with the capital fragility/deposit crowding theory which maintains that an increase in capital removes incentives for banks to effectively monitor their borrowers, resulting in reduced credit supply and consequently high liquidity holdings (Diamond and Rajan, 2000; Gorton and Winton, 2000; Diamond and Rajan, 2001). Similarly, the positive correlation between net interest margin and high quality liquid securities may imply that profitable banks maintain high levels of liquidity. This is in line with the hypothesis that banks use part of their profits to build up their liquidity reserves. Although insignificant, the correlation between regulatory pressure and high quality liquid assets is positive as expected.

Deposit Funding to Total Liabilities is positively correlated with bank size, meaning that deposit funding increases with bank size for banks in emerging market economies. This is contrary to the behavior of banks in developed economies where large banks tend to depend on short term wholesale funding than deposit funding. Profitability measured by net interest margin is negatively correlated with deposit funding, meaning growth in profitability leads to reduced dependence on deposit funding. The implication of this analysis is that sampled banks use part of their profits to finance their business activities, thereby decreasing their reliance on deposit funding. As expected, regulatory pressure is positively correlated with deposit funding.

The correlation between bank size and the ratio of Long Term Funding to Total Liabilities is negative and statistically significant which suggests that large banks in the sample rely less on long term funding probably because capital markets in emerging market economies are less developed which limits their ability to raise long term finance. The variable long term funding to total liabilities is also negatively correlated to deposits, regulatory pressure and real GDP. The correlations are significant at conventional levels. The negative relationship between deposits funding and long term funding is consistent with the deposit supply constraint theory

(Van Rixtel and Gasperini, 2013). The deposit supply constraint theory maintains that banks issue long term securities to alleviate deposit funding constraints. The positive relationship between Long term funding and real GDP suggests that banks long term funding is procyclical, meaning banks have a tendency of increasing (decreasing) long term funding during economic upturns (downturns). A reasonable explanation to these results is that loan demand may rise (decrease) in times of economic booms (recessions) as businesses experience improved (deteriorating) investment prospects, thereby resulting in increased (decreased) long term funding needs of banks.

Table 6.2: Behavioral response of banks correlation matrix

	HQLA/TA	DEP/TF	LTWF/TL	EQ/TF	CAR	SIZE	NIM	NPL	DEPOSITS	REGPRESS	GDP	CBR	RIR
HQLA/TA	1.0000												
DEP/TF	-	1.0000											
LTWF/TF	-	-	1.0000										
EQ/TF	-	-	-	1.0000									
CAR	0.1497**	0.1167	-0.0049	-0.1249*	1.0000								
SIZE	0.0449	0.2806***	-0.1711*	-0.0548	0.2144***	1.0000							
NIM	0.2323**	-0.1979***	0.034	-0.0588	0.3562***	0.0865	1.0000						
NPL	-0.0228	0.1128	0.2712***	-0.0152	0.2460***	-0.0085	0.0465	1.0000					
DEPOSITS	-0.0738	0.8761***	-0.3956***	0.1078	-0.1119	0.1771**	-0.2665*	0.0783	1.0000				
REGPRESS	0.0633	0.0695	-0.1986*	-0.0584	0.2853	-0.1691	-0.2576***	0.1132	-0.0003	1.0000			
GDP	-0.1024	0.4440***	-0.1864*	-0.1479**	0.1085	0.1746**	-0.1536*	0.1445*	0.5619***	-0.1563**	1.0000		
CBR	0.0946	-0.2000***	0.1627	-0.0082	0.1214*	0.0462	0.5335***	0.1063	-0.1277	-0.5079***	0.0907	1.0000	
RIR	0.1042	-0.4601	0.3115***	-0.0809	0.0494	0.0075	0.5463*	0.0591	-0.4189	-0.2215***	-0.3157*	0.6887***	1.0000

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

6.3. UNIT ROOT TEST RESULTS

To prevent spurious regression, variables used in this study were checked for unit roots using the Maddala-Wu unit root test. The results of unit root tests are displayed in Table 6.3 below. The results show that all variables are stationary at 1% level and integrated of order zero, suggesting that the variables do not contain unit roots. Therefore, it can be concluded that data used in this study did not contain unit roots which lead to spurious regression coefficients.

Table 6.3: Behavioral response of banks unit root test results

Variable	Variable description	Chi-square value	Order of integration
HQLA/TA	High Quality Liquid Assets/Total Assets	193.03***	0
LTWF/TF	Long Term Wholesale Funding /Total Liabilities	157.48***	0
DEP/TL	Retail Deposit Funding/Total Liabilities	257.46***	0
EQ/TF	Tier 1 + Tier 2 Capital/Total Liabilities	253.88***	0
CAR	Tier 1 Capital/Total Risk Weighted Assets	186.23***	0
SIZE	Ln(Total Assets)	256.13***	0
NIM	(Interest Income-Interest Expenses)/Total Interest Earning Assets	305.28***	0
DEPOSITS	Total bank deposits	254.94***	0
GDP	$\left(\frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \right)$	417.61***	0
RIR	Nominal interest rate minus inflation rate	136.75***	0
CBR	Central bank policy rate	277.52***	0

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

6.4. RESULTS OF BEHAVIORAL RESPONSE OF BANKS TO LIQUIDITY REGULATIONS

The results of estimating Equations 4.8 to 4.11 using the two-step system GMM estimator are presented in this sub-section. The results displayed in Table 6.4 relates to asset side adjustment (Model 4.8) while the results presented in Table 6.5 relates to liability side adjustments (Models 4.9; 4.10 and 4.11). Empirical estimates for Models 4.9; 4.10 and 4.11 are displayed in Columns 1; 2 and 3 respectively. The results in Tables 6.4 and 6.5 show that all models passed both the Arellano Bond autocorrelation test and Sargan test, implying that the models did not suffer from autocorrelation and over identified instruments.

It is also important at this juncture to highlight that the analysis of the results is mainly centered on the dummy variable (REGPRESS). This variable attempts to measure the extent to which regulatory pressure triggered banks to change their assets and liabilities structures. Consistent with extant literature that studied the behavioral response of banks to binding capital requirements, this study measured regulatory pressure using the probabilistic approach (Ediz *et al.*, 1998; Rime, 2001; Akinsoyinu, 2015). The approach assumes that banks' liquidity decisions are influenced by regulatory pressure once a bank's LCR falls close to or below the minimum regulatory requirement. Using this method, the study claims that banks with an LCR gap that is LCR below minimum regulatory requirement are prone to regulatory scrutiny and/or sanctions. Hence, banks with an LCR shortfall have strong incentives to modify their balance sheets so as to improve their LCR in order to avoid regulatory penalties or sanctions. The variable (REGPRESS) was measured by a dummy variable which equaled 1 for a bank with an LCR below the regulatory threshold in a given period and zero otherwise.

6.4.1. Asset side adjustments

6.4.1.1. Changes in high quality liquid asset scaled by total assets

(i) Lagged dependent variable ($HQLA_{i,t-1}$)

The positive and significant coefficient of the lagged dependent variable ($HQLA_{i,t-1}$) demonstrates that emerging markets banks have a target liquid asset ratio and they partially adjust their balance sheets to reach their desired level. Therefore, the partial adjustment model

used cannot be rejected. The estimated speed of adjustment of approximately 58%, which is 1 minus point estimate of lagged dependent variable ($HQLA_{ic,t-1}$) (that is $1 - 0.4292$), provide some evidence that banks in emerging market economies adjust their high quality liquid assets at a moderately high speed. Such a speed of adjustment could be attributed to pressure from Basel III liquidity regulations that encourage banks to elevate their liquidity buffers.

Furthermore, the positive and significant coefficient of the lagged dependent variable ($HQLA_{ic,t-1}$) suggests that the ratio of high quality liquid assets to total assets is persistent. This means the amount of liquid assets held by a bank in a given period are largely influenced by the amount of liquid assets they held in the previous period. This is reasonable in that banks accumulate liquid assets over time; hence, previous amount of liquid assets tends to explain the amount of liquid assets held in the next period.

Table 6.4: Results for asset side adjustment

Variable	Variable description	Coefficient	Economic impact
$HQLA/TA_{ic,t-1}$	Lagged High Quality Liquid Assets/Total Assets	0.4292* (0.2200)	-
SIZE	Bank size	0.1821* (0.2492)	0.0193
CAR	Bank capital	5.0783 (2.0000)	0.9471
NIM	Profitability	1.4216** (0.6892)	0.1386
NPL	Asset quality	-0.1130** (0.0456)	-0.0499
ID	Income diversification	-0.0766** (0.0337)	-0.0400
REGPRESS	Regulatory pressure	14.8682*** (2.6563)	0.2008
GDP	Real GDP growth	0.0500 (0.4559)	0.0019
FSD	Financial sector development	0.0201 (0.0885)	0.0522
OPENNESS	Financial sector openness	0.1811 (0.4386)	0.0433
Arellano-Bond (2) test		0.7681	
Sargan test		0.6113	
Wald test		283.35***	

Source: Own construction based on data obtained from Bankscope.

***, **, * denotes 1%, 5% and 10% significance level respectively. Standard errors in parenthesis (brackets)

(ii) Regulatory pressure (REGPRESS)

Results show that coefficient of regulatory pressure dummy variable (REGPRESS) is both positive and significant at 1% significance level as predicted. These results confirm that banks subject to binding liquidity requirements responded to liquidity rules by holding more liquid assets. With regard to economic significance, a 1 standard deviation increase in regulatory pressure contributes to 20% growth in high quality liquid asset holdings of banks in emerging markets. These results are consistent with the Basel III expectations (align with LCR behavior) as well as previous studies (Macro Assessment Group, 2010; Rezende *et al.*, 2016, Banerjee and Mio, 2017). Since the LCR numerator is given as a pool of high quality liquid securities, banks have strong incentives to improve the LCR by holding more liquid assets. The immediate benefit of this behavior is reduction of idiosyncratic risks within individual banks. A sufficient stock of high grade liquid assets bolsters banks' ability to withstand short term and severe liquidity crisis thereby limiting second round effects of liquidity spirals reinforcing banking sector stability. Second, holding high quality liquid assets reduces liquidity tail risk by offering counterbalancing liquidity to cover massive cash outflows (Van den End, 2012).

Nevertheless, increased holdings of high grade liquid securities may affect monetary policy conducted through asset purchases since open market purchases will have more effects on commercial banks instead of refinancing operations (Van den End, 2012). Furthermore, banks may be enticed to excessively borrow from the central bank at the expense of the interbank market by pledging non-liquid assets as collateral. This behavior could hamper activity in the unsecured money markets; by that monetary policy transmission can be impeded since money markets play a pivotal role in monetary transmission (Coeure, 2013). Besides working against monetary policy, increased holdings of liquid securities which are skewed towards government securities can create several problems at both micro and macro level. First, increased holdings of government securities may crowd out private sector lending (ESBG, 2014; Li, 2017). Second, large holdings of government securities may engender solvency risk for banks because sovereign bonds are not necessarily risk free. This argument can be justified by analyzing events that transpired during the Eurozone sovereign debt crisis that started at the end of 2009. During the Eurozone debt crisis, countries such Portugal, Italy, Ireland, Greece, Portugal and Spain experienced difficulties in servicing their sovereign debts resulting in sovereign debt defaults.

This event points to the fact that sovereign debt is not necessarily risk free as assumed by Basel. Furthermore, government securities are marked to market to reflect valuation losses in a crisis which may diminish banks' capital positions (Blundell-Wignall and Atkinson, 2010a). Fourth, increased holdings of government instruments may create incentives for governments to run large budget deficits in order to satisfy increased demand for liquid assets (Blundell-Wignall and Atkinson, 2010b). Fifth, increased demand for government securities may cause benchmark interest rates (risk free rate) to fall leading to serious distortions in interest rate setting since depository institutions rely on Treasury bill rates to set their interest rates.

Additionally, this behavioral response of banks may imply that liquidity regulations substitute banks' impetus to manage their own liquidity. Duijm and Wiertz (2016), offer that instead of evaluating their own liquidity risk, banks may end up relying on risk weights provided by the supervisor. Moreover, maintaining a large fraction of assets in liquid assets provide bank managers with a lot of discretion (in terms of free cash flows) which could create agency problems as advocated by Jensen (1986). When managers are left with a lot of free cash flows at their discretion, they are likely to abuse the funds leading to increased agency costs, inefficient resource allocation and bad investments which may destroy shareholder value (Wang, 2010).

(iii) Bank capital (CAR)

The coefficient of capital is positive, inferring that changes in high quality liquid assets respond to changes in bank capital. However, the parameter estimate is not statistically significant, suggesting that although increases in capital cause the stock of high quality liquid assets to rise, the impact has not been large enough to yield statistically significant results. The statistical insignificance of capital on high quality liquid assets adjustment could also be attributed to current pressure on banks to simultaneously fulfill capital and liquidity requirements. Due to these two binding requirements, banks may not be using much of their capital resources to build their liquidity buffers.

(iv) Bank Size (SIZE)

Bank size (SIZE) has a significant and positive impact on changes in high quality liquid assets. This association suggests that yearly changes in high quality liquid assets stock are significantly driven by bank size, implying that as a bank grows in size, it finds it relatively

easier to adjust its stock of liquid securities probably because large banks enjoy economies of scale, which enable them to source external funding relatively quickly and easily at low costs. Therefore, it can be inferred that large commercial banks face minimal difficulties in adjusting their balance sheet structures.

(v) Profitability (NIM)

Profitability, measured by net interest margin, is positively and significantly related to changes in the value of high grade securities which seems to imply that banks use profits to increase their liquid assets. This is in line with the intuition that profit is a source of liquidity (Aspachs *et al.*, 2005). This is because profitable firms are able to accumulate profits (Loncan and Cadeira, 2013); hence, they may decide to use retained earnings to increase their cash and liquid assets holdings (Deans and Stewart, 2012; Debelle, 2012). This evidence concurs with Pinkowitz (2013) who documents that most profitable firms in the United States of America accumulated significant amounts of cash after the global financial crisis, leading to significant increase in their liquidity.

(vi) Asset quality (NPL)

Asset quality proxied by non-performing loans has a negative and significant coefficient. A 1 standard deviation increase in non-performing loans causes liquid assets to decrease by 4.99%. This evidence is counterintuitive in that banks experiencing a rise in non-performing loans need to increase their holdings of liquid securities to cushion themselves against liquidity risk likely to be created by loan losses. From the empirical results, it seems banks sell part of their liquid assets stock to cover current credit losses rather than investing more in liquid assets to cater for future liquidity shortfalls.

(vii) Income diversification (ID)

The estimated coefficient of the variable income diversification (ID) shows that income diversification has a negative and significant impact on changes in high quality liquid assets. This provides some evidence to the notion that yearly changes in the value of high quality liquid assets are negatively associated with shifts in income diversification. This analysis is consistent with Almarzoqi *et al.* (2015) who argued that banks which earn significant revenue from non-

interest income activities may be motivated to invest less in liquid assets. This behavior could be attributed to the fact that banks that earn more revenue from non-core activities, such as structured finance activities, are enticed to tie up more funds in these non-core activities instead of investing in low interest earning liquid asset securities. Moreover, this analysis concurs with the way banks behaved in the period preceding the global financial crisis. Brunnermeier (2009) points out that due to financial engineering and profit motives, several banks especially in developed economies invested heavily in structured products, like mortgage backed securities, and maintained low liquid assets in the run up to the 2007/2009 crisis. However, due to valuation uncertainty and risk attached to these opaque securities, most banks experienced significant losses which exacerbated their liquidity problems.

(viii) Business Cycles (GDP)

The variable real gross domestic product (GDP) was included in the regression model to control the effects of macroeconomic fluctuations on changes in banks high quality liquid assets holdings. Since the study was confined to a “pure” Basel III era (2011 to 2016), in which most economies were expected to have moved out of crisis, the study therefore predicted that banks liquid assets holdings should be positively related to business cycles. The results in Table 6.4 show the coefficient of real GDP is positive, suggesting that banks increase their liquid assets stock during economic booms and reduce them in recessions in line with the Basel III expectations. However, the coefficient of parameter is non-significant implying that shifts in emerging markets banks’ liquid assets are not significantly driven by fluctuations in economic conditions. The insignificant impact of macroeconomic fluctuations on banks liquid asset adjustment could be attributed to the short period of study (seven years).

(ix) Financial sector development (FSD)

Financial sector development reduces financing constraints (Freedman and Click, 2006). Financing constraints refer to difficulties encountered by firms to secure funding from capital markets. Countries characterized with low levels of financial sector development are perceived to have higher financing constraints, hence banks operating in such markets tend to hold significant amounts of liquid securities (Almeida *et al.*, 2004). Therefore, the level of financial sector development is assumed to have a significant impact on banks’ liquid assets adjustment.

The results suggest that financial sector development positively influences banks to adjust their liquid securities stock. Nevertheless, evidence on the impact of this variable is not statistically significant. This means that the level of financial sector development has an insignificant impact on shifts in banks' high quality liquid assets. These findings render support to the intuition that banks in emerging market economies rely more on deposits funding relative to wholesale markets. This may explain the insignificant impact of financial sector development on banks' liquidity assets adjustments.

(x) Financial Sector Openness (OPENNESS)

The variable OPENNESS was included in the regression model to examine the influence of cross border bank flows on banks' liquid assets dynamics. The study expected that banks operating in financial sectors that are more open to the world are able to attract more funding from foreign markets, which enables them to easily adjust their balance sheets. Although the coefficient of OPENNESS parameter estimate in Table 6.4 is positive, it is not statistically significant. These results suggest that banks in emerging market economies have not attracted significant cross border funding during the period of study. As argued by McCauley *et al.* (2012) liquidity requirements could have a significant impact on cross border flows. Given the responsibility of host country under Basel III liquidity requirements, national regulators are motivated to apply liquidity charges to subsidiaries and branches of foreign banks which could hinder cross border funding flows. In fact, as suggested by Figuet *et al.* (2015) phasing in of liquidity requirements could cause cross border lending to emerging market economies to drop by 20%. Similarly, IMF (2015) noted that regulatory tightening in countries where international banks are headquartered resulted in reduced cross border lending by international banks to foreign markets.

6.4.2. Liability side adjustments

Table 6.5: Results for liability side adjustment

Variable	Variable description	DEP/TL (1)	LTWF/TL (2)	EQ/TL (3)
Lagged dependent variable	Lagged dependent variable	0.2224* (0.1337)	0.3128*** (0.0871)	0.9990*** (0.0014)
CAR	Bank capital	-0.2371 (0.2930)	-0.0030*** (0.0006)	-
SIZE	Bank size	2.5252 (2.1325)	0.0014 (0.0015)	0.0011*** (0.0004)
PROF	Bank profitability	-1.5589 (1.1294)	0.0106*** (0.0015)	-0.0012** (0.0006)
NPL	Asset quality	0.2426*** (0.0353)	0.0014*** (0.0006)	-0.0198*** (0.0016)
ID	Income diversification	-0.0343 (0.0992)	-	0.7377*** (0.1494)
AG	Asset growth	-	0.0002*** (0.00001)	-
LIQ	Bank liquidity	-	-	-0.1977*** (0.1494)
DEPOSITS	Bank deposits	-	-0.0690*** (0.0153)	0.7377*** (0.1494)
REGPRESS	Regulatory pressure	9.4793** (4.510)	0.0119*** (0.0022)	0.0945* (0.0493)
GDP	Real GDP growth	0.7099 (0.4718)	-0.0024*** (0.0006)	-0.0043 (0.0083)
FSD	Financial sector development	0.0016 (0.0653)	-	-
OPENNESS	Financial sector openness	-0.6753* (0.3881)	-	-
CBR	Monetary policy	-	0.0025*** (0.0006)	-
IR	Interest rate	-	0.0003 (0.0002)	-
	Arellano-Bond (2) test	0.3268***	0.5126***	0.3154***
	Sargan test	0.3629	0.2673	0.0672
	Wald test	2928.52	9157.51	6.38e+07

Source: Own construction based on Bankscope data

****, **, * indicates statistical significance at 1%, 5% and 10% respectively.*

Standard errors are shown in parenthesis (brackets).

6.4.2.1. Deposit funding scaled by total liabilities

(i) Lagged dependent variable ($DEP_{ic,t-1}$)

Dynamic panel regression results show that the coefficient of the lagged dependent variable ($DEP_{ic,t-1}$) is positive and statistically significant at 10% level. The positive and statistically significant point estimate of the lagged dependent variable ($DEP_{ic,t-1}$) means that the use of a dynamic model in this study is justified. This evidence shows that banks in emerging market economies have target deposits level and adjust their level of deposits over time to close deviations from their target. The reason why banks partially adjust could be as a result of financial frictions arising from market imperfections that prevent banks to raise deposits on short notice to meet their liquidity needs. Therefore, if banks have a target deposits level and partially adjust towards the desired level over time, these results are consistent with the trade-off theory widely used in corporate finance. Based on the theory, managers' decision to maintain an optimal deposits level is influenced by marginal costs and marginal benefits of actively managing the target deposits level (Chang and Yang, 2016).

The estimated speed of adjustment of roughly 78%, which is 1 minus coefficient of lagged dependent variable ($DEP_{ic,t-1}$) (that is $1-0.2224$), reveals that banks in the sample close about 78% of the gap between current and target deposits in a year. Since the adjustment process depends on the trade-off between costs of being off target and costs of adjusting: if the costs of being off target outweigh costs of adjustment then banks would adjust fast and vice-versa (Drobetz *et al.*, 2014). The high speed of adjustment suggests that banks in emerging market economies find it more costly to be off target hence they adjust relatively fast to revert to their target deposit levels. This high speed of adjustment could be attributed to the fact that banks in emerging countries are largely funded by retail deposits, which makes it easy for them to increase deposits funding.

(ii) Regulatory Pressure (REGPRESS)

Results in Column 1, Table 6.5, show that the regulatory pressure dummy variable (REGPRESS) has a positive and significant effect on changes in deposit funding, suggesting that banks in the sample reacted to binding liquidity requirements by increasing funding from core deposits. Therefore, the study found some evidence to support the hypothesis that regulatory

pressure has been effective in coercing banks to shift their funding sources towards stable deposit funding. These results compare with Lang (2016) who established that banks in Hungary responded to liquidity regulations by increasing deposit funding from households and non-financial entities. Similarly, Debelle (2012) and Robertson and Rush (2013) observed that competition for retail deposits has intensified among Australian banks as banks sought more deposits to comply with liquidity charges. Shi and Tripe (2012), also noticed that New Zealand banks are actively pursuing retail funding in reaction to the introduction of liquidity regulations.

The evidence that banks in the sample responded to binding liquidity measures by increasing deposit funding appears to be logical in context of the LCR perspective. The LCR treats retail deposits favorably by applying low run off rates to core deposits; therefore, an increase in retail deposits reduces applicable runoff rates thereby decreasing net cash outflows and improving the LCR. The favourable treatment of retail deposits in the LCR measure is based on their assumed stability. In worst case scenarios, the Basel Committee predicts that a bank can only lose 5% of its core deposits. Han and Melecky (2014) points out that low income depositors (commonly known as retail depositors) have a tendency of maintaining a steady financial behavior through business cycles. The implication of this behavior is that at bank level, retail depositors can provide a diversified and reliable funding base that is less susceptible to changes in a bank's financial conditions. Moreover, the stability of retail deposits is enhanced by deposit insurance. Diamond and Rajan (1983) document that insured depositors have a low risk of running on an institution in times of a crisis, hence they can provide a stable source of funding. Therefore, from a macroprudential regulation perspective, it can be argued that retail depositors can contribute to the banking sector's stability since they proved to be resilient to funding shocks during the 2007 to 2009 financial crisis (Gatev and Strahan, 2006; Ritz and Walther, 2015; Vazquez and Frederico, 2012).

Besides using retail deposits to fulfill liquidity measures, there are some advantages of increasing retail deposits to banks. First, since retail deposits, particularly demand deposits, generally earn below market interest especially in emerging market economies (Borio *et al.*, 2017); increasing core deposits may enhance banks' profits by reducing overall funding costs. This argument may be substantiated by empirical findings of Duraj and Moci (2015) which revealed deposits positively influence profitability of banks in Albania. Likewise, pooling new

depositors may also give banks a wide platform to sell their products thereby boosting their revenue.

Despite the fact that Basel assumes that retail deposits are stable even in times of extreme crisis, this assumption may not hold for underinsured retail depositors. Underinsured depositors are those depositors with cash balances above the deposit protection coverage limit. Underinsured depositors are highly likely to switch to safer products during a crisis thereby withdrawing their funds from banks. In support of this argument, Grind (2009) observed that underinsured depositors withdrew about \$9.4 billion from Washington Mutual over a two-week period in July 2008. Similarly, Flannery (2009) reported that Landsbanki Icesave in Iceland experienced a bank run in September 2008 due to fear by depositors that the country's deposit insurance fund would not be able to meet their claims in the event that the bank collapsed.

Furthermore, although a switch towards retail deposits can to foster banking sector stability due to the resilience of core deposits, this behavior may also compromise systemic stability if competition for high valued retail deposits grows excessively. This line of argument is consistent with presentations made by Hartlage (2012). Drawing a comparison between the LCR and FSS105 liquidity rule introduced in Korea, which is similar to Basel LCR, Hartlage (2012) highlighted that the introduction of FSS105 liquidity rule in Korea increased competition for time deposits (which were needed to satisfy the rule) resulting in large market distortions thereby undermining the stability of the Korean financial sector. Eventually, Korean regulators were forced to relax the regulations. Therefore, this study argues that systemic stability may be jeopardized if banks compete excessively for retail deposits in response to the new liquidity rules.

Moreover, Ahlswede and Schildbach (2012) argue that cluster risk may develop due to concentrated funding in retail deposits that may not be adequately covered by deposit insurance. In order to minimize this risk, regulators may have to increase deposit insurance premium so that most of the deposits are insured. But, a rise in deposit insurance premium may lead to increased insurance costs for commercial banks that may reduce their profits. Ahlswede and Schildbach (2012) also contend that the predominance of retail deposits as the main form of investment for households may reduce the flow of funds to capital markets which may inhibit the development and growth of capital markets in emerging market economies.

(iii) Bank capital (CAR)

The point estimate for bank capital (CAR) shows that a standard deviation 1% increase in equity capital causes bank deposits to drop by about 8%, that is $\left(\frac{4.67 * -0.2371}{13.06}\right)$. This means that changes in equity capital negatively affect changes in banks' deposits. As suggested by Kochubey and Kowalczyk (2014), the implication of such results is that banks which are funded by stable instruments keep low levels of capital. However, the intuition that banks with stable funding sources maintain low levels of capital could not be supported by empirical results because the coefficient of CAR is statistically insignificant. The possible explanation to these results is that the short period of study could have affected the statistical power of capital on banks' deposits adjustment since capital is slow to adjust (Domaski and Turner, 2011; Oura *et al.*, 2013).

(iv) Bank Size (SIZE)

The hypothesis that big banks are able to attract large deposits due to their perceived safety could not be supported by empirical results since the coefficient of bank size (SIZE) is statistically insignificant. Research findings may imply that the role of size in influencing bank deposits has changed in the Basel III period. Basel III requires all banks regardless of size to increase deposit funding. What this implies is that the influence of size on banks' deposits holdings may have been substituted by Basel III liquidity regulations thereby becoming insignificant.

(v) Profitability (PROF)

Regression results report that changes in profitability are negatively associated with adjustments in banks deposits. This evidence suggests that growth in profitability entice banks to decrease their deposits. This behavior could imply that banks use part of their profits (retained earnings) to fund their activities, which reduces their incentives to secure more deposits. However, the explanatory power of profitability is insignificant; suggesting that the impact of profitability has not been large enough to yield a statistically significant influence on changes in deposit funding. Stated differently, the empirical results suggest that profitability has a limited explanatory power on changes in deposit funding.

(vi) Asset quality (NPL)

Asset quality significantly influences changes in deposit funding. According to estimated results, a 24.26% increase in non-performing loans (NPL) causes commercial banks' deposits to increase by 19.43%, which is $\left(\frac{10.46 * 0.2426}{13.06}\right)$, all else equal. Nevertheless, these findings are counterintuitive. Logically, banks experiencing asset quality deterioration are expected to encounter considerable withdrawals as a result of increased solvency risk. One possible explanation to these findings could be that retail depositors in emerging markets have limited investment options, probably due to the fact that capital markets are still developing and do not offer attractive returns, therefore, the response of retail deposits to rising asset portfolio risk appears to be inelastic.

(vii) Income Diversification (ID)

The coefficient of Income Diversification (ID) is negative and statistically insignificant; suggesting that changes in bank deposits cannot be explained by changes in noninterest income. Gurbuz *et al.* (2013) point out that banks with well-diversified income streams tend to have stable operating profits. Since banks can use part of their profits to boost their lending business, the implication of this practice is that banks with well diversified income sources have low impetus to aggressively seek demand deposits. Consequently, a negative relationship between changes in income diversification and bank deposits was anticipated. Results indicate that income diversification negatively influences banks to alter their deposits holdings, consistent with the notion that banks with diversified income sources have low incentives to source deposits. Nevertheless, the coefficient of ID highlights that the impact of income diversification on changes in banks deposits appears to be insignificant. This means that during the period of study noninterest income contribution to changes in banks deposits has been insignificant, probably due to decreases in noninterest revenue for banks in the period succeeding the global financial crisis.

(viii) Business Cycles (GDP)

The point estimate of real gross domestic growth (GDP) suggests that changes in deposit funding are positively influenced by changes in gross domestic product. As argued by Ahlswede

and Schilbach (2012), growth in GDP causes disposable income to rise thereby increasing bank deposits. Nonetheless, the study could not find evidence to prove that deposits growth is significantly driven by changes in gross domestic product because the coefficient of GDP is statistically insignificant. These findings suggest that economic output had an impact on bank deposits, but the effect may not have been large enough to yield a statistically significant influence.

(ix) Financial sector development (FSD)

Literature suggests that financial development measured by financial inclusion promotes savings mobilization which in turn boosts banks deposits (Sahay *et al.*, 2015). As a result, a positive relationship between financial sector development and bank deposits was expected. Although the coefficient of financial sector development (FSD) is positive as expected, it is small and also statistically insignificant. Consistent with Prasad (2010), this evidence offers that financial inclusion appears to be relatively low in emerging market economies. Makina *et al.* (2014) attributes low levels of financial inclusion in emerging countries to, among other factors, high bank charges, stringent regulatory requirements such as Know Your Customer requirements and lack of confidence in banks as a result of high incidences of bank failures.

(x) Financial openness (OPENNESS)

The variable OPENNESS was included in the regression analysis to examine whether countries with open financial systems are able to attract foreign deposits. Results in Column 1, Table 6.5 show that financial sector openness has a negative and significant effect on changes in bank deposits²³. Although these results are contrary to expectations they appear to be logical given capital requirements under Basel III. The main providers of foreign deposits to emerging market economies are major international banks who provide these deposits in the form of loans to foreign banks. Considering that Basel III capital requirements encourage large international banks to adopt the Internal Ratings Based approach to credit risk management, the Internal Ratings Based approach could have created perverse effects on the lending activities of international banks to emerging markets. The Internal Ratings Based approach requires banks to set aside more capital when lending to lower rated borrowers. This implies that international

²³ The study did not split foreign and local deposits due to the dearth of granular deposits data.

banks have to set aside more capital when lending to emerging market economies which may have low ratings compared to developed economies. As a result, international banks might have been decided to reduce lending to banks in emerging market markets. This analysis is in line with the findings of Ghosh *et al.* (2012). Through simulation analysis the Ghosh *et al.* (2012) concluded that emerging market economies could experience a 3% reduction in bank flows as a result of Basel III standards.

6.4.2.2. Long term wholesale funding scaled by total liabilities

(i) Lagged dependent variable ($LTWF_{ic,t-1}$)

Model estimates in Column 2, Table 6.5 indicate that the point estimate of the lagged dependent variable ($LTWF_{ic,t-1}$) is positive and statistically significant at 1% significance level; hence, the use of a partial adjustment model adopted in this study is validated. The study found evidence to substantiate the claim that adjustment costs prevent banks from quickly adjusting their long term funding structures. Adjustment costs arising from asymmetric information and rigidities in funding markets may make it difficult for banks in emerging markets to source long term funding on short notice. Furthermore, these findings highlights that banks long term funding structures are persistent over time. This means that the value of long term debt held by a bank in a given period is dependent on the amount of long term funding in the previous period.

(ii) Regulatory pressure (REGPRESS)

The coefficient of REGPRESS is positive, indicating that regulatory pressure influences banks to shift their funding sources towards long term wholesale funding. Nevertheless, the study found that the influence of regulatory pressure on banks long term debt adjustment is very small; the coefficient is about 1%. These findings may lend support to the intuition that capital markets in emerging market economies are less developed which impedes banks' ability to issue long term bonds. Prasad (2010) reports that bond markets in emerging countries are inadequately developed and high grade corporate bonds that meet minimum standards specified by the LCR are available in limited quantities. For this reason, emerging market economies could have faced difficulties to float long term bonds in order to meet LCR requirements. In addition, empirical results could also be in line with the argument that emerging market economies largely depend on deposit funding, hence the response of long term wholesale funding to liquidity requirements

tend to be weak. This analysis concurs with the findings of the Basel Consultative Group (2014). The Basel Consultative Group documented that banks in emerging countries like Malaysia, Philippines and Saudi Arabia have very high levels of deposits, comprising up to 80% of total funding. Such funding patterns could have inhibited the ability of banks in emerging market economies to shift their funding sources towards long term instruments.

The small impact of regulatory pressure on adjustments in banks long term funding could also be explained by current trends that may affect banks' ability to float long term unsecured bonds. Gassmann *et al.* (2011) point out three trends that could adversely affect banks' ability to issue uncovered bonds. To begin with, there are some changes in the legal environment in some jurisdictions. For example, in Germany, the Germany Bank Restructuring Act permits regulators to sanction reorganization proceedings for a bank that is perceived to be insolvent. The consequence of this legislation is that it may dampen investors' appetite for bank bonds. Next, under Solvency II regulations insurance firms are required to allocate more capital for bank bonds. This causes bank bonds to be less attractive to insurance firms who are the traditional major buyers of bank bonds. Third, uncertainty in financial markets may be motivating asset managers to limit their exposure to banks. Moreover, since bank bonds do not qualify as liquid assets other depository institutions appetite for bank bonds may diminish; hence, banks may face difficulties to instantly adjust their funding structures towards long term funding sources.

(iii) Bank capital (CAR)

The variable bank capital (CAR) has a positive sign, suggesting that well-capitalized banks face little difficulties in adjusting their funding structures towards long term instruments. This finding is consistent with the risk absorption theory proposed by Berger and Bouwman (2009). The theory maintains that higher capital enhances a firm's risk absorption capacity; therefore, highly capitalized banks are expected to experience cheaper and large access to debt markets. These results concur with Gambacorta and Shin (2016) finding that highly capitalized banks have easier and cheaper access to wholesale funding markets because they are presumed to be less risky by investors. Moreover, these findings might be supporting the notion that a large capital base minimizes financial constraints thereby enabling commercial banks to issue more debt securities (Van Rixtel *et al.*, 2016). In addition, empirical results also agree with Admati *et al.* (2010) assertion that debt funding is enhanced as capital grows because capital minimizes

bank risk and can be used as a buffer to absorb losses. Although capital positively contributes to issuance of long term securities like bonds, the contribution of the variable seems to be of little effect given that the coefficient on the variable CAR is only 0.3%. The limited elasticity of capital could be attributed to the fact that banks' funding structures are relatively "sticky" hence banks take time to adjust or the adjustment tend to be slow (Domanski and Turner, 2011; Wimmer *et al.*, 2012).

(iv) Bank Size (SIZE)

Based on the leverage targeting hypothesis, banks are expected to actively manage their liquidity by reducing their debt when risk, that is probability of default, increases and vice versa (Van Rixtel *et al.*, 2016). Literature suggests that the main determinant of bank leverage is size; thus, large banks are presumed to be highly leveraged or heavily borrowed (Heider and Gropp, 2010, Adrian and Shin 2010). Therefore, size was expected to have a positive influence on banks long term adjustment. Results show that the variable bank size (SIZE) has a positive impact on changes in long term wholesale funding as expected, but its influence is not statistically significant. These results imply that bank size does not explain long term funding adjustment for banks used in the sample. These findings could be supporting the view that emerging market economies have small and underdevelopment capital markets as discussed in this study.

(v) Profitability (NIM)

The point estimate of the variable Net Interest Margin (shown as PROF in Column 2, Table 6.5) indicates that a 1.06% growth in bank profits causes banks to increase long term funding by 0.03%²⁴. This relationship is statistically significant at 1% level. This practice is in line with the tax benefit and bankruptcy costs view which states that profitable firms issue more debt in their capital structure because they have a low probability of distress (low costs of bankruptcy) and can significantly benefit from tax shields associated with debt (Gropp and Heider, 2010).

²⁴ Economic impact computed at sample mean by dividing the multiple of standard deviation of explanatory variable and regression coefficient by standard deviation of dependent variable.

(vi) Asset quality (NPL)

The variable Non-performing loans (NPL) was used to measure the riskiness of a bank's asset portfolio. In general, an increase in non-performing loans increases a firm's financial distress thereby reducing the firm's creditworthiness. For this reason, NPL is expected to have a negative effect on changes in long term debt issuance. Contrary to expectations, the coefficient of NPL is positive and statistically significant at 1% level, which indicates that non-performing loans positively influence changes in banks' long term funding. This counterintuitive evidence could be explained by the fact that banks in emerging market economies did not experience significant loan defaults compared to their counterparties in developed economies because the global financial meltdown which caused significant write offs in developed economies was not as severe in emerging market economies. As a result, despite the fact that growth in non-performing loans was expected to negatively affect debt issuance, its impact was less severe in emerging market economies as demonstrated by the small positive coefficient of NPL.

(vii) Assets Growth (AG)

The study found a strong and statistically significant relationship between assets growth and changes in long term debt funding. This suggests that assets growth is an important factor in explaining changes in long term debt funding. This relationship is plausible in that commercial banks are mainly funded by deposits and debt (Diamond and Rajan, 2001). As loan demand surges, banks have strong incentives to approach capital markets for additional funding since deposits take time to gather. This evidence concurs with the findings of Binici and Koxsel (2012) who established a positive and significant relationship between asset growth and leverage growth for banks operating in Turkey.

(viii) Bank Deposits (DEPOSITS)

The study found a negative and significant influence of deposits on long term debt funding consistent with the deposit supply constraint theory (Diamond and Rajan, 2001) and empirical findings of Van Rixtel *et al.* (2016). The deposit supply constraint hypothesis states that banks issue more debt securities to alleviate deposit funding constraints. This means when banks face difficulties to source retail deposits to fund their lending activities they resort to debt issuance. This practice was prevalent in the period preceding the global financial turmoil. The

literature of Kowalik (2013) highlights that due to deposit funding constraints, banks resorted to wholesale funding, primarily short term funding, by issuing securities such as Repurchase Agreements and Asset Backed Commercial Paper.

Besides using deposits to alleviate funding constraints, banks may be enticed to reduce the amount of debt in their capital structure as their level of deposits grows to maximize profits since deposits are relatively cheaper than debt (Allen *et al.*, 2015).

(ix) Business Cycles (GDP)

Regression results in Column 2, Table 6.5 indicate that a negative and significant association exists between business cycles and banks long term debt funding. This means that banks have a tendency of increasing (decreasing) debt funding during economic downturns (booms). The implication of these findings is that bank debt funding is countercyclical. Banks appear to be increasing long term borrowing in times of economic crisis and vice versa. Yet, banks must lend more in times of crisis in order to alleviate recessions. These results emphasize the need for regulators to reinforce the countercyclical capital buffer enunciated under Basel III. The countercyclical capital buffer encourages banks to build up capital buffers in good times thereby enabling them to continuously lend in times of crisis (Basel Committee on Banking Supervision, 2010b). The buffer would also reduce banks' need of long term funding in periods of crisis which would enable them to support businesses instead of themselves seeking external funding.

(x) Monetary Policy (CBR)

The study found that the point estimate of central bank rate, proxy for monetary policy, has a positive and significant impact on changes in long term debt. This evidence corresponds to the intuition that an accommodating monetary policy characterized by low central bank policy rates provide some incentivizes to banks to increase debt funding by issuing more bonds (Borio and Zhu, 2012).

(xi) Market Timing (IR)

Banks are expected to float more long term bonds when they expect a downward sloping yield curve, that is to say when they expect long run interest rates to be low based on the market

timing theory proposed by Van Rixtel *et al.* (2016). The estimated coefficient of the variable interest rate (IR) although it is positive as hypothesized, is not statistically significant. This evidence seems to convey that bond issuance in emerging markets is not significantly driven by the yield curve structure.

6.4.2.3. Equity funding scaled by total liabilities

(i) Lagged dependent variable ($EQ/TL_{ic,t-1}$)

The estimated coefficient of the lagged dependent variable ($EQ/TL_{ic,t-1}$) is highly positive and statistically significant. This is consistent with the hypothesis that adjustment costs prevent banks to completely adjust their capital ratios in each period and therefore motivates banks to maintain large capital buffers. Besides adjustment costs equity issues do have a signaling effect which may create incentives for banks to maintain large capital buffers. The literature of Myres and Majluf (1984) documents that equity issues in the presence of asymmetric information may send negative information to the market about a bank's economic value thereby persuading banks to hold capital above minimum regulatory requirements. The estimated speed of adjustment was 0.1%, which is 1 minus coefficient of lagged dependent variable (that is 1-0.999), meaning commercial banks in the sample close about 0.1% of their capital gap in each year. This indicates that banks in the sample slowly adjusted their capital ratios to reach their target rate during the period under study. These results may be supported by the view that there is less appetite for bank stocks in the Basel III era which hinders banks' ability to issue new equity over a short period of time. Using event study methodology Bruno *et al.* (2016) found that bank shareholders responded negatively to the announcement of Basel III liquidity measures. Bruno *et al.* (2016) stated that the European Union bank shareholders suffered large cumulative wealth losses of about 233 million Euros due to decreases in bank share prices following the announcement of Basel III liquidity rules. The authors attributed the investors' negative reaction to the general belief that the new liquidity standards would be detrimental to banks future earnings.

(ii) Regulatory pressure (REGPRESS)

The estimated parameter of REGPRESS is positive as expected and statistically significant. This evidence suggests that the new liquidity regulations are binding and effective.

Stated differently, research findings offer that commercial banks in emerging market economies responded to liquidity regulations by increasing equity funding consistent with Basel III aims. This behavior is not surprising given the treatment of equity capital in LCR calibration. Equity capital is considered to be perpetual, that is, it has no fixed maturity date; hence, it falls outside the 30-day LCR net cash outflow window. Therefore, banks have strong incentives to increase their funding using equity. Higher equity capital ratios are beneficial from a financial stability point of view although higher equity may impose some costs on banks. Equity capital acts as a buffer that absorbs losses thereby minimizing the likelihood of bank failure. Effectively, the buffer insulates bank creditors against losses which enhance a bank's stability.

Furthermore, equity capital provides incentives for better risk management. Asymmetric information makes it difficult for creditors to correctly price bank risk hence banks with a limited liability tend to assume excessive risk (Dagher *et al.*, 2016). Equity capital can minimize this moral hazard problem by internalizing bankruptcy costs resulting in enhanced risk management.

Notwithstanding this, equity issuance may convey negative information to the market about a bank's financial status (Myres and Majluf, 1984). Investors view equity issues as a reflection of management's insights into the firm's prospects and value. In general, investors treat equity issuance as a sign that the firm's share price is overvalued or management do not have positive net present value projects to invest in. This negative information disincentivizes equity issuance hence bank managers prefer internal funding than external sources, all else equal.

(iii) Bank size (SIZE)

System GMM regression results indicate that bank size has a negative and significant effect on bank capital. One possible interpretation of these results is that large banks operate with low levels of capital because they have easy access to capital markets compared to small banks. Similar results were found by previous researchers in both developed and emerging market economies. Such results were reported by Pereira and Saito (2011) who studied capital management practices of banks in Brazil and established that size negatively affects bank capital. Alternately, these results may be reflecting that large banks feel less pressurized to operate with high levels of capital because of the "too big to fail" phenomenon and the view that small banks face difficulties to access capital from financial markets (Jokipii and Milne, 2009). The "too big

to fail” theory maintains that big banks have a tendency of operating with low levels of capital because they have a high probability of being bailed out in the times of distress as a result of their systemic importance (Fonseca and Gonzalez, 2010). These findings emphasize the need for different rules for systemically important institutions if regulator’s goal of systemic stability is to be achieved. Moreover, these findings may lend support to the notion that big banks enjoy economies of scale compared to their counterparties due to their greater ability to screen and monitor borrowers which reduces their incentives to maintain large capital buffers (Alkadamani, 2015). In addition, the negative coefficient of the variable SIZE could be indicating that smaller banks are less diversified which in turn motivates them to maintain large capital ratios (Pereira and Saito, 2011).

(iv) Profitability (ROE)

In this study, return on equity (ROE) was used to examine the effects of charter value on banks’ capital. The charter value theory predicts that profitable banks tend to hold high capital ratios to protect their charter/franchise value (Demstet *et al.*, 1996). As expected, return on equity (ROE), indicated as PROF in Column 3, Table 6.5, has a statistically significant positive effect on banks’ capital changes. This evidence supports the claim that banks with higher charter values are motivated to set aside more capital from their earnings in order to preserve their franchise value as argued by Gropp and Heider (2010). Another interpretation of these results is that it seems commercial banks in the sample prefer to use retained earnings to increase their equity capital rather than issuing new equity. These results are consistent with the findings of Alkadamani (2015). The study of Alkadamani (2015) examined the behavioral response of 46 commercial banks in four emerging market economies, namely Saudi Arabia, Jordan, Kuwait and United Arab Emirates and found that profitable banks in these economies increased their capital ratios by retaining earnings instead of issuing new equity. From these results, it can be inferred that sampled banks in emerging market economies find it costly to raise additional equity from equity markets hence they prefer to elevate their capital ratios by using funds generated internally. Probably, because capital markets in emerging countries are underdeveloped therefore banks’ ability to source new capital through equity issuance is limited. This practice is consistent with the pecking order theory in corporate finance (Myers and Majluf, 1984). The pecking order theory states that in the presence of asymmetric information, firms

prefer to finance their businesses firstly with internal sources of finance (retained earnings), followed by debt and lastly new equity.

However, the impact of ROE on capital is not very high given that return on equity contribution to changes in bank capital is only 0.1%. This may imply that banks in emerging markets do not sorely depend on retained earnings to build their capital bases, but may be using other debt instruments like subordinated debt, preference shares and debentures to boost their capital base.

(v) Asset quality (NPL)

The variable Non-Performing Loans (NPL) was included in the model to examine the effects of asset quality on bank capital. A higher level of NPL implies greater asset portfolio risk; hence, banks with high NPL ratios are expected to hold more capital for risk management reasons. Contrary to expectations, regression results show that the variable NPL has a negative and significant effect on bank capital dynamics. These results could be explained by the fact that current loan losses weigh down the amount of risk weighted assets used in the determination of equity capital ratio, which in turn reduces the ratio of risk weighted assets to total assets thus the negative impact of NPL on bank capital (Heid *et al.*, 2004).

(vi) Bank liquidity (LIQ)

The negative and statistically significant parameter estimate on bank liquidity (LIQ) shows that liquidity has a negative effect on changes in bank capital. Consistent with Jokipii and Milne (2009), these results reflect that banks with significant investments in cash and marketable securities tend to maintain low levels of capital. This behavior is in line with the intuition that liquid banks are deemed to be less risk, which in turn creates incentives for them to target low capital ratios (Aggarwal and Jacques, 2001). Indeed, Diamond and Rajan (2000) points out that bankruptcy costs decrease as the amount of liquid assets grows; therefore, banks with large liquidity buffers tend to operate with low levels of capital. Since empirical findings have demonstrated that banks with high levels of liquidity tend to target low capital levels, the study offers that there is need for joint implementation of capital and liquidity regulations to ensure that banks maintain adequate levels of both capital and liquidity.

(vii) Bank Deposits (DEPOSITS)

In theory, banks fund their activities with deposits, equity capital and borrowed funds among other funding instruments. Literature suggested that banks in emerging markets have limited access to capital markets; therefore, banks in emerging market economies tend to largely finance their lending activities with deposits. As such, a positive association was predicted between bank deposits and capital. The coefficient on bank deposits (DEPOSITS) shows that deposits have a statistically significant positive effect on bank capital. As expected and confirmed by results in (IMF, 2011), banks in emerging market economies heavily depend on deposits to finance their business activities. This practice could be attributed to underdevelopment of capital markets in most emerging market economies that inhibit banks' ability to diversify their funding structures.

(viii) Business Cycles (GDP)

The point estimate on real gross domestic product growth (GDP) has the expected negative sign, but it is statistically insignificant. Therefore, consistent with previous studies on emerging market economies, Polodoo (2009) and Alkadamani (2015), the study could not find evidence to support the claim that economic activity significantly explains changes in bank capital. These empirical results may imply that banks in emerging market economies are responding to the countercyclical buffer proposed under Basel III. The countercyclical capital buffer requires banks to build up their capital buffers during economic booms which they would draw down in economic downturns to support economic activity. Hence, the countercyclical capital buffer requirement could have altered the strength of interaction of business cycles and bank capital.

6.5. RESULTS OF EFFECTS OF LIQUIDITY STANDARDS ON BANKS' FUNDING STRUCTURES

Besides demonstrating behavioral response of banks to mandatory liquidity charges, results in Table 6.5 (Columns 1, 2, and 3) were also be used to investigate the impact of binding liquidity requirements on banks funding models. As pointed out earlier banks have diverse funding structures that comprise customer deposits (retail and wholesale), wholesale funding (short term and long term), equity capital and securitization. Hence, the study examined how

liquidity regulations, particularly the LCR, have influenced changes in banks' funding instruments. The study intended to examine the impact of liquidity regulations on changes in all funding vehicles listed above; however, due to limited granular data, the analysis was limited to deposit funding, long term wholesale funding and equity funding.

The main variable of interest in this analysis is REGPRESS, which was used to measure the extent to which regulatory pressure triggered adjustments in banks funding models. The insight that can be drawn from results presented in Columns 1, 2 and 3, Table 6.5 is that the impact of regulatory pressure on changes in deposit funding, long term wholesale funding and equity funding is positive and statistically significant. This evidence suggests that regulatory pressure has been effective in persuading banks to increase their dependence on retail deposits, long term wholesale funding and equity funding. Based on this evidence, it can be concluded that Basel III liquidity charges are achieving one of their principal aims, that is, to persuade banks to fund their business activities with low runoff liabilities.

Of interest to also note from these results is that retail deposit funding appears to be more responsive to binding liquidity standards compared to other funding instruments, namely long term and equity funding. The elasticity of retail deposit funding may be attributed to the fact that deposit funding is the main form of financing to banks in emerging markets as discussed earlier. Moreover, the point estimate on the variable Long Term Wholesale Funding/Total Liabilities is small, suggesting that the impact of liquidity standards is less pronounced on long term wholesale funding. Two deductions can be made from this analysis. First, consistent with Domanski and Turner (2011) the study can offer that banks long term funding structures "sticky" (slow to change), reflecting capital markets rigidity. Second, this evidence may be lending support to the argument that capital markets in emerging market economies are less developed and lowly liquid, since it appears as if banks take time to adjust their long term funding structures.

6.6. ROBUSTNESS TESTS

Following previous literature, Fu *et al.* (2011) and others who used alternative estimators for robustness check, the study employed linear GMM and Difference GMM for robustness check. Linear GMM was used to check the robustness of Models 4.8 and 4.11 results while the

results for Models 4.9 and 4.10 were tested for robustness with difference GMM. The results of re-estimating Equations 4.8 to 4.11 using different estimators are presented in Appendix 3(c).

From the reported results, most of the estimates concur with previous results. Nevertheless, there are some variations in sign and statistical significance of some covariates, but the pattern of the influence of liquidity regulations, as indicated by the coefficient and significance of the variable REGPRESS, is consistent across all models. Therefore, robustness test suggests that empirical estimates are fairly robust to dynamic re-specification.

6.7. CHAPTER SUMMARY

The objectives of this chapter were twofold: to analyze how banks responded to binding liquidity requirements and the effects of Basel III liquidity standards on banks funding structures. The concomitant objectives were attained by evaluating balance sheet items that banks in emerging markets have altered in order to meet Basel III LCR. On the asset side of the balance sheet, the study found a strong positive association between changes in high quality liquid assets and regulatory pressure, suggesting that banks in emerging market economies reacted to liquidity regulations proposed under the Basel III framework by increasing their holdings of high grade securities. On the liability side of the balance sheet, empirical results showed that banks responded to the LCR charge by adjusting their deposit, long term wholesale and equity funding. Interestingly, changes in high liquid securities and deposit funding are more significant relative to adjustments in equity and long term funding, implying that banks in emerging markets have increased high quality liquid assets holdings and deposit funding more than long term funding and equity funding. In the same vein, the coefficient on High Quality Liquid Assets to Total Assets (HQLA/TA) variable is greater than the point estimate on Deposits Funding to Total Liabilities (DEP/TL) variable submitting that there is evidence of larger adjustments in asset side adjustments than liability side adjustments. This finding contradicts the finding of Duijm and Wiertz (2016) that LCR adjustment for banks in the Netherlands (developed country) is balanced towards the liability side instead of the asset side of the balance sheet. This analysis may substantiate the argument that banks in emerging markets depend more on themselves (by holding large liquidity buffers) for liquidity management while banks in developed markets rely more on wholesale markets for liquidity management.

The coefficients of the lagged variables High Quality Liquid Assets/Total Assets, Retail Deposits/Total Liabilities, Long Term Wholesale Funding/Total Liabilities and Equity Capital/Total Liabilities were positive and statistically significant. This means that all dependent variables used in the present study exhibited persistence. Furthermore, only the variable non-performing loans had a statistically significant impact on changes in banks' funding models. Therefore, asset quality appears to have a significant effect on banks funding structures adjustment.

CHAPTER VII

IMPACT OF LIQUIDITY CHARGES ON BANKS' PROFITABILITY

7.0. INTRODUCTION

One of the main concerns raised about liquidity standards is their potential adverse impact on banks profitability mainly because liquid assets are low yielding assets. Accordingly, the fifth objective of this research explored the impact of liquidity standards on emerging market banks' profitability. The dependent variable, profitability, was regressed against a non-linear polynomial of order two for liquid securities and set of bank specific and macro-economic variables. The chapter is organized as follows; unit root test results are presented first, followed by descriptive statistics and correlation matrix results and then regression results and the discussion empirical results last.

7.1. DESCRIPTIVE STATISTICS

In this section, descriptive statistics of variables used in the study are analyzed. The dependent variable employed is return on assets (ROA) which informs about management's ability to generate earnings from the firm's assets. The regressors used in the study are liquid assets ratio, the square of liquid assets ratio, bank size, bank capital, cost-to-income ratio, non-performing loans, specialization, bank deposits, real gross domestic product and central bank rate. Descriptive statistics discussed are mean, standard deviation, skewness, kurtosis, 10th and 90th percentile. The summary statistics are presented in Table 7.1²⁵.

The variable SPEC which was used to measure business specialization reported a mean value of 0.59 with a standard deviation of 0.11. The range value of 0.46, which is given as maximum value minus minimum value $(0.81 - 0.35)^{26}$, shows that there is less dispersion in the panel dataset. This analysis is confirmed by the small standard deviation value of 0.11, which highlights that there is little spread in specialization among sampled banks. These results suggest

²⁵ Variables discussed in previous chapters are not analyzed in this section to avoid repetition.

²⁶ Not reported to save space.

that most commercial banks in the study specialize in traditional intermediation function of deposit acceptance and loan extension.

The average value of cost to income ratio among sampled banks is quite high. The ratio averaged 60.35% for the period January 2011 to December 2016. This ratio signifies that for every \$100 operating income generated by the banks \$60.35 went towards operating expenses. The positive skewness value of 6.20 reflects that the right tail of the distribution is longer than the left tail while the large kurtosis value of 54.65 shows that the distribution has heavy tails.

Table 7.1: Impact of liquidity regulations on banks profitability descriptive statistics

Description	Variable	Mean	Standard Deviation	Skewness	Kurtosis
Net Profit/Total Assets	Profit (ROA)	0.88	2.61	-7.87	92.15
Liquid Assets/Total Assets	Bank liquidity (LIQ)	34.27	23.71	0.28	1.54
(Liquid Assets/Total Assets) ²	Bank liquidity squared (LIQ ²)	1734.07	1823.87	0.70	1.97
Ln(Total Assets)	Bank size (SIZE)	19.23	3.51	-0.31	3.12
Tier 1 + Tier 2 Capital/Total Risk Weighted Assets	Bank capital (CAP)	10.20	4.42	1.81	7.20
Operating Costs/Operating Income	Management efficiency (COST_INC)	60.35	31.36	6.20	54.65
Non-Performing Loans/Outstanding Loans	Credit risk (CR)	4.36	10.46	8.45	77.42
Loans/Total Assets	Specialization (SPEC)	0.59	0.11	-0.39	2.04
Retail Deposits	Bank deposits (DEPOSITS)	0.66	0.14	-0.85	3.55
Real Gross Domestic Product growth	Real GDP growth (GDP)	4.20	2.28	-0.78	4.19
Central Bank Rate	Monetary policy (MP)	5.65	2.93	-0.13	2.79

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

7.2 CORRELATION MATRIX

The pairwise correlation matrix was used to reflect the nature of the relationship between variables used in the study. The results for pairwise correlation are displayed in Table 7.2 below. As aforementioned, variables already analyzed are omitted in this analysis to avoid repetition. Furthermore, analysis was mainly focused on statistically significant correlations. Three variables were analyzed in this section, namely specialization (SPEC), COST to INCOME ratio (COST_INC) and the regulatory dummy variable REGPRESS.

The correlation between specialization and bank deposits is 0.5188. This means specialization is positively correlated to bank deposits. This relationship is not surprising since banks in emerging markets are more focused on traditional financial intermediation; therefore, growth in deposits tend to boost banks' lending activities. The correlation between specialization and the regulatory pressure dummy variable REGPRESS is negative and statistically significant, suggesting that banks responded to regulatory pressure emanating from liquidity rules by decreasing lending.

The variable cost to income ratio is positively correlated to non-performing loans. This correlation indicates that growth in non-performing loans causes banks' cost to income ratio to rise. This evidence is plausible in that rising non-performing loans signifies poor credit risk assessment and management which may lead to reduced bank profitability. Similarly, increase in cost to income ratio reflects inefficient cost management which may chew a bank's profits. Hence, the variables tend to co-move.

REGPRESS is positively correlated to ROA. This relationship implies that increased regulatory pressure causes bank profitability to increase. One reasonable explanation to these results could be that increased holdings of liquid assets reduces banks funding costs as they are perceived to be have low liquidity risk thereby resulting in high profitability (Bordeleau and Graham 2010). Another plausible explanation of these research findings could be that banks performance is not necessarily linked to its asset composition, but other factors - internal and external (Marozva 2015).

Table 7.2: Impact of liquidity regulation on banks profitability correlation matrix

	ROA	LIQ	LIQ ²	SIZE	CAP	COST_INC	CR	SPEC	DEPOSITS	REGPRESS	GDP	CBR
ROA	1.0000											
LIQ	0.0522	1.0000										
LIQ ²	0.0386	0.1967***	1.0000									
SIZE	0.0438	0.0459	0.1097	1.0000								
CAP	0.0751	0.1467**	0.1824**	0.2143***	1.0000							
COST_INC	-0.3628***	0.1566**	0.1659**	0.0931	0.0106	1.0000						
CR	-0.1694**	-0.0215	-0.0301	-0.0085	0.2460***	0.2195***	1.0000					
SPEC	-0.0441	0.0584	0.2162***	0.3468***	0.2484***	0.1084	0.0353	1.0000				
DEPOSITS	-0.1323*	-0.0698	0.0094	0.1771**	-0.1119	0.1076	0.0783	0.5188***	1.0000			
REGPRESS	0.0638	-0.1278*	-0.183**	-0.1002	0.0181	0.0744	0.0171	0.3797***	-0.0003	1.0000		
GDP	-0.077	-0.093	0.0012	0.1746**	0.1085**	-0.0284	0.1445**	0.4541***	0.5619***	-0.0005	1.0000	
MP	0.0699	0.0978	0.1568**	0.0462	0.1214*	0.0649	0.1063	0.2581***	-0.1277*	-0.1212***	0.0907	1.0000

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

7.3. UNIT ROOT TEST RESULTS

In order to avoid spurious regression, the panel dataset was first checked for unit roots. The Maddala-Wu Fisher type test was tested using the Augmented Dicker-Fuller unit root test, and the results are displayed in Table 7.3 below. The results show that all variables are stationary in levels; therefore, it can be concluded that the panel dataset did not contain unit roots. As such, the data can be applied in regression analysis without problems of spurious regression.

Table 7.3: Unit root test results for Impact of liquidity regulations on banks' profitability

Variable description	Variable	Chi-square value	Order of Integration
Net Profit/Total Assets	Profit (ROA)	264.7177****	0
Liquid Assets/Total Assets	Bank liquidity (LIQ)	192.6386****	0
(Liquid Assets/Total Assets) ²	Bank liquidity squared (LIQ ²)	224.7806****	0
Ln(Total Assets)	Bank size (SIZE)	256.1203****	0
Tier 1 + Tier 2 Capital/Total Risk Weighted Assets	Bank capital (CAP)	186.3055****	0
Operating Costs/Operating Income	Management efficiency (COST_INC)	157.2066****	0
Non-Performing Loans/Outstanding Loans	Credit risk (CR)	155.4583****	0
Loans/Total Assets	Specialization (SPEC)	215.8900****	0
Retail Deposits	Bank deposits (DEPOSITS)	254.9454****	0
Real Gross Domestic Product growth	Real GDP growth (GDP)	417.6138****	0
Central Bank Rate	Monetary policy (MP)	277.5196****	0

Source: Own construction based on data obtained from Bankscope.

****, **, * denotes 1%, 5% and 10% significance level respectively.*

7.4. RESULTS FOR IMPACT OF LIQUIDITY CHARGES ON BANKS' PROFITABILITY

Table 7.4: Impact of liquidity charges on banks' profitability results

Variable	Model 1		Model 2	
	Coefficient (1)	Economic impact (2)	Coefficient (3)	Economic impact (4)
Profit (ROA _{ic, t-1})	0.6506*** (0.0268)	-	0.6349*** (0.1665)	-
Bank liquidity (LIQ)	0.1763*** (0.0457)	1.6012	0.1665*** (0.0268)	1.5125
Bank liquidity squared (LIQ ²)	-0.0031*** (0.0006)	-2.1663	-0.0030*** (0.0004)	-2.0964
Bank Capital (CAP)	0.1041*** (0.0234)	0.1763	0.1017 (0.0237)	0.1722
Bank size (SIZE)	0.0494 (0.2604)	0.0664	-0.0358 (0.2940)	-0.0481
Management efficiency (COST_INC)	0.0020 (0.0032)	0.0240	-0.0018 (0.0040)	-0.0216
Credit risk (CR)	-0.1285*** (0.0075)	-0.1763	-0.1300*** (0.0090)	-0.521
Specialization (SPEC)	5.7239* (3.2285)	0.2412	6.4126*** (3.0395)	0.2703
Bank deposits (DEPOSITS)	6.3891*** (1.9316)	0.3427	7.6587*** (1.9207)	0.1426
Regulatory pressure (REGPRESS)	0.5311** (0.037)	0.0656	0.6919** (0.2939)	0.0853
Real GDP growth (GDP)	-0.0739 (0.0661)	-0.0646	-0.1248* (0.0605)	-0.1090
Monetary policy (MP)	-0.1239*** (0.0300)	-0.1391	-0.2353*** (0.0605)	-0.2642
Time fixed effects	No	No	Yes	Yes
Arellano-Bond (2) test	0.1422		0.1881	
Sargan test	0.1215		0.1255	
Wald test	82 594.55***		73 695.51***	

Source: Own design based on data obtained from Bankscope.

***, **, * denotes 1%, 5% and 10% significance level respectively

Standard errors are displayed in parenthesis (brackets)

Time dummies coefficient not reported for brevity.

The results of estimating Equation 4.13 with system GMM estimator are presented in Table 7.4. Before discussing empirical results displayed in Table 7.4, it is pertinent to highlight that the empirical model used in this study passes both the Arellano and Bond test of second order autocorrelation in residuals and Sargan test of instruments validity because the p-values are statistically significant, that is, greater than 5% significance level. The study therefore can conclude that reported estimates do not suffer from autocorrelation and instrument over-identification problems that may result in wrong inferences. Wald test results also show that the model is properly fit since the p-value is statistically significant, that is, less than 5% significance level. The results displayed in Columns 1 and 2, Table 7.4 exclude time dummies while the results in Columns 3 and 4, Table 7.4 controls for time dummies. On the whole, time fixed effects have no significant impact on estimated empirical results.

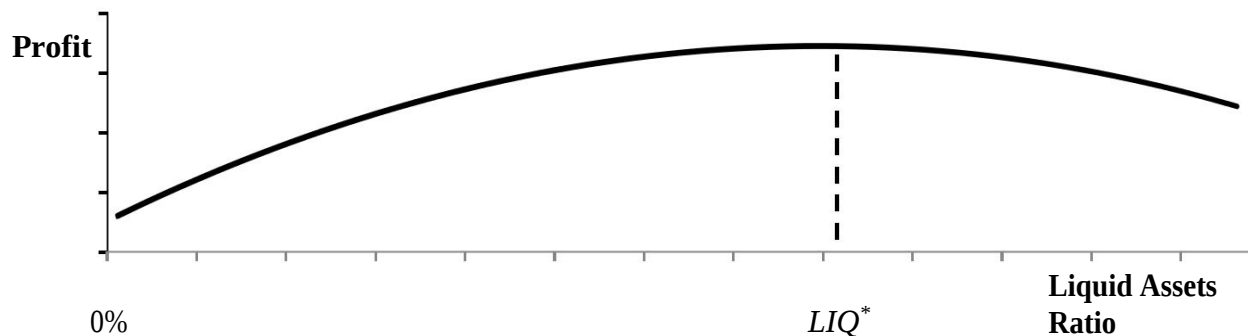
7.4.1. Lagged dependent variable ($ROA_{ic,t-1}$)

The study found a significant positive association between ROA and ROA_{t-1} , suggesting that banks in the sample have target levels of profitability they pursue. Without time dummies, the coefficient of 0.6506 on the lagged dependent variable ($ROA_{ic,t-1}$) corresponds to an adjustment speed of about 0.35, which is 1 minus lagged return on assets ratio ($1-0.6506$), indicating that commercial banks in the sample close 35% of deviation from desired profit level within a year. When time dummies are included, the adjustment speed increases to roughly 0.37. This slow adjustment speed is consistent with the claim that adjustment costs preclude banks to instantly adjust. In addition, this evidence appears to be consistent with the view that bank profits are persistent over time, meaning current levels of bank profits are closely related to their previous values. This view is in line with Fama and French (2000) who documented that firm profits are mean reverting in a competitive environment. In their paper, Fama and French (2000) highlighted that profitable firms tend to be imitated by less profitable ones thereby losing their competitive advantage. On the other hand, less profitable firms have strong incentives to implement prudent investment decisions so as to enhance their profitability. The overall effect of this behavior is that banks operating profits revert to their mean average in the long run.

7.4.2. Bank liquidity (LIQ) and Bank liquidity squared (LIQ²)

Contrary to the conventional wisdom that liquidity negatively affects bank profitability, empirical results show that bank liquidity positively contributes to profitability of commercial banks in emerging markets. A one standard deviation increase in liquid assets investments causes bank profitability to rise by 1.6 units. In an attempt to explain why credit markets are inefficient in emerging markets Freedman and Click (2006) noted that some banks in emerging market economies prefer to invest in government securities than lending to the private sector. Freedman and Click (2006) highlighted that factors such as moderate returns earned on government securities, low administration and transaction costs motivate banks in emerging markets to hold government securities portfolios. Therefore, the fact that banks in emerging markets can earn satisfactory returns on government securities may explain the positive association between bank liquidity and profitability.

Figure 7.1: Relationship between liquid assets and bank profitability



Source: Own design

Furthermore, consistent with expectations and previous literature from both emerging market economies (Shahchera, 2012) and advanced economies (Bordeleau and Graham, 2010), empirical results show that a non-linear relationship exists between the square of bank liquidity and bank profitability. As illustrated in Figure 7.1, the negative and statistically significant point estimate on (β_2) shows that profitability is maximized at LIQ^* . Stated differently, the association between bank profitability and the square of LIQ is in form of a downward concave parabola. The implication of these findings is that there are marginal benefits of holding liquid securities up to a certain optimal point (LIQ^*), beyond this point further increase in liquid securities holdings diminishes banks' profits, all other things constant. This evidence concurs with the

intuition that funding markets rewards banks that hold significant liquid assets by charging them low interest rates because they are perceived to be highly liquid and able to settle obligations (Bordeleau and Graham, 2010). Nevertheless, beyond the optimal point (LIQ^*) marginal benefits of holding liquid assets are outweighed by marginal costs of increasing holdings of low yield earning liquid assets. Moreover, these findings agree with the inventory theory of liquidity buffer which maintains that there are costs and benefits of maintaining liquidity buffers (Baltensperger, 1980; Santomero, 1984). The inventory theory states that maintaining a buffer of liquid assets is costly in terms of low returns earned by liquid assets relative to risky assets. On the other hand, the benefit of keeping liquidity buffers is that liquid assets provide a cushion against unexpected liquidity shocks. Liquidity buffers allow banks facing unexpected cash outflows to liquidate the liquefiable securities to cover maturing obligations rather than selling illiquid assets (loans) at fire sale prices to cover the liquidity deficits.

7.4.3. Regulatory pressure (REGPRESS)

The key variable in this analysis is (REGPRESS), which is a dummy variable that attempts to measure the impact of liquidity standards on banks profitability. Results of estimating Equation 4.5 with the two-step system GMM estimator indicate that the coefficient of REGPRESS is positive and statistically significant at 5% level. In terms of economic significance, a one standard deviation increase in regulatory pressure causes bank profitability to increase by 6.56%. Contrary to the widespread belief that Basel III liquidity measures would diminish banks' profitability, this study found that regulatory pressure emanating from liquidity standards actually enhances the profitability of banks in emerging market economies. These results may not be surprising when one considers the goal of Basel III liquidity standards. The regulations aimed at enhancing banks' resilience to liquidity shocks arising from either an economic or financial market crisis. In this context, Giordana and Schumacher (2017) found that Basel III liquidity requirements reduce banks' probability of default. Thus, increased liquid assets holdings enhance the safety/stability of a bank (Diamond and Kashyap, 2016). Literature has pointed out that safe banks can attract cheap funding (both deposits and equity) as they are perceived to be highly creditworthy (Kosmidou, 2008). As such, empirical results may be demonstrating that liquidity standards which enhance the safety of banks enabled banks in emerging markets to source funding at low costs leading to higher profitability. This analysis

agrees with the expected bankruptcy cost theory postulated by Berger (1995) and applied by Bordeleau and Graham (2010). Based on the expected bankruptcy cost theory advanced by Berger (1995), an increase in capital is associated with a reduction in a bank's financing costs because investors consider highly capitalized banks to be safe; hence, they charge low premiums to such borrowers. Bordeleau and Graham (2010), extended this concept to examine the relationship between bank liquidity and profitability. Bordeleau and Graham's (2010), assertion was that an increase in liquid assets gives banks favorable perception in funding markets, thereby reducing their funding costs and increasing their earnings, all else equal. Therefore, these results could be supporting the intuition that increasing liquid assets increases bank profits by lowering banks' funding costs, *ceteris paribus*.

Moreover, these results may be suggesting that banks in emerging markets devised new business strategies to improve their profit on the backdrop of heightened regulatory pressure. Banks might have passed regulatory burden/costs to consumers through raising lending rates or increasing service fees to remain profitable. In view of this, Ernst and Young (2013b) observed new strategies adopted by banks in Indonesia, Turkey, South Africa and Malaysia to boost their profits in Basel III regime. In Indonesia, banks diversified into micro and high margin retail lending. As a result of increased focus on micro lending, profits for banks in Indonesia have been rising. Banks in Turkey introduced new service fees such as on credit cards and also increased collections on existing fees to remain profitable. In South Africa, all big banks repriced their loans in response to increased funding costs. Besides repricing loans, banks in South Africa engaged in active portfolio management by switching from low yield assets such as mortgages to high yield assets like unsecured lending and auto loans. In Malaysia, a change in asset mix is taking place, where banks have reduced interbank lending and central bank deposits and switched to high yield earning fixed income securities since bonds in Malaysia pay 4.5% while central bank instruments attract between 3 - 3.3%. As a result of this change in asset mix, a large proportion of profits for banks in Malaysia are now derived from bond holdings.

In addition, management quality, business models and strategic management tools and decisions may differ across banks; therefore, returns that managers can generate on a bank's assets may also vary between banks. As such, banks with high levels of liquid assets holdings may not be necessarily less profitable as argued by Alger and Alger (1999). Such inference is

consistent with Marozva (2015) who concluded that bank performance is not necessarily dependent on its assets composition, but other internal factors and macroeconomic fundamentals may also explain bank profitability. Marozva (2015) concurs with Giordana and Schumacher (2017) finding that funding structure rather than asset composition affects bank profitability.

Alternatively, this evidence may be offering support to earlier results obtained under the second objective. Objective two findings offered that Basel III liquidity standards are less effective in emerging market economies possibly because banks in emerging market economies already had elevated liquid assets holdings before Basel III came into effect. Therefore, the introduction of new liquidity regulations seems not to have adversely affected profitability of banks in emerging market economies. To support this analysis, the present study contrasts findings of Banerjee and Mio (2017) study conducted in the United Kingdom (developed economy) and empirical findings from emerging market economies. Banerjee and Mio (2017), concluded that stricter liquidity measures adversely affected the earnings of British banks primarily by coercing them to shift towards low interest earning liquid assets. Yet, evidence from this study suggests that increased holdings of liquid assets significantly increased the profitability of banks in emerging market markets possibly because they already held large liquidity buffers. Therefore, this comparison demonstrates that Basel III appears to have more profound effects on banks in developed economies than emerging markets.

7.4.4. Bank capital (CAP)

Research findings show that a positive and statistically significant relationship exists between changes in bank capital and changes in bank profitability. The point estimate of CAP indicates that a 10% rise in capital causes banks' profitability to increase by about 18%. Consistent with Athanasoglou *et al.* (2006) and Flamini *et al.* (2015), the positive and significant association between capital and return on assets implies that the one period model of perfect capital markets with symmetric information is irrelevant to emerging markets banking sector. In other words, this evidence suggests that emerging markets' capital markets are imperfect. Therefore, considering an imperfect market characterized by asymmetric information and bankruptcy costs, one would expect capital structure to have an influence on earnings capacity of banks contrary to Modigliani and Miller (1958) proposition that capital structure does not influence firm performance. In an imperfect capital market, highly capitalized banks can borrow

at low costs as a result of reduced expected bankruptcy costs and financial distress (Berger, 1995). Similarly, when the symmetric information assumption is relaxed thereby allowing the signaling hypothesis to hold, banks expecting better performance would signal this positive information by maintaining high capital ratios (Berger, 1995). Thus, from this analysis it can be inferred that, in an imperfect world characterized by asymmetric information and bankruptcy costs, banks with large capital ratios tend to post huge profits.

Another interpretation of these results could be that commercial banks in emerging markets made sound lending decisions over the period 2011 to 2016 which confirms the proposition that highly capitalized banks engage in risky lending to reap huge profits (Rao and Lakew, 2012). This analysis agrees with Kosmidou (2008) finding that banks with high capital ratios have low default probability which enhances their creditworthiness and subsequently reduce their cost of funding thereby boosting their profits. Based on this evidence, boosting capital ratios of banks in emerging markets as enunciated under Basel III package is imperative as it offers banks additional buffers to withstand credit losses as well as liquidity shocks and also provides a safety net to depositors.

7.4.5. Bank size (SIZE)

Bank size, measured by the logarithm of total assets, was found to have a positive and statistically insignificant effect on the profitability of commercial banks in emerging markets in both models, that is, model with and without time fixed effects. This insignificant relationship may be attributed to the role of size in explaining banks' profitability in the presence of Basel III. Before Basel III, large banks relied on short term wholesale funding to finance their business activities due to the "too big to fail" hypothesis explained earlier. Given that short term funding tends to be cheaper than long term funding when one considers an upward sloping yield curve (Duijm and Wiert, 2016), large banks may have enjoyed high profits by borrowing at low costs in the period preceding Basel III. However, it seems Basel III has changed this by requiring banks, of all sizes, to shift their funding structures from unstable short term to reliable long term funding instruments. This change could explain why the impact of SIZE on banks' profitability is statistically insignificant.

Although the coefficient of SIZE is not statistically significant, its sign may warrant analysis. The positive association between bank size and profitability may suggest that large commercial banks are more profitable than smaller banks. This evidence is in line with earlier studies which support the conjecture that big banks benefit from economies of scale and scope (Kosmidou, 2008; Rao and Lakew, 2012). Haunter *et al.* (2005) documents that size affects bank efficiency via two possible channels. First, large banks because of their high market power are able to bargain for lower borrowing rates relative to smaller banks. Second, large banks are able to spread their fixed costs (economies of scale) leading to reduced operational costs and also tend to attract a highly specialized workforce which enhances their efficiency. Two important insights can therefore be drawn from this analysis. One, large commercial banks in emerging market economies used in the study appear to enjoy economies of scale. Two, large commercial banks can use their market power to earn high profits.

7.4.6. Management efficiency (COST_INC)

Empirical results show that the coefficient of management efficiency, proxied by cost to income ratio is statistically insignificant in both the model with and without time dummies. Hence, the assertion that management efficiency affects the performance of banks in emerging markets could not be verified by empirical results. Consequently, it can be inferred that operational efficiency is not an important determinant of profitability for banks in emerging market economies. Although the coefficient of (COST_INC) is statistically insignificant at conventional levels, its sign could offer some important implications to bank managers. Since management efficiency is measured by the ratio of cost to income, a rise in this ratio implies that costs are rising at a higher rate than income, thereby indicating poor operational efficiency which results in reduced profitability, *ceteris paribus*. On the other hand, if revenue is rising at a higher rate than expenses, profitability would be enhanced, all else equal. Empirical results show that the sign of COST_INC is negative. This could imply that banks in emerging market economies were not efficiently managing their operating costs over the period of study. Thus, bank managers in emerging market economies should keep an eye on their operating costs to enhance their profitability.

7.4.7. Credit Risk (CR)

As expected, the variable NPL has the correct negative sign and is statistically significant at 1% level. The coefficient has a value of (-0.1285), conveying that a 12.85% increase in non-performing loans leads to a reduction in bank profitability by about 18%. Thus, the study found statistical evidence at 1% significance level to support the proposition that an increase in non-performing loans erodes bank profitability, all else equal. The ratio of non-performing loans to gross loans signifies how well management is managing its loan book. In consideration of the fact that interest income is the main source of revenue to commercial banks, growth in non-performing loans weighs down banks profitability. Study results suggest that banks in emerging markets used in the sample are lending beyond the repayment capacity of their borrowers or face difficulties in collecting outstanding debt. This could be attributed to challenges faced by banks in emerging markets in debt collection. Freedman and Click (2006) pointed out that it is difficult to enforce loan contracts in emerging market economies due to the time and costs involved in the process. In addition, the International Finance Corporation (2004) asserts that collateral laws are weak in emerging markets because the judicial proceedings cause delays in repossessing and selling the pledged asset to recover funds loaned out. Consistent with this view, Freedman and Click (2006) highlighted that it takes up to five years for banks in Brazil and Chile to seize and sell the pledged asset. Asymmetric information could also be another factor that impedes effective credit risk assessment in emerging market economies. Absence of collateral registries and credit bureaus also makes it difficult for lenders to obtain all relevant information needed to evaluate the credit worthiness of potential borrowers. Moreover, accounting statements manipulation is also rampant in emerging countries when it comes to corporate lending. Cihak *et al.* (2013), reports that earnings manipulation is about 40% and almost 100% for listed firms in Turkey and Zimbabwe respectively. These factors impede proper credit risk assessment leading to high non-performing loans, thereby eroding earnings of commercial banks in emerging markets.

7.4.8. Specialization (SPEC)

The variable BM was incorporated in the regression model to evaluate the impact of business models on banks profitability. It was measured as the proportion of loans to total assets, and the study predicted that banks specialized in lending are more profitable. As projected, the

effect of specialization on bank profitability is strong positive and statistically significant at 10% level. A one standard deviation increase in loan to assets ratio contributes 24% growth in banks profitability. These findings are consistent with the theory of specialization which states that banks specialized in traditional lending are more profitable (Kolari *et al.*, 2006). The explanation that can be given to these results is the fact that net interest income from loans is the core source of revenue for commercial banks (Vong and Chan, 2009). Lending is more profitable to banks than other forms of investments because margins on loans are generally higher than margins from other investment securities (Beccalli *et al.*, 2016). Therefore, empirical results suggest that commercial banks operating in emerging market economies are actively engaged in traditional lending business.

7.4.9. Bank deposits (DEPOSITS)

Similar to Vong and Chan (2009) and Shahchera (2012), the study established that growth in deposits improves banks profitability. The coefficient of (6.3891) on the variable DEPOSITS shows that a 6-unit increase in total deposits of banks causes return on assets to grow by approximately 0.34 units. Since commercial banks are normally inclined towards traditional financial intermediation, that is accepting deposits and converting them into loans, banks that are able to transform more deposits into loans tend to be more profitable, *ceteris paribus*. From a different perspective, given that deposits constitute a large portion of emerging market economies banks' funding, as discussed earlier, banks that are able to borrow at low rates and offer loans at competitive rates should generate more earnings, all things equal. In the same vein, Demirguc-Kunt and Huizinga (1999), highlighted that demand deposits in emerging market economies usually attract interest rates that are below market rates; therefore, empirical results could be implying that banks in the sample are capitalizing on low deposits rates to maximize their returns.

7.4.10. Economic conditions (GDP)

Pertaining to the impact of macroeconomic fundamentals on banks profitability, the study found a negative and statistically significant effect of GDP on bank performance in the model with time dummies. A 12% growth in economic output translates to a 10.90% reduction in banks profitability. Contrary to the conventional wisdom that economic growth enhances bank

performance, this study found that economic growth diminishes profitability of banks in emerging markets. A plausible explanation of these results could be that banks in emerging markets seem to be incautious in their lending. It appears they over lend in times of economic booms. However, most of the loans may be improperly issued (no diligent credit appraisal) and collected resulting in high loan delinquencies and ultimately high credit losses which diminish their profitability. These results suggest that commercial banks in emerging markets need to lend conservatively in times of good economic prospects. Another possible explanation of these findings could be that although most economies have been in recovery post, the global financial crisis loan losses probably incurred during the crisis are still haunting commercial banks in emerging market economies.

7.4.11. Monetary policy (MP)

Another macroeconomic variable considered in this study was central bank rate. This variable was included to assess the effects of changes in monetary policy on banks profitability. The variable Monetary Policy (MP) exhibit a statistically significant coefficient of (-0.1239) in the model without time dummies, implying that a surge in central bank rates by 12.39% translates to a fall in bank profits to fall by 13.91%. It seems tightening of monetary policy adversely affects depository institutions ability to generate profits. This impact can be examined via the centric view of monetary policy also known as the bank lending channel, which states that monetary policy tightening leads to reduced bank lending because a contractionary monetary policy deplete banks reserves thereby weakening their deposits bases and ability to lend (Janjua *et al.*, 2014). This transmission mechanism hinges on the influence of policy rates on benchmark interest rates. Considering that the central bank rate is the yardstick rate used by banks in determining their lending rates (Bank of Zambia, 2010), an increase in policy rates may lead to a rise in banks' lending rates resulting in weak demand of bank loans by both households and business entities, all else equal. Since bank profits are significantly influenced by lending volumes, a reduction in loan supply may result in reduced banks' profitability, *ceteris paribus*. Therefore, these results provide some evidence to the fact that the monetary policy affects the bank lending channel of commercial banks in emerging market economies.

7.5. ROBUSTNESS TESTS

In this section, results of robustness test of key results (presented in Appendix 3(d)) are discussed. The robustness tests were conducted by using system GMM, changing covariates, ignoring non-linearity and adding other regressors to the baseline model. First, considering the linear equation results it can be noted that liquidity, measured by liquid asset ratio, has a negative impact on banks profitability. These findings imply that bank profitability decreases as banks increase their investments in liquid assets. This is consistent with the hypothesis that increased liquidity assets holdings diminish bank profitability because liquidity securities earn low returns compared to risky assets like loans. Next, the variable capital had a positive effect on bank profitability under the two-step GMM estimator, yet exhibits a negative and significant influence on bank profitability under linear GMM. The negative impact of capital under linear GMM estimation may be suggesting that highly capitalized banks tend to be less profitable. Operational efficiency, proxied by cost to income ratio, had an insignificant positive effect on bank profitability under two-step GMM estimation, but has a negative and statistically significant influence under linear GMM. The meaning of these findings is that operational inefficiency, high cost to income ratio, adversely affects banks earnings consistent with the efficiency theory. The efficiency theory maintains that inefficient banks are less profitable. Lastly, using linear GMM estimation, the relationship between monetary policy, measured by the central bank rate, and the bank's profitability is negative and statistically significant. The implication of these findings is that monetary policy tightening adversely affects banks profit generation ability.

The alternative dynamic models, that is, models with loan loss as an alternative measure of credit risk, liquid asset ratio as a different measure of liquidity and the non-linear model show that most of the coefficients have expected signs and statistical significance. The point estimates of the lagged return on asset ratios are positive and statistically significant confirming the proposition that banks' profitability is persistent over time. Of interest to also mention, is the negative and significant impact of operational efficiency, measured by the variable cost to income, on bank profitability. This association implies that banks with increasing cost to income ratios tend to report low profits. The evidence is reasonable since growth in costs beyond growth in revenues usually diminishes banks' revenue, all else equal.

Overall, robust results show that the impact of the key variable of interest REGPRESS on banks' profitability is consistent, that is, positive and statistically significant. Secondly, most results obtained under the baseline model (Model 4.13) prevail; hence, the study can conclude that empirical results are robust to other estimations.

7.6. CHAPTER SUMMARY

This chapter presented, analyzed and discussed results pertaining to the effects of mandatory liquidity standards on profitability of banks in emerging market economies. The study established that banks' profits exhibit persistence as they tend to revert towards their mean over time. Furthermore, a non-linear association was determined between bank liquidity and profitability, suggesting that there are marginal benefits of heightened liquidity assets holdings up to an optimal point beyond which further increases in liquid assets diminishes banks' profits. Contrary to the widespread belief that the LCR which compels banks to increase their liquid assets stock against expected liabilities would weigh down banks' earnings, empirical results revealed that regulatory pressure associated with liquidity standards actually increased the profitability of banks in emerging markets. From this finding, it can be inferred that harmonized liquidity regulations had no adverse effects on the performance of banks in emerging market economies. The following factors; liquidity, capital, business model and deposits were found to have a significant effect on banks performance while credit risk and monetary policy had an adverse impact on banks' profit earning ability. The variables; bank size, cost to income ratio and real GDP growth had insignificant coefficients meaning evidence on these variables is inconclusive. The next chapter summarizes, concludes and offer plausible recommendations to bankers, policy makers and future researchers.

CHAPTER VIII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.0. INTRODUCTION

In light of results presented in the preceding chapters, this chapter presents the main findings of the study, and proceeds to draw conclusions based on the research findings and offer plausible recommendations to policy makers and bankers. Lastly, this chapter highlights limitations experienced in conducting the study and proposed areas of future research. The chapter is structured as follows: the first section provides a summary of the study and main findings, the second section draws conclusions based on key findings while the third section offers recommendations and the last section suggests areas of further research that other students and academics can explore.

8.1. KEY FINDINGS, IMPLICATIONS, CONTRIBUTIONS AND RECOMMENDATIONS OF THE STUDY

8.1.1. Objective 1: Liquidity management practices of banks in emerging markets

The first objective of the study was aimed at providing insights into liquidity management techniques pursued by banks in emerging markets economies. Research findings revealed that banks in emerging market economies have target/optimal liquidity levels which they partially adjust to maintain their desired liquidity level. The speed of adjustment established in this study (0.45) indicates that banks in emerging market economies slowly adjust towards their desired liquidity level, suggesting that they face high adjustment costs. The adjustment process is influenced by the costs of adjusting towards the target level and costs of being off-target. If the costs of adjusting outweigh the costs of being in disequilibrium, banks slowly adjust and vice-versa. Based on these findings, it can be concluded that the costs of being off-target are low relative to the costs of adjusting; therefore, banks in emerging markets slowly adjust their liquidity to revert to their desired level. Moreover, the study found that banks face financial frictions that preclude them from instantaneously adjusting their liquidity when they are off target. In light of these findings, it can be inferred that adjustment costs create incentives for

banks in emerging markets to maintain liquidity buffers. This evidence also probably explains why banks in emerging market economies maintain high levels of liquidity.

The study went a step ahead to verify whether banks in emerging market economies are financially constrained. Empirical results confirmed that financial frictions in credit markets engender deposit constraints on banks operating in emerging markets and these financial constraints appear to be high in small banks than large banks. From these results, it can be concluded that small banks in emerging markets are more financially constrained than large banks. This evidence also contributes to the analysis of monetary policy transmission in emerging markets. The finding that small banks are more financially constrained than large banks may suggest that the bank lending channel of monetary policy implementation works effectively through small banks in emerging market economies. Therefore, bank regulators in emerging markets should work more with small banks when conducting their monetary policies.

Furthermore, the study established that bank specific characteristics influence liquidity decisions of banks in emerging markets. The finding that bank size positively influences banks' liquidity adjustment implies that banks in emerging market economies depend more on liquid assets and less on wholesale funding for liquidity management. From this evidence, the study can conclude that banks in emerging markets are risk averse. In terms of policy implications, this behavior engenders banking sector stability; hence, policy makers should reinforce it through strict monitoring of LCR regulation compliance.

The study established that banks in emerging markets increase liquid assets holdings as their lending business grows. Since maturity transformation, that is, deposits acceptance and loan extension, exposes banks to liquidity risk, empirical results suggest that banks in emerging markets are risk averse as they increase holdings of liquid assets in response to growth in loans (illiquid assets). Moreover, this behavior demonstrates prudent liquid management. From these results, it can be inferred that banks in emerging markets conservatively and prudently manage their liquidity. Regulators in emerging markets ought to reinforce this good practice by monitoring the compliance of banks to the LCR rule which encourages banks to maintain liquid assets that correspond to their expected net cash outflows over a 30-day period.

Research findings also revealed that banks in emerging markets with large volumes of transaction deposits maintain large liquidity buffers, suggesting that banks in emerging markets react to growing transactions deposits by increasing investments in liquid assets. In reality, capital markets are not perfect, meaning that banks cannot immediately source short term funding in financial markets when confronted with unexpected liquidity demands. It seems banks in emerging markets respond to market imperfections by accumulating liquidity reserves in order to hedge liquidity risk. This practice demonstrates sound liquid management; hence, regulators should strengthen this good behavior through strict supervision of the LCR standard.

Another interesting finding worth mentioning is the negative impact of loan loss reserves ratio on banks' liquid assets adjustment. This finding suggests that banks in emerging market economies poorly manage credit risk and has some implications for both bank managers and supervisors. Loan loss provisions are important because they play a significant role in determining the stability and soundness of banks' institutions. Inadequate loan loss provisioning may result in capital erosion which jeopardizes the banking sector's stability. As such, banks' loan loss provisions estimates are a vital tool for micro-prudential regulation that regulators use to monitor the quality of banks' loan portfolios. Based on these empirical findings, bank managers in emerging markets should set aside more funds to cater for doubtful debts. In other words, they should adopt forward looking loan loss management practices. Likewise, due to asymmetric information between regulators and banks, bank regulators need to obtain timely information on banks' loan loss provisions since loan losses are reported on an accrual basis. Delays in obtaining such information in time would paint a good picture on banks' solvency which may not be true.

The study also contributes to analysis of the relationship between macroeconomic conditions and banks' liquidity holdings. The positive association between real GDP growth and banks' liquidity buffers suggests that bank liquidity is procyclical, meaning that banks in emerging markets accumulate (draw down) liquidity buffers when the economy is performing well (badly). This behavior is consistent with the aims of the LCR. The LCR encourages banks to build up liquidity buffers in good times and draw them down in terms of crisis. As such, the study advocates policy makers to reinforce this interplay through tight supervision of liquidity requirements.

Monetary policy in emerging market economies was found to be ineffective in altering overall banking sector liquidity in emerging markets since the study could not establish a significant statistical relationship between monetary policy and banks' liquidity buffers. This implies that central banks' efforts to stimulate economic activity by reducing short term interest rates are defeated in emerging markets probably because aggregate bank liquidity is very high. This calls for regulators to look at other tools of stimulating economic activity by manipulating bank liquidity. One such tool at the disposal of regulators in emerging market economies is statutory reserve requirements. This analysis possibly explains why statutory reserve requirements are very high in emerging markets.

A further contribution of this study was to provide an answer to the question, "*Do liquidity management practices of banks vary according to bank size?*" The finding that small banks in emerging market appear to be more conservative than large banks in their liquidity management emphasizes the need for regulators to pay more attention on the behavior of large banks in order to foster banking sector stability. The 2007/2009 global financial crisis was mainly blamed on the malpractices of large banks, the so-called systemically important banks; therefore, capital and liquidity positions of large banks should be closely monitored if macroprudential goals of bank regulation are to be achieved.

Overall, the study established that risk aversion and prudence play a significant role in explaining the amount of liquid assets maintained by banks in emerging market economies. This behavior was attributed to changes in liquidity management practices of banks in emerging market in response to lessons learnt from the 1997 Asian financial crisis. The Asian financial crisis left a number of bank managers' fingers burnt; hence, bank managers in emerging markets seem to have revised their liquidity management practices to avoid another burning. True to that fact, come the global financial crisis, banks in emerging markets entered the crisis with high liquidity buffers contrary to the behavior of banks in developed markets. Another blessing in disguise that seems to be working for banks in emerging market economies is underdevelopment of capital markets. Underdevelopment of capital markets has forced banks in emerging markets to hold large liquidity reserves for precautionary reasons as they cannot tap funding from capital markets at will. From this discussion, one can conclude that banks in emerging markets clearly

understand and follow the wisdom offered by the old adage, “*shortage in liquidity will kill you instantly*” (SunGard, 2012:1).

8.1.2. Objective 2: Impact of liquidity regulations on banks liquidity management practices

One of the main findings of the study and contributions to the body of knowledge is the finding that Basel III LCR complement existing liquidity management practices of banks in emerging markets. The result implies that regulatory pressure stemming from the LCR regulation had little impact on liquidity management behaviors of banks in emerging markets. From these results, it can be concluded that the LCR charge is less effective in altering liquidity management behaviors of banks that already managed their liquidity in the spirit of the rule, but effective in banks that largely operate with low liquidity buffers and rely on wholesale funding for liquidity management. In light of this, the study supports the adoption of Basel III liquidity reforms in banking institutions that operate with low levels of liquid and use wholesale funding to cover liquidity gaps.

The finding that Basel III LCR complement existing liquidity management practices of banks in emerging markets contradicts widespread belief that the LCR would change/substitute the role of contextual factors (that influence bank liquidity) in explaining banks’ liquid adjustment dynamics. These results were attributed to the fact that banks in emerging market economies already managed their liquidity in a manner that is consistent with the LCR rule, that is, they already operate with large liquidity buffers and continue to rely on deposit funding. Based on these results, banks’ regulators in emerging markets need to reinforce sound liquidity management practices exhibited by banks. This can be achieved through periodic liquidity stress tests, say on a quarterly basis, for both short-term and long-term bank specific and system wide stress scenarios and a combination of both. Given that banks normally develop stress tests that exclude second round or system wide effects, partly because they lack requisite data that is needed to develop a liquidity stress test, supervisors have a key role to play in the conduct of stress tests at macro level. A horizontal approach to stress testing could be ideal in the sense that it is conducted for a number of banks using similar approaches, scenarios and assumptions (Basel Committee on Banking Supervision, 2013). The benefit of macro stress testing is that it enables bank supervisors to assess the possible effects of market wide stress scenarios and

potential second round effects on banks' ability to withstand liquidity shocks. Results of liquidity stress tests also enable banks to develop robust contingency funding plans which comprehensively maps out alternative funding in times of crisis.

8.1.3. Objective 3: Behavioral response of banks to liquidity standards

The third objective investigated how banks have achieved changes in their liquidity ratios in pursuit of binding LCR liquidity charges. Regression results reported that sampled banks responded to binding liquidity requirements by increasing the stock of high quality liquid securities, retail deposit funding, long term wholesale funding and equity funding. Hence, it can be concluded that the LCR liquidity regulation is achieving some of its aims as far as emerging markets are concerned. In particular, the LCR regulation appears to be effective in compelling banks in emerging market economies to increase holdings of securities deemed to be liquid and fund their activities with stable funding structures. Increasing liquidity buffers and increasing funding from stable instruments (retail deposits, long term debt and equity) engenders banking sector stability. As a result, the study is in favor of Basel III liquidity standards adoption in emerging market economies. This evidence contributes to ongoing discussions about the implementation and effectiveness of Basel III LCR standard.

The evidence that banks in emerging market economies responded to regulatory pressure by increasing high quality liquid assets stock in line with Basel III LCR expectations since the rule requires banks to elevate their portfolios of high quality liquid assets. The immediate benefit of this behavior is reduction of idiosyncratic risks within individual banks. A sufficient stock of high grade liquid assets bolsters banks' ability to withstand short term and severe liquidity crisis thereby limiting second round effects of liquidity spirals; therefore, banking sector stability is reinforced. Second, holding high quality liquid assets reduces liquidity tail risk²⁷ by offering counterbalancing liquidity to cover massive cash outflows (Van den End, 2012). Nevertheless, increased holdings of high grade liquid securities may affect monetary policy conducted through asset purchases since open market purchases will have more effects on banks instead of refinancing operations (Van den End, 2012). Furthermore, banks may be enticed to excessively borrow from the central bank at the expense of the interbank market by pledging non-liquid

²⁷ Tail risk can be described as events with a low probability of occurring but should they occur they have an adverse impact on portfolio values (Bhansali, 2008).

assets as collateral. This behavior could hamper activity in the unsecured money markets; hence, monetary policy transmission can be impeded since money markets play a pivotal role in monetary transmission (Coeure, 2013). That said, the study urges policy makers to keep an eye on banks' repurchase agreement (Repo) activities in order to safeguard the smooth functioning of money markets.

Besides working against monetary policy, increased holdings of liquid securities which are skewed towards government securities can create several problems at both micro and macro level. First, increased holdings of government securities may crowd out private sector lending (ESBG, 2014; Li, 2017). Second, large holdings of government securities may engender solvency risk for banks because sovereign bonds are not necessarily risk free based on events that transpired during Eurozone sovereign debt crisis. During the Eurozone debt crisis, a number of countries experienced difficulties in servicing their sovereign debts which triggered a crisis in the Eurozone proving that sovereign debt is not necessarily risk free. Furthermore, government securities are marked to market to reflect valuation losses in a crisis which may diminish banks' capital positions (Blundell-Wignall and Atkinson, 2010a). Fourth, increased holdings of government instruments may create incentives for governments to run large budget deficits in order to satisfy increased demand for liquid assets (Blundell-Wignall and Atkinson, 2010b). Fifth, increased demand for government securities may cause benchmark interest rates (risk free rate) to fall leading to serious distortions in interest rate setting since depository institutions rely on Treasury bill rates to set their interest rates. Hence, policy makers ought to monitor concentration risk in banks' liquid assets portfolio (in terms of their HQLA constituents) to prevent market distortions and systemic risk.

Additionally, this behavioral response of banks (increased liquid assets holdings) may imply that liquidity regulations substitute banks' impetus to manage their own liquidity. Duijm and Wierts (2016), offer that instead of evaluating their own liquidity risk banks may end up relying on risk weights provided by supervisor. Thus, it is imperative for regulators to look beyond liquidity coverage ratios reported by banks, but also check underlying factors used in the determination of the ratio, that is, balance sheet items that make up the ratio. Moreover, maintaining a large fraction of assets in liquid assets can provide bank managers with a lot of discretion (in terms of free cash flows) which could create agency problems. The free cash flow

theory proposed by Jensen (1986) maintains that free cash flows²⁸ create agency problems. When managers are left with a lot of free cash flows at their discretion, they are likely to abuse the funds leading to increased agency costs, inefficient resource allocation and bad investments which may destroy shareholder value. Therefore, shareholders are advised to monitor managers' use of free cash flows so as to preserve firm value. Moreover, increased holdings of low yield earning liquid securities may create incentives for banks to take excessive risk in unregulated or less regulated areas in search of high returns which may propagate systemic risk. Accordingly, policy makers must cautiously monitor systemic risk build-up in unregulated or less regulated sectors of the financial system and take corrective action promptly.

Furthermore, the study ascertained that banks in emerging markets reacted to mandatory liquidity requirements by increasing the share of retail deposits in total funding. From a macroprudential regulation perspective, this behavior can engender financial sector stability because retail deposits are resilient to funding shocks (Gatev and Strahan, 2006; Ritz and Walther, 2015; Vazquez and Frederico, 2012). From a micro perspective, growth in retail deposits particularly demand deposits that earn below market interest may boost banks profitability via reduction in overall cost of funding. In addition to this, a large clientele base allows banks to sell other products and increase non-interest income through transaction charges which effectively increase their revenue (Hartlage, 2012). Therefore, banks in emerging markets are advised to design strategies that enable them to attract significant retail deposits. Banks can mobilize retail deposits through acquisitions, expanding branch network, instituting competitive deposit rates, offering non-financial benefits to depositors such as automatic entry into periodic promotions for new depositors that offer attractive prizes, product differentiation and creative marketing. This study established that banks responded to regulatory pressure by increasing high quality liquid assets stock in line with regulators' expectations. The immediate benefit of this behavior is reduction of idiosyncratic risks within individual banks. A sufficient stock of high grade liquid assets bolsters banks' ability to withstand short term and severe liquidity crisis thereby limiting second round effects of liquidity spirals, by that financial sector stability is

²⁸ Lehn and Pouslen (1989) define free cash flows as net operating income before depreciation, minus tax, interest and dividends scaled by net sales.

reinforced. Second, holding high quality liquid assets reduces liquidity tail risk²⁹ by offering counterbalancing liquidity to cover massive cash outflows (Van den End, 2010). Nevertheless, increased holdings of high grade liquid securities may affect monetary policy conducted through asset purchases since open market purchases will have more effects on banks instead of refinancing operations (Van den End, 2010). Furthermore, banks may be enticed to excessively borrow from the central bank at the expense of the interbank market by pledging non-liquid assets as collateral. This behavior could hamper activity in the unsecured money markets; by that monetary policy transmission can be impeded since money markets play a pivotal role in monetary transmission (Coeure, 2013). That said, the study urges policy makers to keep a watchful eye on banks behavior. Precisely, monetary authorities should keep an eye on banks' repurchase agreement (Repo) activities in order to safeguard smooth functioning of money markets.

Moreover, the finding that banks in emerging market economies responded to regulatory pressure by shifting towards equity capital provides incentives for better risk management. Since asymmetric information makes it difficult for creditors to correctly price bank risk, equity capital can minimize this moral hazard challenge by internalizing bankruptcy costs resulting in enhanced risk management. Likewise, a switch towards long term debt instruments minimizes asset and liability mismatches thereby fostering financial sector stability. Notwithstanding this, the weak impact of regulatory pressure on changes in equity and long term wholesale funding suggests that banks in emerging markets face difficulties in adjusting their balance sheets towards these funding instruments. This constraint was attributed to low levels of financial sector development in emerging market economies. Low levels of financial sector development may also explain why most savings in emerging markets are in the form of bank deposits and physical assets such as real estate and why wealthy people in countries like Malaysia tend to invest offshore. Therefore, policy makers are urged to prioritize financial sector development in terms of developing and managing a wide range of financial markets such as equity, bond and derivative markets to widen funding sources of banks.

²⁹ Tail risk can be described as events with a low probability of occurring, but should they occur, they have an adverse impact on portfolio values (Bhansali, 2008).

McKinsey & Co (2017) submits six different policies that emerging market economies can improve their financial systems. First, they need to develop a liquid government securities market in order to provide a large pool of benchmark assets. Second, they have to advance the growth of a deep and broad investor base so as to enhance capital supply. Third, emerging markets can develop their capital markets by increasing issuer participation mainly through privations. This policy has proved to be effective as it initiated the developments of capital markets in Europe in the 1970s. China also seems to be benefiting from state enterprises privatization. Fourth, emerging markets can deepen their capital markets by promoting competition between domestic market participants by restricting the operations of foreign firms so that they do not end up controlling domestic markets. However, this may be counterproductive if competition is thwarted. Moreover, domestic firms may be put at a disadvantage through protectionism in the event that the markets open to foreign players. The fifth policy that can be adopted by policy makers in emerging markets to promote capital market development is to create free markets by opening domestic markets to foreign players. Lastly, policy makers in emerging market can reinforce price discovery and resource allocation through ad-hoc direct and indirect interventions in the markets to correct price distortions, and also to control the distribution of resources among economic agencies.

8.1.4. Objective 4: Impact of liquidity regulations on banks' funding models

The fourth objective of study analyzed the impact of liquidity regulations on banks funding models. The empirical results revealed that regulatory pressure has been effective in persuading banks in emerging markets to increase deposit funding, long term wholesale funding and equity funding. It can be concluded that the LCR rule has been effective in provoking banks in emerging markets to modify their funding structures, by switching towards stable and long term funding instruments. The implications and recommendations of this objective are similar to those presented under Objective 3 above (Section 8.1.3) hence they are not repeated here.

8.1.5. Objective 5: Effects of Basel III LCR liquidity charge on banks' profitability

Lastly, one of the main concerns raised about the Basel III liquidity requirements is their potential undesirable effects on banks profitability since increased holdings of liquid assets is assumed to depress interest income as liquid securities generally earn low returns. It is on this

background that the fifth objective evaluated the effects of liquidity charges on the profitability of banks in emerging market economies. The key finding of interest was that regulatory pressure positively affects the ability of banks in emerging markets to generate profits. To that end, the study found evidence to refute the general belief that phasing in of liquidity regulations would adversely affect the performance of banks in emerging markets. It can be said that the LCR charge has no detrimental effects on the performance of banks in emerging markets. In fact, empirical evidence demonstrates that there are benefits for banks to hold more liquid assets. In light of these results, it can be concluded that funding structures rather than asset composition affect the profitability of bank in emerging markets. Accordingly, the study supports the implementation of the Basel III liquidity regulations in emerging market economies. This evidence contributes to the interplay between liquidity regulations and banks' profitability discourse.

Besides, increased holdings of liquidity securities ameliorate liquidity risk at bank level which fosters the banking sector's stability. Since the study established that the Basel III LCR rule did not erode the profitability of banks in emerging market economies over the period of study, investors (both local and international) are advised to consider stocks of banks in emerging market economies in their portfolios.

The non-linear relationship established between liquidity and profitability implies that there is an optimal level of liquidity that banks must hold in order to maximize profits. However, this benefit can only be enjoyed to the extent that the benefits of maintaining liquid assets outweigh opportunity costs of maintaining low yield earning assets. This implies that a risk-return trade-off exists between bank liquidity and profitability. This evidence highlights the importance of optimal liquidity management in banking firms. This study therefore recommends bank executives in emerging markets to develop liquidity optimization models that assist them in making the most effective use of liquid assets they hold. Moreover, national regulators are advised to take into consideration the trade-off between safety and opportunity costs of holding low yield securities when they implement liquidity regulations in their jurisdictions.

The study also established that a positive relationship exists between bank deposits and profitability. The implication of this finding is that growth in deposits especially demand, which normally pay below market rates in emerging market economies, boosts the profitability of banks

in emerging markets. Therefore, bank executives in emerging markets are advised to design strategies that enable them to source more retail deposits. One way banks in emerging markets can increase their deposits is reaching the unbanked masses through agency banking. This strategy enables banks to venture into unbanked areas at low cost so as to boost their deposits and subsequently profits. At the same time, they should put in place robust credit risk management systems to minimize loan delinquencies that may arise as they transform more deposits into loans. This can be done by adopting sophisticated internal rating based approaches to credit risk assessment and measurement proposed under Basel II and III standards.

8.2. LIMITATIONS OF THE STUDY

As with any study, limitations are bound to exist. In this present study, the following limitations were experienced.

8.2.1. Data collection

This study intended to collect data from many banks operating in emerging market economies; however, due to missing information in the Bankscope database, the study sample was restricted to forty banks, which may compromise the reliability of the results. This implies that study results may not be generalized beyond the sample that was gathered.

8.2.2. Estimation technique

Similar to empirical literature, Shrieves and Dahl (1992), Jacques and Nigro (1997), Aggarwal and Jacques (2001) and Rime (2001) that examined banks' response to capital regulations using simultaneous equations approach, this study intended to employ simultaneous equation estimators for Objectives 3 and 4 that capture concurrent adjustments in the numerator and denominator items of the LCR. However, due to the dearth of granular data on LCR components from the banks' balance sheets the study could not apply such estimators; hence, resorted to system GMM for estimation which also addresses endogeneity.

8.2.3. Use of published financial statements

Bankscope database is made up of data extracted from individual banks financial statements. Yet, published financial statements are prone to managerial manipulation which may

compromise the quality of information contained in the financial statements; therefore, affect estimated results. The reason why management may be reluctant to disclose all pertinent information is that they fear competitors may exploit disclosed information to their merit (Linsley and Shrives, 2005). Therefore, in this study, data validity relied on the reporting quality of individual banks.

8.2.4. Period of study

The present study's period was confined to a "pure" Basel III period, that is, January 2011 to December 2016. However, during this period, banks could have been recovering from the effects of the global financial crisis implying that the sampling window might not have covered a "normal state of affairs". Nevertheless, the threat of this limitation is minimized by the fact that the global financial crisis was not as severe in emerging market economies relative to developed economies (International Monetary Fund, 2011).

8.3. AREAS OF FURTHER RESEARCH

- ❖ This study was confined to the Basel III period, that is, 2011 to 2016; other researchers may carry out a comparative analysis of banks liquidity management practices under the pre and post Basel III conditions.
- ❖ This study focused on stock approaches to liquidity management; other researchers may examine the interplay between the Basel III liquidity rules and liquidity management practices of banks from a cash flow perspective.
- ❖ The study was interested in funding liquidity derived on the liability side; other researchers may explore liquidity management behaviors of banks under Basel III from both sides of the balance sheet, that is, funding and asset liquidity.
- ❖ Another area that other researchers may explore is to investigate the impact of Basel III liquidity charges on bank competition and stability.

REFERENCES

- Abreu, J. and Gulamhussen, M. (2013). *The relationship between capital requirements and bank behavior: A revision in the light of Basel II*. Proceedings of the 19th European Financial Management Conference, 23 - 26 June, Aarhus, Denmark.
- Accenture. (2015). Liquidity Coverage Ratio: Implications and a Pragmatic Approach to Implementation. Accenture. Available: https://www.accenture.com/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_9/Accenture-Liquidity-Coverage-Ratio.pdf (Accessed 13 January 2016).
- Admati, A.R., DeMarzo, P.M., Hellwig, M. and Pfleiderer, P. (2013). *Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not socially expensive*. Preprints of the Max Planck Institute for Research on Collective Goods (No. 2013/23).
- Adrian, T. and Shin, H.S. (2010). Liquidity and leverage. *Journal of Financial Intermediation*, 19(3): 418-437.
- Agarwal, S., Deng, Y., Luo, C. and Qian, W. (2015). The hidden peril: The role of the condo loan market in the recent financial crisis. *Review of Finance*, 20(2): 467-500.
- Aggarwal, R. and Jacques K. T. (2001). The impact of FDICIA and prompt corrective action on bank capital and risk: Estimates using a simultaneous equations model. *Journal of Banking & Finance*, 25(6): 1139-1160.
- Aggarwal, R. and Jacques, K.L. (1998). Assessing the impact of prompt corrective action on bank capital and risk. *Federal Reserve Bank of New York Economic Policy Review*, 4(3): 23-33.
- Ahlswede, S. and Schildbach, J. (2012). *Poised for comeback: Bank deposits*. Deutsche Bank. Available: https://www.dbresearch.com/PROD/RPS_ENPROD/PROD0000000000454753/Poised_for_a_comeback%3A_Bank_deposits.PDF (Assessed 17 August 2017)
- Ahmad, F. and Rasool, N. (2017). Determinants of bank liquidity: Empirical evidence from listed commercial banks with SBP. *Journal of Economics and Sustainable development* 8(1): 47-55.
- Ahmad, R. and Matemilola, B.T. (2013). Determinants of Bank Profits and Net Interest Margins. *Emerging Markets and Financial Resilience*, 4(C): 228-248.
- Ahn, S. C. and Schmidt, P. (1995). Efficient estimation of models for dynamic panel data. *Journal of Econometrics*, 68(1): 5-27.
- Akinsoyinu, C. A. (2015). The Impact of Capital Regulation on Bank Capital and Risk Decision. Evidence for European Global Systemically Important Banks. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 5(3): 167-177.

Akter, R. & Roy, J.K. (2017). The Impacts of Non-Performing Loan on Profitability: An Empirical Study on Banking Sector of Dhaka Stock Exchange. *International Journal of Economics and Finance* 9(3): 126-132.

Al-Anani, N. A. (2009). *Evaluation of the impact of international standards set by the basle committee on banking supervision on Jordanian law*, Unpublished PhD Thesis. Durham: Durham University.

ALCO Partners, (2001). *Liquidity and Funds Management*, Comptroller of the Currency Administrator of National Banks Handbook. Available: http://www.alcopartners.com/RegulatoryDox/Controller_liquidity.pdf (Accessed 29 April 2016)

Alessi, C. (2012). *The Basel Committee on Banking Supervision*, Council on Foreign Relations. Available: <https://www.cfr.org/backgrounder/basel-committee-banking-supervision> (Accessed 15 January 2016)

Alger, G. and Alger, I. (1999). *Liquid Assets in Banks: Theory and Practice*, Boston College Department of Economics, Boston (Working Paper No. 446).

Alkadamani, K. (2015). Capital Adequacy, Bank Behavior and Crisis: Evidence from Emergent Economies. *European Journal of Sustainable Development*, 4(2): 329-338.

Al-Khouri, R. (2012). Bank Characteristics and Liquidity Transformation: The Case of GCC Banks. *International Journal of Economics and Finance*, 4(12): 114-120.

Allen, F. and Carletti, E. (2012). Systemic Risk and Macroprudential Regulation. *International Journal of Banking, Accounting and Finance*, 5(1/2): 28-48.

Allen, F. and Carletti, E., (2013). Financial Markets, Institutions and Liquidity. In *RBA Annual Conference Volume*. Reserve Bank of Australia.

Allen, F. and Gale, D. (2000). *Comparing financial systems*. Massachusetts, United States of America: MIT Press.

Allen, F. and Gale, D. (2000). Financial contagion. *Journal of Political Economy*, 108(1): 1-33.

Allen, F. and Gale, D.M. (2017). How should bank liquidity be regulated?. Paper Prepared for the Federal Reserve Bank of Atlanta's 2014 Financial Markets Conference on 'Tuning Financial Regulation for Stability and Efficiency, 27 March, Atlanta.

Allen, F., Carletti, E. and Marquez, R. (2015). Deposits and bank capital structure. *Journal of Financial Economics*, 118 (3): 601-619.

Almarzoqi, R., Naceur, M.S.B. and Scopelliti, A. (2015). *How Does Bank Competition Affect Solvency, Liquidity and Credit Risk? Evidence from the MENA Countries*. International Monetary Fund, Washington DC. (Working Paper No. 15-210).

Almeida, H., Campello, M. and Weisbach, M.S. (2004). The cash flow sensitivity of cash. *The Journal of Finance* 59(4): 1777-1804.

Alshatti, A. S. (2015). The Effect of the Liquidity Management on Profitability in the Jordanian Commercial Banks. *International Journal of Business and Management* 10(1): 62-71.

Altunbas, Y., Gambacorta, L. and Marques-Ibanezc, D., 2014. Does Monetary Policy Affect Bank Risk?. *International Journal of Central Banking*, 10(1): 95-135

American Bankers Association, (2017). *International Standard Setting Preserving Global Consistency through Transparency, Accountability, and Serving Local Interests*. American Bankers Association. Available: [https://www.aba.com/Advocacy/Documents/InternationalStandardSetting.ABA.May17%20\(002\).pdf](https://www.aba.com/Advocacy/Documents/InternationalStandardSetting.ABA.May17%20(002).pdf) (Accessed 15 august 2017).

Anderson, T. W. and Hsiao, C.(1982). "Formulation and estimation of dynamic models using panel data. *Journal of Econometrics*, 18(1): 47-82.

Angklomkliew, S., George, J. and Packer, F. (2009). Issues and developments in loan loss provisioning: the case of Asia. *Bank for International Settlements Quarterly Review, December*: 69-93.

Angora, A. and Roulet, C. (2011). *Liquidity assessment and the use of liquidity ratio as defined in the Basel III accords to identify bank distress*, University of Limoges, France (Working Papers).

Antoniades, A. (2016). Liquidity Risk and the Credit Crunch of 2007–2008: Evidence from Micro-Level Data on Mortgage Loan Applications. *Journal of Financial and Quantitative Analysis*, 51(6): 1795-1822.

Araten, M. and Turner, C. (2013). Understanding the funding cost differences between global systemically important banks (GSIBs) and non-G-SIBs in the USA. *Journal of Risk Management in Financial Institutions*, 6(4): 387-410.

Archer, S. and Karim, R.A.A. (2014). The IILM Short-Term Swinging for Liquidity Management: A Success Story in Enhancing Financial Stability. *SEACEN Financial Stability Journal*, 3: 11-23.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies* 58(2): 277-297.

Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, 68(1): 29-51.

Arif, A. and Nauman, A. (2012). Liquidity risk and performance of banking system. *Journal of Financial Regulation and Compliance*, 20(2): 182-195.

Armstrong, J. and Caldwell, G. (2008). Liquidity risk at banks: Trends and lessons learned from the recent turmoil. Bank of Canada. *Financial System Review*, pp.47-52.

Aronsen, P.A., Erard, M., Nordal, B.K and Turtveit, L. (2014). *Norwegian banks' adjustment to stricter capital and liquidity requirements*, Norges Bank. (Staff Memo No. 18-2014).

- Ashraf, B. N., Arshad, S. and Hu, Y. (2016). Capital Regulation and Bank Risk-Taking Behavior: Evidence from Pakistan. *International Journal of Financial Studies*, 4(3): 16-36.
- Aspachs, O., Nier, E. and Tiesset, M. (2005). *Liquidity, Banking Regulation and the Macroeconomy. Evidence on bank liquidity holdings from a panel of UK-resident banks*. Unpublished manuscript. Bank for International Settlements: Basel.
- Asquith, P. and Mullins, D.W. (1986). Equity issues and offering dilution. *Journal of Financial Economics*, 15(1-2): 61-89.
- Athanasoglou, P. P. (2011). *Bank capital and risk in the South Eastern European region*. Bank of Greece, Athens. (Working Paper No. 137).
- Athanasoglou, P., Delis, M. and Staikouras, C.K. (2006). *Determinants of Bank Profitability in the South Eastern European Region*. Bank of Greece, Athens. (Working Paper No. 25).
- Athukorala, P-C. and Tsai, P-L. (2003). Determinants of household saving in Taiwan: Growth, Demography and Public Policy, *The Journal of Development Studies*, 39(5): 65-88.
- Ayaydin, H. and Karakaya, A. (2014). The effect of bank capital on profitability and risk in Turkish banking. *International Journal of Business and Social Science*, 5(1): 252-271.
- Babihuga, R. and Spaltro, M., (2014). *Bank funding costs for international banks*. International Monetary Fund. (Working Paper No. 14-71)
- Bagehot, W. (1873). *A description of the money market*. New York: Macmillan & Co.
- Bailey, R. (2005). *Basel II and Development Countries: Understanding the Implications*, London School of Economics and Political Science, Development Studies Institute. (Working Paper No. 05-71).
- Balin, B. J. (2010). *Basel I, Basel II, and emerging markets: A non-technical analysis*. The Johns Hopkins University School of Advanced International Studies (SAIS), Washington DC, United States of America.
- Baltagi, B. H. (2005). *Econometric Analysis of Panel Data, 3rd edition*. West Sussex: John Wiley & Sons.
- _____ (2008). *Econometric analysis of panel data*, New Jersey: John Wiley & Sons.
- _____ (2011). *Econometrics*. London, United Kingdom: Springer.
- Baltensperger, E. (1980). Alternative approaches to the theory of the banking firm. *Journal of Monetary Economics*, 6(1): 1-37.
- Balthazar, L. (2006). From Basel 1 to Basel 3. In *From Basel 1 to Basel 3: The Integration of State-of-the-Art Risk Modeling in Banking Regulation* (pp. 209-213). Palgrave Macmillan UK.
- Banerjee, R. N. and Mio, H. (2017). The impact of liquidity regulation on banks. *Journal of Financial Intermediation*, 11(7): 1-15.

Banerji, A., Saksonovs, M.S., Lin, M.H.H. and Blavy, M.R. (2014). *Youth unemployment in advanced economies in Europe: searching for solutions*, International Monetary Fund. (Staff Discussion Papers No. 14/11).

Bank of Canada (2012). *The Bank Rate*. Bank of Canada, Canada.

Bank of England (2015). *EU membership and the Bank of England*. Bank of England, London, United Kingdom.

Bank of England (2013). *A framework for stress testing the UK banking system*. Bank of England, London.

Bank of Zambia (2010). *Survey on how commercial banks determine lending interest rates in Zambia*. Bank of Zambia, Lusaka, Zambia.

Barrell, R. and Gottschalk, S. (2010). Capital adequacy requirements in emerging markets. In *The Basel Capital Accords in Developing Countries* (pp. 97-140). London: Palgrave Macmillan.

Barth, J.R., Caprio Jr, G. and Levine, R. (2013). Bank Regulation and Supervision in 180 Countries from 1999 to 2011. *Journal of Financial Economic Policy*, 5(2): 111-219.

Barth, J.R., Caprio Jr, G. and Levine, R., (2001). *Bank regulation and supervision: what works best?*. 13th Annual World Bank Conference on Development Economics, Washington, DC.

Barth, J.R., Gan, J. and Nolle, D.E., (2009). *Global Banking Regulation and Supervision: What are the Issues and what are the Practices?* New York: Nova Science Publishers.

Basel Committee on Banking Supervision, (1988). International convergence of capital measurement and capital standards, *Bank for International Settlements*, Basel, Switzerland.

_____ (1996). Amendment to the Capital Accord to Incorporate Market Risks, *Bank for International Settlements*, Basel, Switzerland.

_____ (2001). History of the Basel Committee and its Membership. *Bank for International Settlements*, Basel, Switzerland.

_____ (2004). International Convergence of Capital Measurement and Capital Standards. A Revised Framework, *Bank for International Settlements*, Basel, Switzerland.

_____ (2005). *An explanatory note on the Basel II IRB risk weight functions*. *Bank for International Settlements*, Basel, Switzerland.

_____ (2006). *The management of liquidity risk in financial groups*. *Bank for International Settlements*, Basel, Switzerland.

_____ (2008). Principles for Sound Liquidity Risk Management and Supervision. *Bank for International Settlements*, Basel, Switzerland.

_____ (2009). *Revisions to the Basel II market risk framework*. Bank for International Settlements, Basel, Switzerland.

_____ (2010a). Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring. *Bank for International Settlements*, Basel, Switzerland.

_____ (2010b). Basel III: A global regulatory framework for more resilient banks and banking systems. *Bank for International Settlements*, Basel, Switzerland.

_____ (2013). Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools. *Bank for International Settlements*, Basel, Switzerland.

_____ (2014). The Net Stable Funding Ratio. *Bank for International Settlements*, Basel, Switzerland.

_____ (2015a). Assessment of Basel III LCR Regulation-Hong Kong SAR. *Bank for International Settlements*, Basel, Switzerland.

_____ (2015b). A brief history of the Basel Committee, *Bank for International Settlements*, Basel, Switzerland.

_____ (2015c). Corporate governance principles for banks, *Bank for International Settlements*, Basel, Switzerland.

Bank for International Settlements (2011). *Macroprudential Policy Tools and Frameworks: Progress Report to G20*, Bank for International Settlements, Basel, Switzerland.

Basel Consultative Group, (2014). *Impact and implementation challenges of the Basel framework for emerging market, developing and small economies*. Basel Committee on Banking Supervision, Basel. (Working Paper No. 27).

Basso, O., Delgado, F.L. and Meza, M. (2012). *Strengthening Bank Capital and Liquidity in Central America: the Road to Basel III*. International Monetary Fund Mimeo, Washington DC, United States of America.

Baum, C. F. (2006). *An introduction to modern econometrics using Stata*, Texas: StataCorp LP.

Baum, C.F., Schaffer, M.E. and Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *Stata journal*, 3(1): 1-31.

Bearingpoint, (2013). *Behavioral cash flow modeling*. Bearingpoint. Available: https://www.bearingpoint.com/files/BEDE13_0880_FC_EN_Behavioral_cash_flow_modeling_final_web.pdf (Assessed 31 October 2017).

Beau, E., Hill, J., Hussain, T. and Nixon, D., 2014. Bank funding costs: what are they, what determines them and why do they matter?. *Bank of England. Quarterly Bulletin*, 54(4): 370-385.

Beccalli, E., Frantz, P and Lenoci, F. (2016). *Hidden effects of bank recapitalizations. Does ownership structure matter?* Proceedings of the 26th European Financial Management association, 29 June – 2 July, Basel, Switzerland.

Beck, T. (2008). *Bank Competition and Financial Stability: Friends or Foes?*, World Bank. (Policy Research Working Paper No. 4656).

Benston, G. J. and Kaufman, G. G. (1995). Is the banking and payments system fragile? *Journal of Financial Services Research*, 9(3-4): 209-240.

Benston, G.J. and Kaufman, G.G., (1996). The Appropriate Role of Bank Regulation. *The Economic Journal*, 106(436): 688-697.

Berben, R.P., Bierut, B., Van den End, J.W. and Kakes, J. (2010). Macro-effects of higher capital and liquidity requirements for banks. Empirical evidence for the Netherlands, *Dutch National Bank Occasional Studies*, 8(3): 7-38.

Berger, A. N. (1995). The relationship between capital and earnings in banking. *Journal of Money, credit and Banking*, 27(2): 432-456.

Berger, A. N. and Bouwman, C. H. (2005). *Bank capital and liquidity creation*. EFA 2005 Moscow Meetings Paper, June 2005, Moscow.

_____ (2009). Bank liquidity creation. *Review of Financial Studies*, 22(9): 3779-3837.

_____ (2012). *Bank liquidity creation, monetary policy and financial crises*. Available:
<http://web.mit.edu/cbouwman/www/downloads/BergerBouwmanFinCrisesMonPolicyAndBankLiqCreation.pdf> (Assessed 14 April 2016).

_____ (2017). Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability*, 30(C): 139-155.

Berger, A.N. and Udell, G.F. (1994). Did risk-based capital allocate bank credit and cause a credit crunch in the United States?. *Journal of Money, credit and Banking*, 26(3): 585-628.

Berger, A.N., DeYoung, R., Flannery, M.J., Lee, D. and Oztekin, O. (2008). How do large banking organizations manage their capital ratios?. *Journal of Financial Services Research*, 34(2-3): 123-149.

Bernanke, B.S. (2011). *Implementing a macroprudential approach to supervision and regulation*, Federal Reserve Bank of Chicago, Chicago. (Working Paper No.1110).

Berrospide, J. (2011). *Liquidity hoarding and the financial crisis: An empirical evaluation*. Unpublished Manuscript, Federal Reserve Bank of New York: New York.

Bertsch, C. and Molin, J. (2016). Revisiting the role of Central Banks as liquidity providers: Old and New challenges. *Swedish National Bank, Economic Review*, (2): 89-158.

Bichsel, R. and Blum, J. (2004). The relationship between risk and capital in Swiss commercial banks: a panel study. *Applied Financial Economics*, 14(8): 591-597.

Biggar, D. and Heimler, A. (2005). *An increasing role for competition in the regulation of banks. Antitrust Enforcement in Regulated sectors–Subgroup 1*, International Competition Network, Bonn. (Working Paper 586).

Bijapurkar, R. (2011) Creating a new savings paradigm for emerging markets. Aviva. Available: <https://www.slideshare.net/Management-Thinking/big-picture-thinking-towards-sustainable-savings> (Accessed 27 October 2017).

Bindseil, U. (2000). *Central Bank liquidity management: Theory and Euro area practice*. European Central Bank, Frankfurt, Germany.

Bindseil, U. and Jablecki, J. (2013). *Central Bank Liquidity Provision, Risk-Taking and Economic Efficiency*. European Central Bank, Frankfurt. (Working Paper. No. 1542).

Binici, M. and B. Koksall (2012). Is the Leverage of Turkish Banks Procyclical? *Central Bank Review*, 12(2): 11-24.

Blum, J. (1999). Do capital adequacy requirements reduce risks in banking? *Journal of Banking & Finance*, 23(5): 755-771.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1): 115-143.

Blundell-Wignall, A. and Atkinson, P.E. (2010(a)). Thinking beyond basel iii. *OECD Journal: Financial Market Trends*, (1): 9-33.

_____. (2010(b)). *What Will Basel III Achieve?* German Marshall Fund of the United States (GMFUS). Available: [http://gem.sciencespo.fr/content/publications/pdf/Blundell Atkinson Basel III achievements112010. pdf](http://gem.sciencespo.fr/content/publications/pdf/Blundell%20Atkinson%20Basel%20III%20achievements112010.pdf). (Assessed 02 June 2015)

Bond, S. R. (2002). Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal*, 1(2): 141-162.

Bonner, C. (2012). *Liquidity regulation, funding costs and corporate lending*. Dutch National Bank, Amsterdam. (Working Paper No 361).

Bonner, C. and Eijffinger, S.C.W. (2012). *The Impact of the LCR on the Interbank Money Market*, European Banking Center. (Working Paper No. 75)

_____. (2016). The impact of liquidity regulation on bank intermediation. *Review of Finance*, 20(5): 1945-1979.

Bonner, C. and Hilbers, P. (2015). *Global liquidity regulation-Why did it take so long?*, Dutch National Bank, Amsterdam. (Working Paper No. 455).

Bonner, C., Van Lelyveld, I. and Zymek, R. (2015). Banks' liquidity buffers and the role of liquidity regulation. *Journal of Financial Services Research*, 48(3): 215-234.

Bordeleau, E. and Graham, C. (2010). *The impact of liquidity on bank profitability*, Bank of Canada, Ottawa. (Working Paper No.38).

Borio, C. (2003). Towards a macroprudential framework for financial supervision and regulation?. *CESifo Economic Studies*, 49(2): 181-215.

Borio, C., Gambacorta, L. and Hofmann, B. (2017). The Influence of Monetary Policy on Bank Profitability. *International Finance*, 20(1): 48-63.

Borio, Z. and Zhu. H. (2012), Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism? *Journal of Financial Stability*, 8(4), 236-251.

Botha, E. and Makina, D. (2011). Financial regulation and supervision: Theory and practice in South Africa. *The International Business & Economics Research Journal*, 10(11): 27-36.

Bouwman, C. H. (2013). *Liquidity: How banks create it and how it should be regulated*. Forthcoming in The Oxford Handbook of Banking (2nd edition; A.N. Berger, P. Molyneux, and J.O.S. Wilson)

Boyd, J. H. and De Nicolo, G. (2005). The theory of bank risk taking and competition revisited. *The Journal of Finance*, 60(3): 1329-1343.

Brealey, R.A., Myers, S.C., Allen, F. and Mohanty, P. (2012). *Principles of Corporate Finance*. New Dehli: Tata McGraw-Hill Education.

Bruilt, C. (1999). *The Rationale for a Single National Financial Services Regulator*. Financial Services Authority, London. (Occasional Paper No.2).

Bruinshoofd, W.A. and Kool, C.J. (2004). Dutch Corporate Liquidity Management: New Evidence on Aggregation. *Journal of Applied Economics*, 7(2): 195-230.

Brunnermeier, M. K. and Pedersen, L.H. (2009). Market liquidity and funding liquidity. *Review of Financial Studies*, 22(6): 2201-2238.

Brunnermeier, M.K. (2009). Deciphering the liquidity and credit crunch 2007–2008. *The Journal of Economic Perspectives*, 23(1): 77-100.

Bruno, B., Onali, E and Schaeck, K. (2014). Market reaction to bank liquidity regulation. *Journal of Financial and Quantitative Analysis* (forthcoming).

Bruno, G. S. (2005). Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. *Economics Letters*, 87(3): 361-366.

Buckova, V. and Reuse, S. (2011). Basel III global liquidity standards: critical discussion and impact onto the European banking sector. *Financial Assets and Investing*, 3(3): 7-18.

Buehler, K., Noteboom, P. and Williams, D. (2013). *Between deluge and drought. The Future of US Bank Liquidity and Funding*, McKinsey and Company, New York. (Working Papers on Risk No. 48).

Button, K. J. and Swann, D. (1989). *The age of regulatory reform*. Oxford University Press, United States of America. Available:

<http://www.niesr.ac.uk/pubs/DPS/dp269.pdf> (Accessed 19 January 2017).

Caballero, R. J., Farhi, E. and Gourinchas, P.O. (2008). An equilibrium model of "global imbalances" and low interest rates, *American Economic Review*, 98(1), 358-93.

Caballero, R.J. and Krishnamurthy, A. (2008). Musical chairs: a comment on the credit crisis. *Bank of France Financial Stability Review: Special Issue on Liquidity*, 11: 9-11.

Calem, P. and Rob, R. (1999). The impact of capital-based regulation on bank risk-taking. *Journal of Financial intermediation* 8(4): 317-352.

Calomiris, C. W. (2015). *What is wrong with prudential bank regulation and how to fix it*. Testimony before the US House Committee on Financial Services. Available: <https://www0.gsb.columbia.edu/faculty/ccalomiris/papers/What%27s%20Wrong%20with%20Prudential%20Bank%20Regulation%20and%20How%20to%20Fix%20It.pdf> (Assessed 19 August 2016).

Calomiris, C. W. and Herring, R. J. (2013). How to Design a Contingent Convertible Debt Requirement That Helps Solve Our Too Big to Fail Problem. *Journal of Applied Corporate Finance* 25(2): 39-62.

Camba-Mendez, G., Carbo-Valverde, S. and Rodriguez-Palenzuela, D. (2014). *Financial reputation, market interventions and debt issuance by banks: a truncated two-part model approach*, European Central Bank. (Working Paper No. 1741).

Cangiano, M. (2017). Treasury Core Functions. Ministry of Economy and Finance. Available: http://www.rgs.mef.gov.it/Documenti/VERSIONE-I/Comunicazione/Workshop-e-convegni/Seminario_2017-02-6_8/08_-_Treasury_Functions_and_Cash_Management_-_Cangiano.pdf (Assessed 31 October 2017).

Capie, F. and Wood, G. (2013). Do we need regulation of bank capital. Some evidence from the UK. *Institute of Economic Affairs Current Controversies* (40): 15-33.

Carlson, M. A., Duygan-Bump, B. and Nelson, W.R. (2015). *Why do we need both liquidity regulations and a lender of last resort? A perspective from Federal Reserve lending during the 2007-09 US financial crisis*, Basel. (Bank for International Settlement Working Paper No.493).

Carney, M., (2013). *Crossing the Threshold to Recovery*. Speech given at the Nottinghamshire Chamber of Commerce and the Institute of Directors at the East Midlands Conference Centre, 28 August.

Carpenter, D. and Moss, D. A. (2013). *Preventing regulatory capture: Special interest influence and how to limit it*, Cambridge: Cambridge University Press.

Caruana, J. and Kodres, L. (2008). Liquidity in global markets. *Bank of France Financial Stability Review. Special Issue on Liquidity* 11: 65-74.

Casu, B., Claudia G., and Philip, M. (2006). *Introduction to banking*, New Jersey: Prentice Hall.

Cecchetti, S. G. and Schoenholtz, K.L. (2015). *Money, Banking and Financial Market*. McGrawHill, New York, United States of America.

- Cecchetti, S. G. and Disyatat, P. (2010). Central bank tools and liquidity shortages, *Federal Reserve Bank of New York Economic Policy Review*, August 2010: 29-42.
- Chan, N.T.L. (2012). Excessive Leverage: Root Cause of Financial Crisis. *Speech at The Economic Summit*. Hong Kong, 9 December 2011.
- Chang, V. Y. and Yang, M. H. (2016). Do Insurers Partially Adjust Their Liquidity toward Target Levels? Evidence from the US Property-Liability Insurance Industry. *Journal of Financial Studies*, 24(1): 103-139.
- Chan-Lau, J. A. and Oura, H. (2014). *Bail in Clause, Deposit Preference, and Asset Encumbrance: The end of Cheap Senior Unsecured debt? A Structural Perspective*. International Monetary Fund, Washington DC.
- Chaves, R.A. and Gonzalez-Vega, C. (1992). Principles of Regulation and Prudential Supervision: Should They Be Different for Microenterprise Finance Organizations?, *Economics and Sociology*. (Occasional Paper No. 1979).
- Chawla, S. (2013). Liquidity Concepts, Instruments and Procedure. Available: <https://www.slideshare.net/malerkotla/liquidity-concepts-instruments-and-procedure> (Accessed 13 March 2018).
- Chen, G. and Wu, M.Y., 2014. *Bank Ownership and Credit Growth in Emerging Markets During and After the 2008–09 Financial Crisis—A Cross-Regional Comparison*. International Monetary Fund (Working Paper No. 14-171).
- Chen, I-J. and Phuong, L.N. (2014). *The determinants of Bank Liquidity Buffer*. Mediacast. Available: https://mediacast.blob.core.windows.net/production/Faculty/StoweConf/submissions/swfa2014_submission_9.pdf (Accessed 14 May 2017).
- Cifuentes, R., Ferrucci, G. and Shin, H.S. (2005). Liquidity risk and contagion. *Journal of the European Economic Association*, 3(2-3): 556-566.
- Cihak, M. M. and Podpiera, R. (2006). *Is one Watchdog Better Than Three? International Experience with Integrated Financial Sector Supervision*, International Monetary Fund, Washington DC. (Working Paper No. 6-57).
- Cihak, M., Demirgüç-Kunt, A., Feyen, E. and Levine, R. (2013). Financial Development in 205 Economies, 1960 to 2010. *Journal of Financial Perspectives*, 1(2): 17-36.
- Claessens, S. (2009). *Competition in the Financial Sector: Overview of Competition Policies*, International Monetary Fund. (Working Paper No. 45).
- Clark, B.J., Francis, B.B. and Hasan, I. (2008). Do firms adjust toward target capital structures? Some international evidence. SSRN. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1364095 (Accessed 4 August 2017).

Craig, B.R. and Dinger, V. (2013). Deposit market competition, wholesale funding, and bank risk. *Journal of Banking & Finance*, 37(9): 3605-3622.

Coeure, B. (2013). *Liquidity regulation and monetary policy implementation: from theory to practice*. Speech at the Toulouse School of Economics, 3 October, Toulouse.

Cohen, B. H. and Scatigna, M. (2015). Banks and capital requirements: channels of adjustment. *Journal of Banking & Finance*, 69(1):56-69.

Cohen, B.H., (2013). How have banks adjusted to higher capital requirements?. *BIS Quarterly Review*: 25-41.

Committee on the Global Financial System Markets Committee (2010). Funding Patterns and Liquidity management of Internationally active banks, Bank for International Settlements. (CGFS Paper No. 39).

Cooper, D. R. and Schindler, P.S. (2006). *Business research methods (11th edition)*, New York :McGraw-Hill Irwin.

Cornett, M. M. and Tehranian, H. (2004). An overview of commercial banks: performance, regulation, and market value. *Review of Financial Economics*, 13(1): 1-5.

Covas, F. and Driscoll, J. C (2014). *Bank liquidity and capital regulation in general equilibrium*. Federal Reserve Bank, Washington, DC. (Finance and Economics Discussion Series 85-2014)

Crockett, A. (2000). *Marrying the micro-and macro-prudential dimensions of financial stability*. Bank for International Settlements, Basel.

Crotty, J. (2009). Structural causes of the global financial crisis: A critical assessment of the 'new financial architecture.' *Cambridge Journal of Economics*, 33: 563-580.

Cucinelli, D. (2013a). The determinants of bank liquidity risk within the context of euro area. *Interdisciplinary Journal of Research in Business*, 2(10): 51-64.

Cucinelli, D. (2013b). The Relationship between Liquidity Risk and Probability of Default: Evidence from the Euro Area. *Risk governance and control: Financial markets and Institutions* 3(1): 42-50.

Cummings, J. R. and Wright, S. (2016). Effect of higher capital requirements on the funding costs of Australian banks. *Australian Economic Review* 49(1): 44-53.

Dagher, J., Dell'Ariccia, G., Laeven, L., Ratnovski, L. and Tong, H., 2016. *Benefits and Costs of Bank Capital*. International Monetary Fund. Washington DC. (Staff Discussion Note No 16/04).

Dal Bo, E. (2006). Regulatory Capture: A Review. *Oxford Review of Economic Policy*, 22(2): 203-225.

Daniel, K. and Moskowitz. T.J. (2016). Momentum crashes. *Journal of Financial Economics* 122(2): 221-247.

- Dao, B.T. and Ankenbrand, T. (2014). *Capital Adequacy & Banking Risk: An Empirical Study on Vietnamese Banks*. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2524233 (Accessed 02 June 2015).
- Darvas, Z., Schoenmaker, D. and Veron, N. (2016). *Reforms to the European Union Financial Supervisory and Regulatory Architecture and Their Implications for Asia*. Asian Development Bank Institute, (Working Paper No. 615).
- Das, R. (2010). *Definitions and Measures of Money Supply in India*, Munich Personal RePEc Archive Paper No. 21391. Available: https://mpira.ub.uni-muenchen.de/21391/1/MPRA_paper_21391.pdf (Accessed 10 April 2015).
- Davidson, R. and MacKinnon, J.G. (1983). Inflation and the Savings rate. *Applied Economics* 15(6): 731-743.
- Davis, E.P. and Obasi, U. (2009). *The effectiveness of banking supervision*. Brunel University, West London. (Working Paper No. 09-27).
- Davis, K. (2008). *Enhancing Risk Management and Governance in the Region's Banking System to Implement Basel II and to Meet Contemporary Risks and Challenges Arising from the Global Banking System*, Training Program 8 - 12 December, Shanghai, China.
- Davis, K. (2014). *Liquidity Regulation in Asia: Are there benefits from Basel?* Asian Financial Regulatory Cooperation. Paper presented at Asian Financial Regulatory Cooperation, Australia and New Zealand Banking Group, Melbourne, December 1, 2014.
- De Haan, L. and Van den End, J. W. (2013a). Banks' responses to funding liquidity shocks: Lending adjustment, liquidity hoarding and fire sales. *Journal of International Financial Markets, Institutions and Money*, 26(C): 152-174.
- De Haan, L. and Van den End, J.W. (2013b). Bank liquidity, the maturity ladder, and regulation. *Journal of Banking & Finance*, 37(10): 3930-3950.
- Deans, C. and C. Stewart (2012). Banks' funding costs and lending rates. *Reserve Bank of Australia Bulletin* 2012: 37-43.
- Debelle, G. (2012). *Bank Funding*. Speech at the Australian DCM Summit. 28 June 2011, Sydney, Australia.
- Deep, A. and Schaefer, G. (2004). *Are Banks Liquidity Transformers?*, John F. Kennedy School of Government, Harvard University. (Faculty Research Working Paper Series No. 04-021).
- DeGennaro, R. P. and Robotti, C. (2007). Financial market frictions. *Economic Review-Federal Reserve Bank of Atlanta*, 92(3): 1-16.
- Delechat, C., Arbelaez, C.H., Muthoor, P.S. and Vtyurina, S. (2012). *The Determinants of Banks' Liquidity Buffers in Central America*, International Monetary Fund, Washington DC, United States of America. (Working Paper No.12/301).

Demirguc-Kunt, A. and Kane, E. J. (2002). Deposit insurance around the globe: where does it work? *The Journal of Economic Perspectives* 16(2): 175-195.

Demirguc-Kunt, A. and Huizinga, H., (1999). Determinants of commercial bank interest margins and profitability: some international evidence. *The World Bank Economic Review*, 13(2): 379-408.

Demirguc-Kunt, A., Baybars K., and Luc L. (2005). *Deposit Insurance around the World: A Comprehensive Database*. World Bank, Washington DC. (Policy Research Working Paper No. 3628).

Demsetz, R. S., Marc R.S. and Philip E.S. (1996). *Banks with something to lose: The disciplinary role of franchise value*. Federal Reserve Bank, New York. (Economic Policy Review / October 1996)

Demsetz, R. S., Saidenberg, M. R. and Strahan, P. E. (1999). Banks with Something to Lose: The Disciplinary Role of Franchise Value, FRBNY Economic Policy Review, 1-14.

Den Hertog, J.A. (1999). 500 General Theories of Regulation. *Encyclopedia of Law and Economics*, (1): 223 - 270.

Den Hertog, J.A. (2010). *Review of economic theories of regulation*, Tjalling C. Koopmans Research Institute. (Discussion Paper Series No. 10-18).

Denis, D. J. and Sibilkov, V. (2009). "Financial constraints, investment, and the value of cash holdings. *The Review of Financial Studies*, 23(1): 247-269.

Dewatripont, M. and Tirole, J. (1994). A Theory of Debt and Equity: Diversity of Securities and Manager Shareholder Congruence. *The Quarterly Journal of Economics* 109(4): 1027-1054.

DeYoung, R. and Jang, K. Y. (2016). Do banks actively manage their liquidity? *Journal of Banking & Finance*, 66(C): 143-161.

DeYoung, R. and Rice, T (2004). How do banks make money? The fallacies of fee income. *Economic Perspectives-Federal Reserve Bank of Chicago*, 28(4): 34-52.

Di Giorgio, G., Di Noia, C. and Piatti, L., (2000). Financial market regulation: *The case of Italy and a proposal for the euro area*. Wharton School, University of Pennsylvania, Pennsylvania. (Working Paper 0024).

Di Nicolo, G., Gamba, A. and Lucchetta, M. (2011). *Capital Regulation, Liquidity Requirements and Taxation in a Dynamic Model of Banking*, Germany National Bank, Frankfurt. (Working Paper No. 10).

Diamond, D. W. and Dybvig, P.H. (1983). Bank runs, deposit insurance and liquidity. *The Journal of Political Economy*, 91(3): 401-419.

Diamond, D. W. and Kashyap, A. K. (2016). Liquidity Requirements, Liquidity Choice, and Financial Stability. *Handbook of Macroeconomics*, 2: 2263-2303.

- Diamond, D. W. and Rajan, R. G. (2000). A theory of bank capital. *The Journal of Finance*, 55(6): 2431-2465.
- Diamond, D. W. and Rajan, R. G., (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. *Journal of Political Economy*, 109(2): 287-327
- Dietrich, A., Hess, K. and Wanzenried, G. (2014). The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking & Finance* 44(C): 13-25.
- Dinger, V. (2009). Do foreign-owned banks affect banking system liquidity risk? *Journal of Comparative Economics*, 37(4): 647-657.
- Dionne, G. and Harchaoui, T. M. (2008). Banks' capital, securitization and credit risk: An empirical evidence for Canada. *Insurance and Risk Management*, 75(4): 459-485.
- Distinguin, I., Roulet, C. and Tarazi, A. (2013). Bank regulatory capital and liquidity: Evidence from US and European publicly traded banks. *Journal of Banking & Finance*, 37(9): 3295-3317.
- Domanski, D., Moessner, R. and Nelson, W. (2014). *Central banks as lenders of last resort: experiences during the 2007-10 crisis and lessons for the future*. Bank for International Settlements Papers chapters, 79, pp.43-75.
- Domanski, D. and Sushko, V. (2014). Rethinking the lender of last resort: workshop summary. *BIS Papers chapters*, No. 79: 1-9.
- Dow, S. C. (1996). Why the banking system should be regulated. *The Economic Journal* 106(436): 698-707.
- Dowd, K. (1992). Introduction: the experience of free banking. *The Experience of free banking*, Routledge, pp.1-6.
- Dowd, K. (1996). The case for financial laissez-faire. *The Economic Journal*, 106(436): 679-687.
- Drehmann, M. and Nikolaou, K. (2013). Funding liquidity risk: definition and measurement. *Journal of Banking & Finance*, 37(7): 2173-2182.
- Drobetz, W., Schilling, D.C. and Schroder, H. (2014). *Heterogeneity in the Speed of Adjustment across Countries and over the Business Cycle*, Available: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.641.2420&rep=rep1&type=pdf> (Assessed 30 July 2017).
- Duijm, P. and Wiert, P. (2016). The effects of liquidity regulation on bank assets and liabilities. *International Journal of Central Banking*, 12(2): 385-411.
- Duraj, B. and Moci, E. (2015). FACTORS INFLUENCING THE BANK PROFITABILITY: EMPIRICAL EVIDENCE FROM ALBANIA. *Asian Economic and Financial Review*, 5(3): 483-493.
- European Central Bank Economic Bulletin (2016). *Recent developments in the composition and cost of bank funding in the Euro area*. Issue 1, European Central Bank, Frankfurt.

Economics, O. (2013). *Analyzing the impact of bank capital and liquidity regulations on US economic growth*. A report prepared for The Clearing House Association, April.

Edem, D. B. (2017). Risk Management and Corporate Performance: A Study of First Bank of Nigeria Ltd. *Pakistan Research Journal of Management Sciences*, 1(1): 1-12.

Ediz, T., Michael, I. and Perraudin, W. (1998). The impact of capital requirements on UK bank behaviour. *Federal Reserve Bank of New York Economic Policy Review* 4(3): 15-22.

Eichengreen, B. (2008). Ten questions about the subprime crisis. *Financial Stability Review-Special Issue on Liquidity. Bank of France Financial Stability Review: Special Issue on Liquidity*, 11. 19-28.

Elliott, D. J. (2014). *Bank Liquidity Requirements: An Introduction and Overview*. The Brookings Institution. Available:

https://www.brookings.edu/wpcontent/uploads/2016/06/23_bank_liquidity_requirements_intro_o_verview_elliott.pdf

(Accessed 05 February 2016).

Elliott, D. J. (2015). *Market Liquidity. A Primer*, Brookings Institution. Available:

https://www.brookings.edu/wp-content/uploads/2016/06/Elliott-Market-Liquidity-A-Primer_06222015.pdf (Accessed 09 April 2016).

Emran, M.S. and Farazi, S. (2008). *Government Borrowing and Private Credit: Evidence from Developing Countries*. World Bank, Washington DC.

Erb, C.B., Harvey, C.R. and Viskanta, T.E. (2000). Understanding emerging market bonds. *Emerging Markets Quarterly*, 4(1): 7-24.

Ernst and Young (2013a). *Banking in emerging markets Seizing opportunities, overcoming challenges*. London, United Kingdom.

Ernst and Young (2013b). *Banking in emerging markets Seizing opportunities, overcoming challenges: Country reports*. London, United Kingdom.

ESBG (2014). *Economic demonstration of the economic impact of liquidity ratios in particular for SME lending*, ESBG Publication, Brussels, Belgium.

Estrada, D. and Osorio, D., 2006. A Market Risk Approach to Liquidity Risk and Financial Contagion. *Essays on Economic Policy*, 24: 242-271.

European Banking Authority Report (2015). *Overview of the potential implications of regulatory measures for banks' business models*. European Banking Authority, Frankfurt, Germany.

European Central Bank (2002). *Developments in Banks' Liquidity Profile and Management*, European Central Bank. Frankfurt, Germany.

_____ (2008). *EU's Banks' Liquidity Stress Testing and Contingency Funding Plans*. European Central Bank, Frankfurt, Germany.

_____. (2010). *BEYOND ROE-HOW TO MEASURE BANK PERFORMANCE*, European Central Bank, Frankfurt, Germany.

_____. (2014). *Financial Stability Review May 2014*, European Central Bank, Frankfurt, Germany.

European Central Bank Economic Bulletin (2016). *Recent developments in the composition and cost of bank funding in the Euro area*. European Central Bank Economic Bulletin, Issue 1, 2016.

Fabbro, D. and Hack, M. (2011). The effects of funding costs and risk on banks' lending rates. *Reserve Bank of Australia Bulletin*, Q1: 35-42.

Fama, E. F. and French, K. R. (2000). Forecasting profitability and earnings. *The Journal of Business*, 73(2): 161-175.

Farag, M., Harland, D. and Nixon, D. (2013). Bank capital and liquidity. *Bank of England Quarterly Bulletin*, 53(3): 201-215

Federal Deposit Insurance Corporation (2016). *Bank examination: Concepts and Guidelines*. Federal Deposit Insurance Corporation, Washington DC, United States of America.

Federal Reserve (2005). *The Federal Reserve System: Purposes and Functions*. Federal Deposit Insurance Corporation, Washington DC, United States of America.

Federal Reserve Board (2001). *Joint Agency Advisory on Brokered and Rate-Sensitive Deposits*. Available: <https://www.federalreserve.gov/boarddocs/srletters/2001/sr0114a1.pdf> (Accessed 13 March 2018).

Ferrucci, G. and Miralles, C. (2007). *Savings behaviour and global imbalances: The role of emerging market economies*, European Central Bank, Frankfurt, Germany.

Feyen, E. and del Mazo, I.G. (2013). *European bank deleveraging and global credit conditions: implications of a multi-year process on long-term finance and beyond*, The World Bank. (Working Paper No. 6388).

Fielding, D. and Shortland, A. (2005). Political violence and excess liquidity in Egypt. *Journal of Development Studies*, 41(4): 542-557.

Figuet, J.M., Humblot, T. and Lahet, D. (2015). Cross-border banking claims on emerging countries: The Basel III Banking Reforms in a push and pull framework. *Journal of International Financial Markets, Institutions and Money*, 34(C): 294-310.

Financial Stability Board, (2011). *Financial Stability Issues in Emerging Market and Developing Economies*. Report to the G-20 Finance Ministers and Central Bank Governors. Available: <https://openknowledge.worldbank.org/bitstream/handle/10986/27274/680230WP0Box360ial0stability0issues.pdf?sequence=1> (Assessed 15 June 2016).

Fiscal Policy Research Institute (2010). *Regulation and Supervision for Sound Liquidity Management for Banks*. Fiscal Policy Research Institute, Thailand.

- Fisher, P. (2008). What happened to risk dispersion. *Financial Stability Review - Special Issue on Liquidity*. Bank of France Financial Stability Review. Special Issue on Liquidity 11: 29-37.
- Flamee, M. and Windels, P. (2009). Restructuring financial sector supervision: Creating a level playing field. *The Geneva Papers on Risk and Insurance-Issues and Practice* 34(1): 9-23.
- Flamini, V., Schumacher, L. and McDonald, C.A. (2009). *The determinants of commercial bank profitability in Sub-Saharan Africa*, International Monetary Fund, Washington DC. (Working Paper 9/15).
- Flannery, M.J. (2009). *Iceland's failed banks: A post-mortem*. Report, Special Investigation Commission. Island. Available: <https://www.island.is/media/skyrsla-rannsoknarnefndar-althingis/RNAvefVidauki3Enska.pdf> (Accessed 29 November 2016).
- Fonseca, A.R. and Gonzalez, F. (2010). How bank capital buffers vary across countries: The influence of cost of deposits, market power and bank regulation. *Journal of Banking & Finance*, 34(4): 892-902.
- Fontaine, J.S., Garcia, R. and Gungor, S. (2015). *Funding liquidity, market liquidity and the cross-section of stock returns*. Bank of Canada. (Working Paper No.12).
- Freedman, P. L. and Click, R. W. (2006). Banks that don't lend? Unlocking credit to spur growth in developing countries. *Development Policy Review*, 24(3): 279-302.
- Freixas, X. (1997). *Microeconomics of Banking*, Massachusetts: MIT Press.
- Fresh, A. and Baily, M.N (2009). What does international experience tell us about regulatory consolidation? Brookings Institute, Washington DC.
- Fu, Y., Lee, S., Xu, L. and Zurbrugg, R. (2011). *Market force or government regulation: which drives banking capital movements in China?* Unpublished PhD Thesis. Berwick, Australia: World Business Institute.
- Furfine, C. (2000). *Evidence on the response of US banks to changes in capital requirements*. Bank for International Settlements, Basel, Switzerland. (Working Paper No. 88).
- Gale, D. and Yorulmazer, T. (2013). Liquidity hoarding. *Theoretical Economics*, 8(2): 291-324.
- Gambacorta, L., Schiaffi, S. and Van Rixtel, A. (2017). *Changing business models in international bank funding*, Bank for International Settlements, Basel. (Working Paper No. 614).
- Garcia-Herrero, A., (2004). *Banking crises in Latin America in the 1990s: lessons from Argentina, Paraguay and Venezuela*. In Latin American Economic Crises (pp. 40-57). Palgrave Macmillan United Kingdom.
- Gassmann, P., Fiedler, R. and Wackerbeck, P. 2011. *Managing Liquidity in the New Regulatory Era—Tactical and Operational Consequences for Banks*. PriceWaterhouseCoopers, London, United Kingdom.

- Gatev, E. and Strahan, P.E. (2006). Banks' advantage in hedging liquidity risk: Theory and evidence from the commercial paper market. *The Journal of Finance*, 61(2): 867-892.
- Gatev, E., Schuermann, T. and Strahan, P.E. (2007). Managing bank liquidity risk: How deposit-loan synergies vary with market conditions. *The Review of Financial Studies*, 22(3): 995-1020.
- Gautam, R. (2016). The Determinants of Banks Liquidity: Empirical Evidence on Nepalese Commercial Banks. *Journal of Interdisciplinary Studies*, 2(2): 69-78.
- Gaytan, A. and Ranciere, R. (2006). *Banks, Liquidity Crises and Economic Growth*. Brazil School of Economics and Finance. Available: <http://epge.fgv.br/files/1127.pdf> (Accessed 23 June 2015).
- Geng, J., Xie, W., Zhang, G. and Zhou, H., (2011). Challenges for the Unified Financial Supervision in the Post-Crisis Era: Singaporean Experience and Chinese Practice. *Journal of Financial and Economic Practice*, 11(2): 26-49.
- Ghosh, S. (2009). Charter value and risk-taking: evidence from Indian banks. *Journal of the Asia Pacific Economy*, 14(3): 270-286.
- Ghosh, S., Nachane, D.M., Narain, A. and Sahoo, S. (2003). Capital requirements and bank behaviour: An empirical analysis of Indian public sector banks. *Journal of International Development*, 15(2): 145-156.
- Ghosh, S., Sugawara, N. and Zalduendo, J., (2011). Bank Flows and Basel III—Determinants and Regional Differences in Emerging Markets. *World Bank-Economic Premise*, (56): 1-6.
- Gilje, E.P., Loutskina, E. and Strahan, P.E. (2016). Exporting liquidity: Branch banking and financial integration. *The Journal of Finance*, 71(3): 1159-1184.
- Gilson, S.C. (1997). Transactions costs and Capital Structure Choice: Evidence from Financially Distressed Firms, *The Journal of Finance*, 52(1): 161-196.
- Giordana, G. A. and Schumacher, I. (2017). An Empirical Study on the Impact of Basel III Standards on Banks' Default Risk: The Case of Luxembourg. *Journal of Risk and Financial Management*, 10(2): 8-45.
- Giordana, G. and Schumacher, I. (2011). *The impact of the Basel III liquidity regulations on the bank lending channel: A Luxembourg case study*, Central Bank of Luxembourg, Luxembourg. (Working Paper No.61).
- Gobat, J., Yanase, M. and Maloney, J.F., 2014. *The Net Stable Funding Ratio: Impact and Issues for Consideration*. International Monetary Fund, Washington DC. (Working Paper No. 106).
- Goddard, J.A., Molyneux, P. and Wilson, J.O. (2004). Dynamics of growth and profitability in banking. *Journal of Money, Credit, and Banking*, 36(6): 1069-1090.
- Goldman Sachs, (2017). *Liquidity Coverage Ratio disclosure*. Goldman Sachs. Available: <http://www.goldmansachs.com/investor-relations/financials/current/other-information/2q-2017-liquidity-coverage-ratio.pdf> (Assessed 21 November 2017).

- Goldstein, I., Jiang, H. and Ng, D.T. (2017). Investor flows and fragility in corporate bond funds. *Journal of Financial Economics*, 126(3): 592-613.
- Gomes, F.A.R. and Franchini, D.D.S. (2009). The stationarity of consumption-income ratios: Evidence from South American countries. *Economia Aplicada*, 13(4): 463-479.
- Gomes, T. & Wilkins, C. (2013). The Basel III Liquidity Standards: An Update. *Financial System Review*, June 2013: 37-43.
- Gomes, T. and Khan, N. (2011). Strengthening bank management of liquidity risk: The Basel III liquidity standards. *Bank of Canada Financial System Review*, 5,: 35-42.
- Gongol, T. and Vodova, P. (2014). Liquidity Risk Regulation. *Financial Assets and Investing* 1(1): 7-21.
- Gonzalez, R.L., Lopez, J. and Saurina, J. (2007). *Determinants of access to external finance: evidence from Spanish firms*. Federal Reserve Bank of San Francisco, San Francisco.
- Goodhart, C. A. (2005). Financial regulation, credit risk and financial stability. *National Institute Economic Review*, 192(1): 118-127.
- _____. (2008). Liquidity risk management, *Bank of France Financial Stability Review: Special Issue on Liquidity*, 11: 39-44.
- _____. (2010). The future of finance. *The LSE Report*, London School of Economics and Political Science.
- _____. (2011). *The Basel committee on banking supervision: A history of the early years 1974–1997*, Cambridge: Cambridge University Press.
- _____. (2015). Linkages between macro-prudential and micro-prudential supervision. *Butterworths Journal of International Banking and Financial Law*, 30(10): 607-609.
- Goodhart, C., Hartmann, N., Llewellyn, D., Rojas-Suarez, L. and Weisbrod, S. (1998). *Financial Regulation: Why, How and Where Now*, London: Routledge.
- Goswami, M.M. and Sharma, M.S. (2011). *The development of local debt markets in Asia*. International Monetary Fund, Washington DC. (Working Paper No. 11-132).
- Greene, W. H. (2003). *Econometric Analysis*, 5th edition. Prentice Hall, New Jersey, United States of America.
- _____. (2008). The econometric approach to efficiency analysis. In *The measurement of productive efficiency and productivity growth* 1: 92-250.
- Grieser, W.D and Hadlock, C.J., (2016). *Panel Data Estimation in Finance: Preliminary Assumptions and Parameter Consistency*. Tulane University. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2759386 (Accessed 2 February 2017).
- Grill, M., Lang, H.J and Smith, J. (2015). *The leverage ratio, risk-taking and bank stability*, European Banking Authority Mimeo.

- Grind, K. (2009). *The downfall of Washington Mutual*. Puget Sound Business Journal. Available: <https://www.bizjournals.com/seattle/stories/2009/09/28/story1.html> (Accessed 29 November 2016).
- Gropp, R., and Heider, F. (2010). The Determinants of Bank Capital Structure. *Review of Finance*, 14(4): 587–622
- Group of Thirty (G30), (2008). *The Structure of Financial Supervision: Approaches and Challenges in a Global Marketplace*. Group of Thirty, Special Report. Washington DC, United States of America.
- Gujarati, D. N. and Porter, D. C. (1999). *Essentials of econometrics, 4th edition*. McGraw Hill, New York, United States of America.
- Gurbuz, A.O., Yanik, S. and Ayturk, Y., (2013). Income diversification and bank performance: Evidence from Turkish banking sector. *Banking and Financial Markets*, 7(1): 9-29.
- Guru, B.K., Staunton, J. and Balashanmugam, B., (2002). Determinants of commercial bank profitability in Malaysia. *Journal of Money, Credit, and Banking*, 17(1): 69-82.
- Gurley, J. G. and Shaw, E.S. (1955). Financial aspects of economic development. *The American Economic Review*, 45(4): 515-538.
- Hamadi, H. and Awdeh, A (2012). The Determinants of bank Net Interest Margin: Evidence from the Lebanese banking sector. *Journal of Money, Investment and Banking*, 23(23): 85-98.
- Hamm, M. (2013). Basel III: Better prepared for known risks. *Banken+Partner* 5: 22-25.
- Han, R. and Melecky, M. (2013). *Financial inclusion for financial stability: Access to bank deposits and the growth of deposits in the global financial crisis*. World Bank, Washington DC (Policy Research Working Paper No. 6577).
- Hand, D.J. (2007). The Risks of Financial Institutions. *International Statistical Review*, 75(2): 266-267.
- Hansen, B. E. (2017). *Econometrics*, Madison: University of Wisconsin, United States of America.
- Hardy, D.C., 2006. *Regulatory Capture in Banking*. International Monetary Fund, Washington DC. (Working Paper 06/34).
- Hartlage, A. W. (2012). The Basel III Liquidity Coverage Ratio and Financial Stability. *Michigan Law Review*, 111(3): 453-483.
- Harvey, J. and Spong, K. (2001). The decline in core deposits: what can banks do,? *Federal Reserve Bank of Kansas City Financial Industry Perspectives*: 35-48.
- Hasan, M. (2002). *The Significance of Basel 1 and Basel 2 for the future of the banking industry with special emphasis on credit Information*. Presented at the Credit Alliance/Information Alliance Regional Meeting, 3-4 April 2002, Amman.

- Hasanovic, E. and Latic, T. (2017). *The Determinants of Excess Liquidity in the Banking Sector of Bosnia and Herzegovina*. The Graduate Institute Geneva. (Working Paper No. 11-2017).
- Haubrich, J.G. and Wachtel, P. (1993). Capital requirements and shifts in commercial bank portfolios. *Economic Review-Federal Reserve Bank of Cleveland* 29(3): 1-15.
- Hauner, D. (2005). Explaining efficiency differences among large German and Austrian banks. *Applied Economics*, 37(9): 969-980.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, 46(6):1251-1271.
- Hawkins, J. and Mihaljek, D. (2001). *The banking industry in the emerging market economies: competition, consolidation and systemic stability. An overview*. Bank for International Settlements papers, 4: 1-44.
- Hebbink, G., Prast, H.M. and Wetenschappelijk, A. (1998). *REGULATION AND BANKING: A SURVEY*. Dutch National Bank, Amsterdam. (Working Paper No. 565).
- Heid, F. (2007). The cyclical effects of the Basel II capital requirements. *Journal of Banking & Finance*, 31(12): 3885-3900.
- Heid, F, Porath, D. and Stolz, S. (2004). *Does capital regulation matter for bank behaviour? Evidence for German savings banks*, Deutsche Bundesbank, Frankfurt. (Discussion Paper, Series 2, No. 3).
- Hemple, G.H. and Simonson, D.G. (1998). *Bank Management: Text and Cases*. New Jersey: John Wiley and Sons.
- Hirtle, B., Schermann, T. and Stiroh, K. (2009). *Macroprudential Supervision of Financial Institutions: Lessons from the SCAP*, Federal Reserve Bank of New York. (Staff Reports No. 409).
- Hlouskova, J. and Wagner, M. (2006). The performance of panel unit root and stationarity tests: results from a large scale simulation study. *Econometric Reviews*, 25(1): 85-116.
- Hoenig, T.M. (2013). *Basel III capital: A well-intended illusion*. Presented at International Association of Deposit Insurers 2013 Research Conference, April 9 2013, Basel, Switzerland.
- Holmes, M. J., Otero, J. and Panagiotidis, T. (2007). *On the Sustainability of The EU's Current Account Deficits*, Loughborough University. (Working Paper No.6).
- Holod, D. and Peek, J. (2004). *Asymmetric information and liquidity constraints: a more complete test*. Fedederal Deposit Insurance Corporation Center for Financial Research. (Working paper No.2).
- Homolle, S. (2004). Bank capital regulation, asset risk, and subordinated uninsured debt. *Journal of Economics and Business*, 56(6): 443-468.
- Hu, J.C. (2011). *Asset securitization: theory and practice* . New Jersey: John Wiley and Sons.

- Huang, R. and Ratnovski, L. (2010). *The risks of bank wholesale funding*. International Monetary Fund, Washington DC. Working Paper 10/170
- Hugonnier, J. and E. Morellec (2017). Bank capital, liquid reserves, and insolvency risk. *Journal of Financial Economics*. (forthcoming).
- Huier, R., Rodrigues, P.J. and Zeiss, C., (2005). Serial Correlation in Dynamic Panel Data Models with Weakly Exogenous. In *Regressors and Fixed Effects, Working Paper-March 9, 2005, JW Goethe-University*.
- Hull, J. (2012). *Risk Management and Financial Institutions*. New Jersey: John Wiley & Sons.
- Hussain, M. E and Hassan, M. K. (2005). *Basel Capital Requirements and Bank Credit Risk Taking In Developing Countries*, University of New Orleans, Department of Economics and Finance Working Papers No. 34.
- Hurd, T.R. (2017). Bank Panics and Fire Sales, Insolvency and Illiquidity. *arXiv preprint arXiv:1711.05289*.
- Hussain, S. (2014). The assessment of operational efficiency of commercial banks in India using cost to income ratio approach. *International Journal of Management and Business Research*, 4(3): 225-234.
- Ibe, S.O. (2013). The Impact of Liquidity Management on the Profitability of Banks in Nigeria. *Journal of Finance and Bank Management*, 1(1): 37-48.
- Imbierowicz, B. and Rauch, C. (2014). The relationship between liquidity risk and credit risk in banks. *Journal of Banking & Finance* 40(C): 242-256.
- International Council of Securities Associations, (2015). *Market-Based Financing in Emerging Market Countries*. Paper presented at the 28th Annual General Meeting, 15-17 April, Mumbai, India.
- International Finance Corporation (2004). *Doing Business in 2004: Understanding Regulation*, World Bank, Washington DC, United States of America.
- International Monetary Fund (2009). *Regional Economic Outlook: Asia and Pacific*, Washington DC, United States of America.
- Ito, T. and Park, Y. C. (2014). *Developing Asian Bondmarkets*, Canberra, Australia: ANU Press.
- Jablecki, J. (2009). The impact of Basel I capital requirements on bank behavior and the efficacy of monetary policy. *International Journal of Economic Sciences and Applied Research*, 2(1): 16-35.
- Jackson, P., Furfine, C., Groeneveld, H., Hancock, D., Jones, D., Perraudin, W., Radecki, L. and Yoneyama, M. (1999). *Capital Requirements And Bank Behaviour: The Impact of the Basel Accord*, Bank for International Settlements, Basel, Switzerland.
- Jacob, J. and Osang, T. (2015). *Democracy and Growth: A Dynamic Panel Data Study*, Citeseer. Available:

http://www.wiwi.uni-siegen.de/vwl/research/kolloquium/dokumente_kolloquium/osang_ss17.pdf
(Accessed 11 January 2017).

Jacobs, J., Styger, P. and Van Vuuren, G. (2012). The regulatory treatment of liquidity risk in South Africa. *South African Journal of Economic and Management Sciences*, 15(3): 294-308.

Jacques, K. and Nigro, P. (1997). Risk-based capital, portfolio risk, and bank capital: A simultaneous equations approach. *Journal of Economics and Business*, 49(6): 533-547.

Jamaica, B. O. (2005). *Standards of Sound Business Practices-Liquidity Management*. Bank of Jamaica, Jamaica.

Janjua, P.Z. and Rashid, A. (2014). Impact of Monetary Policy on Bank's Balance Sheet in Pakistan. *International Journal of Economics and Finance*, 6(11): 187-196.

Jayarathne, J. and Morgan, D. (1997). *Information problems and deposit constraints at banks*, Federal Reserve Bank of New York, New York. (Working Paper No. 9731).

Jenkinson, N., Penalver, A. and Vause, N., 2008. Financial innovation: what have we learnt?. *Bank of England. Quarterly Bulletin*, 48(3): 31-46.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, 76(2): 323-329.

Jickling, M. (2010). *Who Regulates Whom? An Overview of US Financial Supervision*, . Pennsylvania: DIANE Publishing.

Jobst, A. (2008). Back to Basics-What Is Securitization? *Finance & Development* 45(3): 48-49.

Joh, S. W. and Kim, J. (2008). *Does Competition Affect the Role of Banks as Liquidity Providers?* 5: 1478-1520.

Johnson, G. and Santor, E. (2013). Central Bank Liquidity Provision and Core Funding Markets. In *RBA Annual Conference Volume*. Reserve Bank of Australia.

Jokipii, T. and Milne, A. (2008). The cyclical behaviour of European bank capital buffers. *Journal of Banking & Finance*, 32(8): 1440-1451.

_____ (2011). Bank capital buffer and risk adjustment decisions. *Journal of Financial Stability*, 7(3): 165-178.

Jones, D. (2000). Emerging problems with the Basel Capital Accord: Regulatory capital arbitrage and related issues. *Journal of Banking & Finance*, 24(1): 35-58.

Jorda, O. (2005). Estimation and inference of impulse responses by local projections. *The American Economic Review*, 95(1): 161-182.

Joseph, C. (2013). *Advanced Credit Risk Analysis and Management*. John Wiley & Sons, West Sussex, United Kingdom.

- Kahane, Y. (1977). Capital adequacy and the regulation of financial intermediaries. *Journal of Banking & Finance*, 1(2): 207-218.
- Kalemli-Ozcan, S., Sorensen, B. and Yesiltas, S. (2012). Leverage across firms, banks, and countries. *Journal of International Economics*, 88(2): 284-298.
- Kalemli-Ozcan, S., Laeven, L. and Moreno, D. (2015). *Debt Overhang, Rollover Risk and Investment in Europe*, Proceedings of the 21st Dubrovnik Economic Conference, June 7-9, Dubrovnik, Croatia.
- Kanj, O. and El Khoury, R. (2013). Determinants of Non-Resident Deposits in Commercial Banks: Empirical Evidence from Lebanon. *International Journal of Economics and Finance*, 5(12): 135-150.
- Karpuz, A., Kim, K. and Ozkan, N. (2016). *Employment Protection Laws and Corporate Liquidity Management*. Proceedings of the 2016 Financial Management Association Conference, 30 June, Boston, United States of America.
- Kashyap, A. K. and Stein, J. C. (1995). *The impact of monetary policy on bank balance sheets*. Carnegie-Rochester Conference Series on Public Policy (Vol. 42, pp. 151-195).
- Kashyap, A.K., Rajan, R. and Stein, J.C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking. *The Journal of Finance*, 57(1): 33-73.
- Kasekende, L.A., Bagyenda, J. and Brownbridge, M. (2012). *Basel III and the global reform of financial regulation: how should Africa respond? A bank regulator's perspective*. Bank of Uganda Mimeo.
- Kaufman, G. G. (1996). Bank failures, systemic risk, and bank regulation. *Cato Journal*, 16(1): 17-45.
- Kaufman, G.G. (1988). Bank Runs: Causes, Benefits, and Costs. *Cato Journal*, 7(3): 559-594.
- Keeley, M. C. (1990). Deposit insurance, risk, and market power in banking. *The American Economic Review*, 80(5): 1183-1200.
- Kim, D. and Santomero, A. M. (1988). Risk in banking and capital regulation. *The Journal of Finance*, 43(5): 1219-1233.
- Kim, M.S. (2010). *Liquidty Risk Measurement and Management in Korea*. The South East Asian Central Banks Research and Training Center, Kuala Lumpur, Malaysia.
- Kim, C.E. (1998). The effects of asset liquidity: Evidence from the contract drilling industry. *Journal of Financial Intermediation*, 7(2): 151-176.
- Kimathi, A., Mugo, R., Njeje, D. and Otieno, K. (2015). Factors Affecting Liquidity Risk Management Practices in Microfinance Institutions in Kenya. *Journal of Economics and Sustainable Development*, 6(4): 78-90.
- Kiviet, J. F. (1995). On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics* 68(1): 53-78.

- Klomp, J. and De Haan, J. (2015). Bank regulation and financial fragility in developing countries: Does bank structure matter?. *Review of Development Finance*, 5(2): 82-90.
- Kochubey, T. and Kowalczyk, D. (2014). *The relationship between capital, liquidity and risk in commercial banks*, Proceedings of the 9th Young Economists Seminar, 10-11 June, Dubrovnic, Croatia.
- Koehn, M. and Santomero, A. M. (1980). Regulation of bank capital and portfolio risk. *The Journal of Finance*, 35(5): 1235-1244.
- Kok S.C. and Schepens, G. (2013). *Bank reactions after capital shortfalls*. National Bank of Belgium, Brussels. (Working Paper no.250).
- Kolari, J.W., Ou, C. and Shin, G.H. (2006). Assessing the profitability and riskiness of small business lenders in the banking industry, *Journal of Entrepreneurial Finance*, 11(2): 1-26.
- Kosmidou, K. (2008). The determinants of banks' profits in Greece during the period of EU financial integration. *Managerial Finance*, 34(3): 146-159.
- Kothari, S. and Warner, J. B. (2004). *The econometrics of event studies*. Tuck School of Business at Dartmouth, New Hampshire.
- Kotios, A., Galanos, G. and Roukanas, S. (2012). The Rating Agencies In The International Political Economy. *Scientific Bulletin-Economic Sciences*, 11(1): 3-15.
- Koulischer, F. and Struyven, D. (2014). Central bank liquidity provision and collateral quality. *Journal of Banking & Finance*, 49(C): 113-130.
- Kovner, A., Vickery, J. and Zhou, L. (2015). Do big banks have lower operating costs?. *Journal of Financial Perspectives*, 3(1): 157-196.
- Kowalik, M. (2013). Basel Liquidity Regulations: Was it improved with the 2013 Revisions? *Federal Reserve Bank of Kansas 2nd Quarter Economic Review*. pp 65-87.
- Kwenda, F. (2015). Investment and financing constraints: Can working capital management make a difference in South Africa?. *Banks and Bank Systems*, 10(1): 24-33.
- Kyle, A. S. (1985). Continuous auctions and insider trading. *Econometrica*, 53(6): 1315-1335.
- Lang, P. (2016). A model of bank behaviour for the assessment of the potential balance sheet impact of the NSFR liquidity requirement, *Social Studies*, 13(3): 1-42.
- Lang, P. (2017). *A model of bank behaviour for the assessment of the potential balance sheet impact of the NSFR liquidity requirement*. Magyar Nemzeti Bank, Budapest. (Working Paper No. 3)
- Larcker, D. F. and Rusticus, T. O. (2010). On the use of instrumental variables in accounting research. *Journal of Accounting and Economics*, 49(3): 186-205.
- Lastra, R.M. (2003). The Governance Structure for Financial Regulation and Supervision in Europe. *Columbia Journal of European Law*, 10: 49-68.

_____ (2014). *Liquidity management strategies in the Czech banking sector*. Mendel University, Brno. (Working Papers in Business and Economics No. 47/2014).

Lastuvkova, J. (2016). Liquidity Forms and Bank Size. *Acta University of Agriculture and Silviculturae Mendeliana Brno*, 64(6): 1999-2006.

_____ (2017). Dimensions of liquidity and their factors in the Slovenian banking sector. *E+M Finance Journal*, 2(20): 163-174.

Lata, R. S. (2014). *Non-Performing Loan and Its Impact on Profitability of State Owned Commercial Banks in Bangladesh: An Empirical Study*. Proceedings of 11th Asian Business Research Conference.

Laux, C. and Rauter, T. (2017). Procyclicality of US bank leverage. *Journal of Accounting Research*, 55(2): 237-273.

Lehn, K. and Poulsen, A. (1989). Free cash flow and stockholder gains in going private transactions, *The Journal of Finance*, 44(3): 771-787.

Le Lesle, M.V. (2012). *Bank Debt in Europe: "Are Funding Models Broken"*, International Monetary Fund, Washington DC. (Working Paper No. 12/299).

Levine, R. (2005). Finance and Growth: Theory and Evidence. *Handbook of Economic Growth*, 1: 865-934.

Li, B. (2017). *The impact of the Basel III liquidity coverage ratio on macroeconomic stability: An agent-based approach*. Economics Discussion Papers (No. 2017-2).

Li, Z. and Ma, K. (2017). *A Theory of Endogenous Asset Fire Sales, Bank Runs, and Contagion*. Paper presented at Conference on Systemic Risk and the Organization of the Financial System, Chapman University, May 13, 2017.

Li, M., Milne, F. and Qiu, J. (2013). *Central bank screening, Moral hazard, and the lender of last resort policy*. Queen's Economics Department. (Working Paper No. 1317).

Liang, M.J. (2011). *The Impact of the Basel III Capital and Liquidity Requirements: Balance Sheet Optimization*. Business Mathematics and Informatics Internship Report, Vrije University, Amsterdam.

Liebmann, E. and Peek, J. (2015). *Global Standards for Liquidity Regulation*, Federal Reserve Bank of Boston, Boston. (Working Paper No. 15/3).

Linsley, P. M. and Shrives, P. J. (2005). Examining risk reporting in UK public companies. *The Journal of Risk Finance*, 6(4): 292-305.

Lipsey, R. and Chrystal, A. (2015). *Economics*. Oxford: Oxford University Press.

Llewellyn, D. (1999). *The Economic Rationale for Financial Regulation*. London: Financial Services Authority.

- Llewellyn, D.T. (2006). *Institutional Structure of Financial Regulation And Supervision: The Basic Issues*. Paper presented at a World Bank seminar Aligning Supervisory Structures with Country Needs, 6 – 7 June, Washington DC.
- Loncan, T.R. and Caldeira, J.F. (2014). Capital structure, cash holdings and firm value: a study of Brazilian listed firms. *Accounting & Finance Magazine*, 25(64): 46-59.
- Loutskina, E. (2011). The role of securitization in bank liquidity and funding management. *Journal of Financial Economics*, 100(3): 663-684.
- Louzis, D. and Vouldis, A. (2015). *Profitability in the Greek Banking System: A Dual Investigation of Net Interest and Non-Interest Income*. Bank of Greece, Athens, Greece. (Working Paper No. 191).
- Lucas, D. J. and McDonald, L.R. (1992). Bank financing and investment decisions with asymmetric information about loan quality. *The Rand Journal of Economics*, 23(1): 86-105.
- Lucas, R. E. (2014). Liquidity: meaning, measurement, management. *Federal Reserve Bank of St. Louis Review*, 96(3): 199-212.
- Luckett, D.G. (1980). Approaches to bank liquidity management. *Federal Reserve Bank of Kansas City Economic Review*, (March): 11-27.
- Ly, K.C., (2015). Liquidity Risk, Regulation and Bank Performance: Evidence from European Banks. *Global Economy and Finance Journal*, 8(1):11-33.
- Lybek, M.T. and Sarr, M.A. (2002). *Measuring Liquidity in Financial Markets*. International Monetary Fund, Washington DC. (Working Paper No. 2-232).
- Ma, G. and Yi, W. (2010). China's high saving rate: myth and reality. *Economy International*, (2): 5-39.
- Macro Assessment Group (2010). Interim Report. *Assessing the Macroeconomic Impact of the Transition to Stronger Capital and Liquidity Requirements*, Bank for International Settlements, Basel, Switzerland.
- Maddala, G. S. and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics*, 61(1): 631-652.
- Makina, D., Chiwunze, G. and Ndari, E. (2014). *Financial Inclusion Strategies for making Financial Markets work for the Poor in Zimbabwe*, Zimbabwe Economic Policy Analysis and Research Unit Working Papers, Harare, Zimbabwe.
- Malz, A. (2003). *Liquidity Risk, Current Research and Practice*. New York: Risk Metrics Group.
- Mankart, J., Alexander, M. and Spyros, P. (2014). *Bank portfolio choice and regulatory constraints*. Mimeo. Available: <http://www2.aueb.gr/conferences/Crete2014/papers/Pagratis.pdf> (Accessed 15 July 2015).
- Marozva, G. (2015). Liquidity and bank performance. *The International Business & Economics Research Journal*, 14(3): 453-461.

- Martynova, N. (2015). *Effect of bank capital requirements on economic growth: A Survey*. Dutch National Bank, Amsterdam. (Working Paper No. 467).
- Masciandaro, D. and Quintyn, M. (2009). Regulating the Regulators: The Changing Face of Financial Supervision Architectures Before and After The Crisis. *European Company Law* 6(5): 187-196.
- Mashamba, T. and Kwenda, F. (2017). A Look at the Liquidity Management Practices of Banks in South Africa. *Journal of Economics and Behavioral Studies*, 9(3): 113-120.
- Mason, J. R. (2015). *Overview and structure of financial supervision in the US*, European Union Parliament. Available: http://www.europarl.europa.eu/RegData/etudes/STUD/2015/492470/IPOL_STU%282015%29492470_EN.pdf (Accessed 24 June 2017).
- Matejasak, M., Teply, P. (2007). *Regulation of Bank Capital and Behavior of Banks: Assessing the US and the EU-15 Region Banks in the 2000-2005 Period*. Institute of Economic Studies, Charles University in Prague. (Working Paper No. 23/2007).
- Mathuva, D. (2009). Capital adequacy, cost income ratio and the performance of commercial banks: The Kenyan Scenario. *The International Journal of Applied Economics and Finance* 3(2): 35-47.
- Matz, L. and Neu, P. (2006). *Liquidity risk measurement and management: a practitioner's guide to global best practices*, New Jersey: John Wiley & Sons.
- Maudos, J. and Solis, L. (2009). The determinants of net interest income in the Mexican banking system: An integrated model. *Journal of Banking & Finance*, 33(10): 1920-1931.
- McCauley, R., McGuire, P. and Von Peter, G. (2010). The architecture of global banking: from international to multinational?. *BIS Quarterly Review*: 25-73.
- McCoy, P. A. (2006). *The moral hazard implications of deposit insurance: Theory and evidence*. Seminar on Current Developments in Monetary and Financial Law, 23 – 27 October 2006, Washington D.C, United States of America.
- Mehran, H. and L. Mollineaux (2012). Corporate governance of financial institutions. *Annual Review of Financial Economics*, 4(1): 215-232.
- Mendonça, H.F.D., Galvao, D.J.C. and Loures, R.F.V. (2012). Financial regulation and transparency of information: evidence from banking industry. *Journal of Economic Studies*, 39(4): 380-397.
- Merton, R.C. (1977). An Analytic derivation of the cost of Deposit Insurance and Loan Guarantees: An application of Modern Option Pricing Theory. *Journal of Banking & Finance*, 1(1): 3-11.
- Miller, J.E. and Rodgers, Y.V.D.M. (2008). Economic importance and statistical significance: Guidelines for communicating empirical research. *Feminist Economics*, 14(2): 117-149.

- Mishkin, F.S. (1990). *Asymmetric information and financial crises: A historical perspective*, National Bureau of Economic Research, Massachusetts. (Working Paper No. 3400).
- Mitchell, A. W. (1998). The impact of The Risk-Based Capital Requirements on the indigenous banks of the Eastern Caribbean Central Bank area. *Savings and development*, 2: 181-202.
- Mizen, P., Tsoukalas, J. and Tsoukas, S. (2008). *What influences a firm's decision to issue corporate bonds? The role of creditworthiness, reputation and incentives*. Unpublished Doctoral Thesis. Athens: Athens University of Economics and Business.
- Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, 48(3): 261-297.
- Moe, T.G. (2012). *Shadow Banking and the Limits of Central Bank Liquidity Support: How to Achieve a Better Balance between Global and Official Liquidity*, Levy Economics Institute of Bard College. (Working Paper No. 712).
- Morgan, P.J., Regis, J.P and Salike, N. (2015). Loan-to-Value Policy as a Macroprudential Tool: The Case of residential Mortgage Loans in Asia, Asian Development Bank Institute. (Working Paper Series No. 528).
- Moody's, (2001). *How Moody's evaluates US bank and bank holding company liquidity*. Global Credit Research, Moody's Investors Services, New York, United States of America.
- Moore, W. (2010). *How do financial crises affect commercial bank liquidity? Evidence from Latin America and the Caribbean*, University Library of Munich, Germany. (Working Paper No. 21473).
- Morris, S. and Shin, H.S. (2016). Illiquidity component of credit risk. *International Economic Review*, 57(4): 1135-1148.
- Mullings, R. and Unit, F.S. (2003). *Capital Requirements and Commercial Bank Behaviour. The Jamaican Experience*. Bank of Jamaica, Jamaica.
- Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13(2): 187-221.
- Nagel, S. (2012). Evaporating liquidity. *The Review of Financial Studies*, 25(7): 2005-2039.
- Nakagawa, S. and Psalida, E.L. (2007). The quality of domestic financial markets and capital inflows. *Global Financial Stability Report Financial Market Turbulence: Causes, Consequences, and Policies, 3rd Chapter*, International Monetary Fund. Washington D.C. United States of America.
- Nawaz, M., Munir, S., Siddiqui, S.A., Tahseen-ul-Ahad, F.A., Asif, M. and Ateeq, M. (2012). Credit risk and the performance of Nigerian banks. *Interdisciplinary Journal of Contemporary Research in Business*, 4(7): 49-63.
- Ngo, P. T., Puente, D. and Virani, Z. (2016). *The Role of Deposit Insurance in Liquidity Risk Management: Evidence from Systemic Banking Crises*. SSRN. Available:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2736059 (Accessed 28 May 2017).

Nhavira, J.D.G., Mudzonga, E. and Mugocha, E. (2013). *Financial Regulation and Supervision in Zimbabwe: An examination of adequacy and options*. Zimbabwe Economic Policy Analysis and Research Unit, Harare, Zimbabwe.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49(6): 1417-1426.

Nikolaou, K. (2009). *Liquidity risk concepts: Definitions and Interactions*, European Central Bank, Frankfurt, Germany. (Working Paper Series, No. 1008).

Nordic Investment Bank (2017). Risk Management Policies. Nordic Investment Bank. Available: https://www.nib.int/filebank/a/1452263809/f395747f547c3c57c0baefebafed8013/5082-Risk_Management_Policies.pdf. (Accessed 14 March 2018).

Olarewaju, O. M. and Adeyemi, O.K. (2015). Causal Relationship between Liquidity and Profitability of Nigerian Deposit Money Banks. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 5(2): 165-171.

Osinski, J., Seal, K. and Hoogduin, M.L. (2013). *Macroprudential and Microprudential Policies: Toward Cohabitation*, International Monetary Fund, Washington DC. (Staff Discussion Note 13/05)

Oura, H., Gonzalez-Hermosillo, B., Chan-Lau, J.A., Gudmundsson, T. and Valckx, N. (2013). *Changes in Bank Funding Patterns and Financial Stability Risks*, International Monetary Fund, Washington DC, United States of America.

Owolabi, S.A. and Obida, S.S. (2012). Liquidity management and corporate profitability: Case study of selected manufacturing companies listed on the Nigerian stock exchange. *Business Management Dynamics*, 2(2): 10-25.

Packer, F. and Zhu, H. (2012). *Loan loss provisioning practices of Asian banks*. Bank for International Settlements, Basel. (Working Paper No. 375).

Paravisini, D. (2008). Local bank financial constraints and firm access to external finance. *The Journal of Finance*, 63(5): 2161-2193.

Park, C.Y. and Mercado, R.V. (2014). Determinants of financial stress in emerging market economies. *Journal of Banking & Finance*, 45(C): 199-224.

Patrikis, E. T. (1997). *Supervision and Regulation*. Federal Reserve Bank of New York Speech. Available: <https://www.newyorkfed.org/newsevents/speeches/1997/ep970303> (Accessed 10 June 2016).

Pereira, J. A. and Saito, R. (2011). *How Do Capital Buffers Respond to Basel? An Empirical Analysis of the Brazilian Banking System*. An Empirical Analysis of the Brazilian Banking System (April 15, 2011). Midwest Finance Association 2012 Annual Meetings Paper.

Phelan, G. (2016). Financial intermediation, leverage, and macroeconomic instability. *American Economic Journal: Macroeconomics*, 8(4): 199-224.

Pigou, A. (1932). *The economics of welfare*, Macmillan: London.

Pinkowitz, L., Stulz, R. and Williamson, R. (2013). *Is There a US High Cash Holdings Puzzle after the Financial Crisis?*. Dice Center for Research in Financial Economics, Ohio. (Working Paper No. 2013-07).

Plakalovic, N. and Alihodzic, A., (2015). Determinants of the Net Interest Margins in BH banks. *Industry*, 43(1): 133-153.

Polodoo, V. (2009). *Capital Requirements and Bank Behaviour in Mauritius*. SSRN. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1617425 (Accessed 31 October 2016).

Poorman Jr, F. and Blake. J. (2005). *Measuring and modeling liquidity risk: new ideas and metrics*. Financial Managers Society Inc. White Paper. Available: http://www.almnetwork.com/liquidity/2005_incisive_risk.pdf (Accessed 10 August 2015).

Praet, P. and Herzberg, V. (2008). Market Liquidity and Banking Liquidity: Linkages, Vulnerabilities and the role of disclosure. *Bank of France Financial Stability Review: Special Issue on Liquidity*, 11: 95-109.

Prasad, E. S. (2010). *Financial sector regulation and reforms in emerging markets: An overview*, National Bureau of Economic Research, Massachusetts. (Working Paper No. 16428)

Presbitero, A.F., Ghura, D., Adedeji, O.S. and Njie, L. (2015). International Sovereign Bonds by Emerging Markets and Developing Economies: Drivers of Issuance and Spreads. International Monetary Fund, Washington DC. (Working Paper No. 275/2015).

Raeisi, M., Gavara, M. and Dnarezhershk, I.A. (2014). Bank Liquidity and its determinants in Iran. *International Journal of Management Sciences and Economics*, 1(5): 30-36.

Raknerud, A., Vatne, B.H. and Rakkestad, K. (2011). *How do banks' funding costs affect interest margins?* Norges Bank, Oslo. (Working Paper No. 09/2011).

Ramirez, M.D. (2007). A panel unit root and panel cointegration test of the complementarity hypothesis in the Mexican Case: 1960–2001. *Atlantic Economic Journal*, 35(3): 343-356.

Ramos, A. (1996). *Deposit Insurance, Bank Capital Structures and the Demand for Liquidity*, Federal Reserve Bank of Chicago, Chicago. (Working Paper Series WP-96-8).

Rao, K. and Lakew, T. B. (2012). Determinants of profitability of commercial banks in a developing country: Evidence from Ethiopia. *International Journal of Accounting and Financial Management Research* 2(3): 1-20.

Rattanapintha, S. (2010). *Liquidity Risk Measurement and Management in Thailand*. The South East Asian Central Banks Research and Training Center, Kuala Lumpur, Malaysia.

Rauch, C., Steffen, S., Hackethal, A and Tyrell, M. (2008). *Savings Banks, Liquidity Creation and Monetary Policy*. Goethe University Working Paper.

Repullo, R. (2004). Capital requirements, market power, and risk-taking in banking. *Journal of Financial intermediation*, 13(2): 156-182.

Repullo, R. and Suarez, J. (2012). The procyclical effects of bank capital regulation. *The Review of Financial Studies*, 26(2): 452-490.

Reserve Bank of South Africa, (2017). Financial Stability Review. Reserve Bank of South Africa, Johannesburg, South Africa.

Reserve Bank of Fiji (2005). Liquidity risk management requirement for banks: Banking Supervision Policy Statement No.9A, Reserve Bank of Fiji, Suva, Fiji.

Rezende, M., Styczynski, M.F. and Vojtech, C.M. (2016). *The Effects of Liquidity Regulation on Bank Demand in Monetary Policy Operations*. Massachusetts Institute of Technology Golub Center for Finance and Policy.

Rime, B. (2001). Capital requirements and bank behaviour: Empirical evidence for Switzerland. *Journal of Banking & Finance*, 25(4): 789-805.

Risk Management Association, (2013). *Scenario Analysis*. Available: www.rmahq.org/WorkArea/DownloadAsset.aspx?id=6012 (Accessed 15 June 2015).

Ritz, R. A. and Walther, A. (2015). How do banks respond to increased funding uncertainty? *Journal of Financial intermediation*, 24(3): 386-410.

Rivard, R. J. and Thomas, C. R. (1997). The effect of interstate banking on large bank holding company profitability and risk. *Journal of Economics and Business*, 49(1): 61-76.

Robertson, B. and Rush, A. (2013). Developments in banks' funding costs and lending rates. *Reserve Bank of Australia Economic Bulletin*, Q1: 63-70.

Rochet, J.C. (2008). Liquidity Regulation and the Lender of Last Resort. *Bank of France Financial Stability Review: Special Issue on Liquidity*, 11: 45-52.

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1): 86-136.

Ross, S. A., Westerfield, R. and Jordan, B.D. (2008). *Fundamentals of Corporate Finance*, 5th edition. New York: Tata McGraw-Hill Education.

Roy, D.G., Bindya, K. and Swati, K. (2013). Basel I to Basel II to Basel III: A Risk Management Journey of Indian Banks. *AIMA Journal of Management Research*, 7(2/4): 0974-497.

Royal Government of Cambodia (2012). *Financial Sector Development Strategy: 2011 - 2020*, Asian Development Bank, Mandaluyong City, Phillipines.

Saayman, A. (2003). *Securitisation and bank liquidity in South Africa*. School of Economics, Risk Management and International Trade. Potchefstroom University.

Sabri, S. M. (2010). *Malaysia Liquidity Risk: Sailing through the turbulent years*. The South East Asian Central Banks Research and Training Center, Kuala Lumpur, Malaysia.

- Sabunwala, Z. Z. (2012). Impact of Basel III Norms on Banking Sector in Emerging Markets. *Journal of Management & Research*. 1(1): 34-40.
- Sahay, R., Cihak, M., N'Diaye, P. and Barajas, A. (2015). Rethinking financial deepening: Stability and growth in emerging markets. *Journal of Institutional Economics*, 17(33): 73-107.
- Said, R. M. and Tumin. M.H. (2011). Performance and financial ratios of commercial banks in Malaysia and China. *International Review of Business Research Papers*. 7(2): 157-169.
- Saidenberg, M. and Schuermann, T. (2003). *The New Basel Capital Accord and Questions for Research*. Wharton School, University of Pennsylvania. (Working Paper 3/14).
- Santomero, A. M. (1984). Modeling the banking firm: A survey. *Journal of Money, credit and Banking*. 16(4): 576-602.
- Santos, J.A.C. (2001). Bank Capital Regulation in Contemporary Banking Theory: A review of literature. *Financial Markets, Institutions & Instruments*. 10(2): 41-84.
- Santos-Paulino, A. (2003). Macroeconomics in Emerging Markets. *Journal of Development Studies*, 39(6): 183-184.
- Sarat, O. (2010). *Liquidity Risk Measurement and Management in Cambodia*. The South East Asian Central Banks Research and Training Center, Kuala Lumpur, Malaysia.
- Sargan, J. D. (1958). The Estimation of Economic Relationships using Instrumental Variables. *Econometrica*, 26(3): 393-415.
- Sarkar, A. (2009). Liquidity risk, credit risk, and the Federal Reserve's responses to the crisis. *Financial Markets and Portfolio Management*, 23(4): 335-348.
- Schertler, A. (2010). *Insights on Banks' Liquidity Management: Evidence from Regulatory Liquidity Data*, Contributions to the annual meeting of the Association for Social Policy 2010: Economy of the family - Session: Banking Regulation: Liquidity and Regulatory Capital, No. A7-V2.
- Schmitz, B. (2013). *Aims, Implementation, and Implications for Developing and Emerging Economies*, German Institute for Development Policy, Bonn. (Working Paper No. 20/2013).
- Servaes, H. and Tufano, P. (2006). *The theory and practice of corporate liquidity policy*. Deutsche Bank. Available: <http://faculty.london.edu/hservaes/Corporate%20Liquidity%20Policy%20%20Full%20Paper.pdf> (Accessed 22 November 2017).
- Shahchera, M. (2012). *The impact of liquidity asset on Iranian bank profitability*. International Conference on Management, Behavioral Sciences and Economics Issues, 2012, Penang, Malaysia.
- Shen, C. H., Chen, Y.K., Kao, L.F. and Yeh, C.Y. (2009). *Bank Liquidity Risk and Performance*. Proceedings of the 17th Conference on the Theories and Practices of Securities and Financial markets, Hsi-Tze Bay, Kaohsiung, Taiwan.

- Shen, C.H. and Chen, T.H. (2014). *Performance Analysis of Liquidity Indicators as Early Warning Signals*, Hong Kong Institute for Monetary Research. (Working Paper No. 30/2014).
- Shi, J. and Tripe, D. (2012). *The Effects of Changes in Liquidity Rules under Basel III: Evidence from New Zealand*, New Zealand Finance Colloquium. Available: <https://www.nzfc.ac.nz/archives/2012/papers/updated/22.pdf> (Assessed 14 June 2017).
- Shleifer, A. (2005). Understanding regulation. *European Financial Management*, 11(4): 439-451.
- Shrieves, R. E. and Dahl, D. (1992). The relationship between risk and capital in commercial banks. *Journal of Banking & Finance*. 16(2): 439-457.
- Smaghi, L. B. (2010). *Basel III and monetary policy*, Speech at the International Banking Conference – “Matching Stability and Performance: The Impact of New Regulations on Financial Intermediary Management,” 29 September, Milan, Italy.
- Sobol, I. (2013). Liquidity management practices in Islamic banking. *Management and Finance*, 2(1): 566-576.
- South African Banker Magazine, (2012). *Basel III protecting the South African economy*. Available: <http://www.banking.org.za/docs/default-source/publication/banker-sa/banker-sa-01.pdf?sfvrsn=2> (Accessed 15 October 2017).
- Spong, K. (2000). *Banking regulation: Its Purposes, Implementation and Effects*, 5th edition, Missouri: Federal Reserve Bank of Kansas City.
- Stigler, G. J. (1971). The Theory of Economic Regulation. *The Bell journal of Economics and Management Science*. 2(1): 3-21.
- Subhanij, T. (2010). *Liquidity measurement and management in the SEACEN economies*. The South East Asian Central Banks Research and Training Center, Kuala Lumpur, Malaysia.
- Suppakitjarak, N. and Krishnamra, P. (2015). Household saving behavior and determinants of the forms of saving and investment in Thailand. *Journal of Economics, Business and Management*, 3(3): 326-330.
- SunGard, (2012). *Poor liquidity management will “kill” financial institutions*. Global Capital. Available: <http://www.globalcapital.com/article/k398hx5zg5j2/poor-liquidity-management-will-kill-financial-institutions-sungard> (Accessed 7 June 2017).
- Swift, E. (2016). Asset/Liability Management III. Georgia Banking School. Available: <http://gabankers.com/docs/GBAU%20Info/Banking%20School/2016/Courses/Third%20Year/309%20-%20Swift%20-%20ALM%20III.pdf>. (Accessed 14 March 2018).
- Szabłowska, E. (2010). The financial crisis and securitization. *The Journal of Education, Culture and Society*, (1): 37-48.

- Tabak, B., Li, D., Vasconcelos, J. and Cajueiro, D. (2013). *Do Capital Buffers Matter? A Study on the Profitability and Funding Costs Determinants of the Brazilian Banking System*, Central Bank of Brazil, Brasilia. (Working Paper No. 333).
- Tanda, A. (2015). The effects of bank regulation on the relationship between capital and risk. *Comparative Economic Studies*. 57(1): 31-54.
- Tarullo, D. K. (2014). *Liquidity Regulation*. Speech at the Clearing House 2014 Annual Conference, New York, United States of America.
- Tendulkar, R. (2015). *Corporate Bond Markets: An Emerging Market Perspective*. International Organization of Securities Commissions, Madrid, Spain. (Staff Working Paper No. 6/2015).
- The Central Bank of the Bahamas (2008). A GUIDE TO THE CENTRAL BANK'S ON-SITE EXAMINATION PROCESS, The Central Bank of the Bahamas, Nassau, Bahamas.
- Tian, Y. (2009). *Market liquidity risk and market risk measurement*. UnPublished Dissertation, Amsterdam: Delft University of Technology.
- Truno, M., Stolyarov, A., Anger, D. and Assaf, M. (2017). Wholesale funding of the Big Six Canadian Banks, *Bank of Canada Review*, 2017(Spring): 42-55.
- Uche, O. C. (2001). The Theory of Regulation: A Review Article. *Journal of Financial Regulation and Compliance*, 9(1): 67-80.
- Valla, N., Saes-Escorbiac, B. and Tieset, M. (2008). *Bank liquidity and financial stability*, Bank for International Settlements, Basel. (Irving Fisher Committee on Central Bank Statistics Bulletin No. 28).
- Valladares, M. R. (2012). Basel III: *Can it be Implemented in Emerging Markets?* Chicago Mercantile Exchange Group. Available: https://www.cmegroup.com/education/files/ED144_mayra-valladres_basel-iii-can-it-be-implemented-in-emerging-markets.pdf (Accessed 7 November 2016).
- Van den End, J.W. (2012). Liquidity Stress-Tester: Do Basel III and unconventional monetary policy work?. *Applied Financial Economics*, 22(15): 1233-1257.
- Van Rixtel, A., Gonzalez, L.R. and Yang, J. (2016). *The determinants of long-term debt issuance by European banks: evidence of two crises*, Bank of Spain, Madrid. (Working Paper No. 1621).
- Van Roy, P. (2008). Capital Requirements and Bank Behavior in the Early 1990s: Cross country Evidence, *International Journal of Central Banking*. 4(3): 29-60.
- Vazquez, F. and Federico, P. (2015). Bank funding structures and risk: Evidence from the global financial crisis. *Journal of Banking & Finance*. 61(C): 1-14.
- Vento, G. A. and La Ganga, P. (2009). Bank liquidity risk management and supervision: which lessons from recent market turmoil. *Journal of Money, Investment and Banking*, 10(10): 79-126.
- Vodova, P. (2013). Liquid assets in banking: what matters in the visegrad countries?, *E+M Economics and Management*., 26(3): 113-129.

Von Thadden, E. L. (2004). Bank capital adequacy regulation under the new Basel Accord. *Journal of Financial Intermediation*, 13(2): 90-95.

Vong, P. I. and Chan, H. S. (2009). Determinants of bank profitability in Macao. *Macau Monetary Research Bulletin*, 12(6): 93-113.

Wall, L. D. (2015). Stricter microprudential supervision versus macroprudential supervision. *Journal of Financial Regulation and Compliance*, 23(4): 354-368.

Wall, L. D. and Peterson, P.P. (1996). Banks' responses to binding regulatory capital requirements. *Economic Review-Federal Reserve Bank of Atlanta*, 81(2): 1-17.

Wang, G. Y. (2010). The Impacts of Free Cash Flows and Agency Costs on Firm Performance. *Journal of Service Science and Management*, 3(04): 408-418.

Wong, J. (2012). Bank Funding: The Change in Composition and Pricing. *Reserve Bank of New Zealand Bulletin*, 75(2): 15-24.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. London: MIT Press.

_____ (2010). *Econometric Analysis of Cross Section and Panel Data*. London: MIT Press.

_____ (2015). *Introductory Econometrics: A Modern Approach*. Ontario, Canada, Nelson Education.

_____ (2015). *Introductory Econometrics: A modern approach*. South Western, United States of America.

Wymeersch, E. (2007). The structure of financial supervision in Europe: about single financial supervisors, Twin Peaks and multiple financial supervisors. *European Business Organization Law Review*, 8(2): 237-306.

World Bank World Economic Indicators for Cambodia, United Kingdom, Japan, Malaysia, South Africa, South Korea and Thailand. Available:

<http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>

Yan, M., Hall, M.J.B. and Turner, P. (2012). *How liquid are UK banks?*, Loughborough University School of Business and Economics. (Working Paper No. 8).

Banking Supervision Reports

Cambodia. Available:

https://www.nbc.org.kh/english/supervision/commercial_banks.php (Accessed 20 February 2016).

Malaysia. Available:

http://www.bnm.gov.my/index.php?ch=fs&pg=fs_ovr_what&ac=112 (Accessed 20 February 2016).

South Korea. Available:

<http://www.bok.or.kr/broadcast.action?menuNaviId=2368> (Accessed 20 February 2016).

Thailand. Available:

<https://www.bot.or.th/English/FinancialInstitutions/WebsiteFI/Pages/InstList.aspx> (Accessed 20 February 2016).

APPENDICES

Appendix 1: Empirical studies on factors influencing bank liquidity dynamics

Author(s)	Year	Sample & Period of study	Dependent Variable	Independent Variables	Results obtained, Statistical significance
Alger and Alger	1999	32 banks Mexico January 1997 : March 1999	Liquid Assets / Total Assets	Demand deposits	Negative, Significant
				Funding costs	Positive, Insignificant
				Bank size	Negative, Insignificant
				Bank capital	Positive, Significant
Aspachs <i>et al</i>	2005	57 banks United Kingdom 1985 : 2003	Liquid Assets / Total Assets	Lender of Last Resort Support	Negative, Significant
				Profitability	Negative, Significant
				Loan growth	Negative, Significant
				Bank size	Positive, Insignificant
				Gross Domestic Product growth	Negative, Significant
				Policy rate	Negative, Significant
Bonner <i>et al</i>	2015	7000 banks OECD bloc 1998 : 2007	Cash and due from banks / Total Assets	Concentration	Negative, Significant
				Disclosure	Positive, Significant
				Deposit Insurance	Negative, Insignificant
				Bank Size	Positive, Insignificant
				Profitability	Positive, Significant
				Deposits	Positive, Significant
				Capital	Positive, Insignificant
Chen and Phuong	2014	United States of America 1997 : 2010	Liquid Assets / Total Assets	Securitization	Negative, Significant
				Loan Commitments	Negative, Significant
				Transaction Deposits	Positive, Significant
				Deposit-Loan Synergy: Transaction Deposits*Loan Commitments	Negative, Significant
				Monetary Policy: Federal	Negative, Significant

				Reserve Bank Paper Bill Rate	
				Gross Domestic Product	Negative, Significant
				Financial Crisis measured by a dummy variable: 1 for crisis and zero otherwise	Positive, Significant
Delechat <i>et al</i>	2012	96 banks Central America 2006 : 2010	Liquid Assets / Customer Deposits and Short Term Funding	Lagged dependent variable	Positive, Significant
				Capitalization	Negative, Significant
				Profitability	Negative, Insignificant
				Loan-Loss Reserve ratio	Negative, Insignificant
				Bank Size	Positive, Significant
				Foreign Ownership	Negative, Insignificant
				Private Ownership	Positive, Insignificant
				Deposit Dollarization	Positive, Significant
De Young and Jang	2016	11 414 banks United States of America 1992 : 2012	Loans / Core Deposits ratio	Lender of Last Resort	Negative, Insignificant
				Bank Size	Positive, Significant
				PUBLIC: Publicly traded	Positive, Significant
				MBHC: Bank affiliated to holding company	Positive, Significant
				Equity Capital	Negative, Significant
				Concentration	Positive, Significant
Melese and Laximikantham	2015	Ethiopia	Not defined	Growth Plan	Positive, Significant
				Capital Adequacy	Negative, Significant
				Asset Quality: NPL / Gross Loans	Negative, Insignificant
				Bank Size	Negative, Insignificant
				Profitability	Negative, Significant
				Loan Growth	Positive, Insignificant
				Gross Domestic Product	Negative, Significant
				Inflation	Negative, Insignificant

				Interest Rate Margin	Positive, Insignificant
Sudirman	2014	20 banks Indonesia 2004 : 2011	Liquid Assets / Deposits and Short Term Funding	Lagged dependent variable	Positive, Insignificant
				Capital: Tier 1 ratio :Total capital ratio	Negative, Insignificant Positive, Insignificant
				Asset quality	Negative, Significant
				Efficiency: Non-Interest Expenses to Average Assets	Negative, Significant
				Profitability	Positive, Significant
				Funding: Net Loans / Deposits and short term funding	Negative, Significant
				Monetary Policy : Central bank rate	Negative, Insignificant
				Inflation	Positive, Significant
				Capital market development: Stock Market Capitalization to Gross Domestic Product	Positive, Significant
				Gross Domestic Product growth	Positive, Insignificant
Vodova	2013	Visegrad Bloc (Czech Republic, Hungary, Poland, Slovakia) 2000 : 2011	Liquid Assets / Total Assets	Asset Quality: NPL / Gross Loans	Positive, Significant
				Profitability	Positive, Significant
				Bank Size	Negative, Significant
				Gross Domestic Product	Positive, Significant
				Interest Rate on Interbank Transactions	Negative, Significant
				Interest Rate on Loans	Positive, Significant

Source: Own Construction

Appendix 2: Liquidity Coverage Ratio Components

	Numerator (High Quality Liquid Assets)	
	Stock of High Quality Liquid Assets	Weight
	Level 1 Assets	
1	Cash & Due From Banks	100%
2	Central Bank Reserves	100%
3	Marketable securities issued or guaranteed by foreign sovereigns having 0% risk-weight under Basel II Standardised Approach	100%
4	Total Level 1 Assets (1+2+3)	
5	Add amount lent under a reverse Repo transaction undertaken for up to and including 30 days in corporate bonds (irrespective of whether they qualify as Level 2 assets or not)	100%
6	Deduct amount borrowed under a Repo transaction undertaken for up to and including 30 days in corporate bonds (irrespective of whether they qualify as Level 2 assets or not)	100%
7	Total Adjusted Level 1 Assets (4+5-6)	
	Level 2 Assets	
	Level 2A Assets	
8	Marketable securities representing claims on or claims guaranteed by sovereigns, Public Sector Entities or multilateral development banks that are assigned a 20% risk weight under the Basel II Standardised Approach for credit risk and provided that they are not issued by a bank/financial institution or any of its affiliated entities.	85%
9	Corporate bonds, not issued by a bank/financial institution or any of its affiliated entities, which have been rated AA- or above by an Eligible Credit Rating Agency.	85%
10	Commercial Papers not issued by a bank/financial institution or any of its affiliated entities, which have a short-term rating equivalent to the long-term rating of AA- or above by an Eligible Credit Rating Agency.	85%
11	Municipal Bonds with a rating greater than or equal to AA-	85%
12	Total Level 2A Assets (8+9+10)	
13	Add market value of Level 2A corporate bonds placed as collateral under a repo transaction undertaken for up to (and including) 30 days.	85%
14	Deduct market value of Level 2A securities acquired as collateral under a reverse repo transaction undertaken for up to (and including) 30 days	85%
15	Total Adjusted Level 2A Assets (12+13-14)	
	Level 2B Assets	
16	Marketable securities representing claims on or claims guaranteed by sovereigns having risk weights higher than 20% but not higher than 50%	50%
17	Common Equity Shares not issued by a bank/financial institution or any of its affiliated entities listed on a recognized stock exchange	50%

18	Total Level 2B Assets (16+17)	
19	Total Stock of HQLAs = Level 1 + Level 2A + Level 2B – Adjustment for 15% cap – Adjustment for 40% cap	
	Where: Adjustment for 15% cap (See equation 3.12) Adjustment for 40% cap (See equation 3.13)	
	Denominator (Net Cash Outflows)	
A	Cash Outflows	
1	Retail Deposits [(i) + (ii)]	
(i)	Stable Deposits	5%
(ii)	Less Stable Deposits	10%
2	Unsecured wholesale funding [(i) + (ii) + (iii) +(iv) + (v)]	
(i)	Demand and term deposits (less than 30 days maturity) provided by small business customers [(a) + (b)]	
(a)	Stable Deposits	10%
(b)	Less Stable Deposits	10%
(ii)	Operational deposits generated by clearing, custody and cash management activities [(a)+(b)]	
(a)	Portion covered by deposit insurance	5%
(b)	Portion not covered by deposit insurance	25%
(iii)	Non-financial corporates, sovereigns, central banks, multilateral development banks, and PSEs	40%
(iv)	Funding from other legal entity customers	100%
3	Secured Funding [(i) + (ii) + (iii) + (iv)]:	
(i)	Secured funding transaction with RBI/central bank or backed by Level 1 assets with any counterparty	0%
(ii)	Backed by Level 2A assets with any counterparty	15%
(iii)	Backed by Level 2B assets with any counterparty	50%
(iv)	Any other secured funding	100%
4	Additional requirements [(i)+(ii)+(iii)+(iv)+(v)+(vi)+(vii)+(viii)+(ix)+(x) + (xi)]	
(i)	Net derivative cash outflows	100%
(ii)	Liquidity needs (e.g. collateral calls) related to financing transactions, derivatives and other contracts where ‘downgrade triggers’ up to and including a 3-notch downgrade	100%
(iii)	Market valuation changes on derivatives transactions (largest absolute net 30-day collateral flows realised during the preceding 24 months) based on look back approach	100%
(iv)	Increased liquidity needs related to the potential for valuation changes on non-Level 1 posted collateral securing derivatives	20%
(v)	Increased liquidity needs related to excess non- segregated collateral	100%

	held by the bank that could contractually be called at any time by the counterparty	
(vi)	Increased liquidity needs related to contractually required collateral on transactions for which the counterparty has not yet demanded the collateral be posted	100%
(vii)	Increased liquidity needs related to derivative transactions that allow collateral substitution to non-HQLA assets	100%
(viii)	Structured products e.g. Asset Backed Commercial Paper maturing within the 30 days period [(a)+(b)]	
(a)	Liabilities from maturing Structured products e.g. Asset Backed Commercial Paper (applied to maturing amounts and returnable assets)	100%
(b)	Asset Backed Securities applied to maturing amounts	100%
(ix)	Currently undrawn committed credit and liquidity facilities provided to [(a)+(b)+(c)+(d)+(e)+(f)+(g)]	
(a)	Retail and small business clients	5%
(b)	Non-financial corporates, sovereigns and central banks, multilateral development banks, and Public Sector Enterprises – Credit facilities	10%
(c)	Non-financial corporates, sovereigns and central banks, multilateral development banks, and PSEs – Liquidity facilities	30%
(d)	Banks	40%
(e)	Other financial institutions (including securities firms, insurance companies) – Credit facilities	40%
(f)	Other financial institutions (including securities firms, insurance companies) – Liquidity facilities	100%
(g)	Other legal entity customers	100%
(x)	Other contingent funding liabilities [(a) + (b) + (c)]	
(a)	Guarantees, Letters of credit and Trade Finance	5%
(b)	Revocable credit and liquidity facilities	5%
(c)	Any other	5%
(xi)	Any other contractual outflows	5%
B	Total Cash Outflows (1+2+3+4+5+6+7)	
C	Cash Inflows	
1	Maturing secured lending transactions backed by the following collaterals [(i) + (ii) + (iii)]	
(i)	With Level 1 assets	0%
(ii)	With Level 2A assets	15%
(iii)	With Level 2B assets	50%
2	Margin Lending backed by all other collateral	50%
3	All other assets	100%
4	Lines of credit – Credit or liquidity facilities or other contingent	0%

	funding facilities that the bank holds at other institutions for its own purpose	
5	Other inflows by counterparty [(i) + (ii) + (iii)]	
(i)	Retail and small business counterparties	50%
(ii)	Amounts to be received from non-financial wholesale counterparties, from transactions other than those listed in above inflow categories	50%
(iii)	Amounts to be received from financial institutions and central banks, from transactions other than those listed in above inflow categories	100%
6	Net derivatives cash inflows	100%
7	Other contractual cash inflows	50%
D	Total Cash Inflows [1 + 2 + 3 + 4 + 5+6+7]	
E	Total Cash Outflows less Total Cash Inflows [B-D]	
F	25% of Total Cash outflows [B*0.25]	
G	Total Net Cash Outflows [Higher of E or F]	

Source: (Basel Committee on Banking Supervision 2014, Reserve Bank of India LCR Template)

Appendix 3 (a): Robustness test results for Objective 1

Variable	Linear GMM	Alternative Capital measure	Alternative asset quality measure	Size squared	Alternative profit measure
	(1) Coefficient	(2) Coefficient	(3) Coefficient	(4) Coefficient	(5) Coefficient
Lagged liquidity asset ratio ($LAR_{ic,t-1}$)	-	0.7057*** (0.1743)	0.6306*** (0.1856)	0.5784*** (0.1465)	0.4910*** (0.1608)
Bank size (SIZE)	-7.5918** (3.4205)	9.7164*** (3.2433)	5.6578** (2.9740)	49.0940 (77.9338)	3.8570 (3.6391)
Bank size squared ($SIZE^2$)	-	-	-	-386.5538 (695.7952)	-
Bank capital (CAP)	-0.2086 (0.2403)	-	-	-0.1278 (0.2434)	-0.0621 (0.2383)
Capital adequacy ratio (CAR)	-	0.24391 (0.2762)	-0.1529 (0.2708)	-	-
Loan growth (LG)	0.01859* (0.0107)	0.05691*** (0.0151)	0.0530*** (0.0158)	0.0510*** (0.0145)	0.0667*** (0.0162)
Asset quality (LLOSS)	-0.7452*** (0.1665)	-2.7002*** (0.5751)	-	-2.3636 (0.5675)	-0.5937** (0.2540)
Asset quality (NPL)	-	-	0.0719 (0.0370)	-	-
Profitability (ROE)	-0.1200*** (0.0414)	-0.2038*** (0.0349)	-0.0604*** (0.0204)	-0.2103*** (0.0297)	-
Profitability (NIM)	-	-	-0.1714*** (0.0460)	-	1.3706*** (0.4736)
Deposit loan synergy (DLS)	-0.3625*** (0.0461)	-0.2601*** (0.0732)	-	-0.2136*** (0.0425)	-0.1331** (0.0543)

Transaction deposits (TD)	22.564*** (2.6344)	7.3692 (5.6222)	11.0082 (5.5140)	10.4456* (5.5838)	15.6803** (6.6887)
Deposit Insurance (DEPINS)	-	69.9484 (107.396)	69.9484 (75.7946)	78.2539 (96.1629)	18.1113 (116.995)
Real GDP growth (GDP)	1.71608** (0.8582)	1.6206* (0.9102)	1.9767** (0.8282)	1.6380* (0.8765)	2.0190** (0.9281)
Deposit interest rate (DEPRATE)	-	-	-	-	0.5501 (0.3389)
Savings ratio (SR)	0.16491 (0.3436)	-1.3403*** (0.4337)	-1.4119*** (0.4473)	-1.4718*** (0.4784)	-1.1954** (0.4958)
Monetary policy (CBR)	-0.6234 (0.6187)	-0.8639* (0.4671)	-0.0579 (0.5347)	-0.6187 (0.5676)	-0.0851 (0.8579)
Arellano-Bond (2) test	0.7752	0.3447	0.2186	0.7223	0.4811
Sargan test	0.3701	0.5309	0.6633	0.4463	0.4478
Wald test	3711.40***	270.42***	451.44***	883.75***	1069.37***

Source: Own construction based on data obtained from Bankscope

****, **, * indicate significant level at 1%, 5% and 10% respectively*

Standard errors are in parenthesis (brackets)

NB: Deposit insurance dropped due to collinearity (objective 1)

Appendix 3 (b): Robustness test results for Objective 2

Variable	Linear GMM	Alternative Capital measure	Alternative profit measure
	(1) Coefficient	(2) Coefficient	(3) Coefficient
Lagged liquidity asset ratio (LAR _{ic,t-1})	-	0.6284*** (0.1874)	0.7511*** (0.1730)
Bank size (SIZE)	-4.8169** (1.9928)	8.2571** (3.5811)	9.4767*** (3.0735)
Bank capital (CAP)	-0.2979* (0.1805)	0.2197 (0.2696)	-
Capital adequacy ratio (CAR)	-	-	0.2400 (0.2719)
Loan growth (LG)	0.0087 (0.0139)	0.0644*** (0.0210)	0.0602*** (0.0170)
Asset quality (LLOSS)	-0.9093*** (0.1539)	-0.7207*** (0.2503)	-2.5699*** (0.5636)
Profitability (ROE)	-0.1337*** (0.0469)	-	-0.1943*** (0.5636)
Profitability (NIM)		1.4701* (0.4453)	-
Deposit loan synergy (DLS)	-0.3125 (0.0616)	-0.1406* (0.0802)	-0.2460*** (0.0789)
Transaction deposits (TD)	23.6495*** (3.9688)	10.6596* (5.8632)	11.3643** (5.8094)
Regulatory pressure (REGPRESS)	9.9348*** (1.9494)	5.9929*** (1.5092)	5.3495*** (1.9232)

Deposit Insurance (DEPINS)	-	90.1543 (122.2503)	82.5658 (105.762)
Real GDP growth (GDP)	1.9251*** (0.5628)	1.5992* (0.8650)	2.0266** (0.9243)
Savings ratio (SR)	0.5907** (0.2634)	-1.0572* (0.6850)	-1.177** (0.5826)
Monetary policy (CBR)	-0.5806 (0.4489)	-0.3697 (0.7345)	-0.3249 (0.6560)
Arellano-Bond (2) test	0.9230	0.9222	0.2565
Sargan test	0.5445	0.3106	0.4218
Wald test	49928.95***	1373.56***	608.65***

Source: Own construction based on data obtained from Bankscope
***, **, * indicate significant level at 1%, 5% and 10% respectively
Standard errors are in parenthesis (brackets).

Appendix 3 (c): Robustness test results for Objective 3 and 4

Variable	Linear GMM HQLA/TA	Linear GMM EQ/TL	Difference GMM LTWF/TL	Difference GMM DEPF/TL
	(1) Coefficient	(2) Coefficient	(3) Coefficient	(4) Coefficient
Lagged dependent variable	-		0.2892*** (0.0885)	0.2333** (0.0958)
Bank size (SIZE)	3.0382*** (0.8547)	-0.0708*** (0.0042)	-0.0077 (0.0103)	15.0693*** (4.1341)
Bank capital (CAR and CAP)	0.4710*** (0.1819)	-	-0.0032*** (0.0009)	-0.0123 (0.2878)
Loan Growth (LG)	-	-	0.0002*** (3.8E-05)	-
Asset quality (NPL)	-0.0004*** (0.0001)	-0.0004*** (0.0001)	0.0014*** (0.0005)	0.2791*** (0.0219)
Profitability (NIM/ROE)	-0.0030*** (0.0005)	-0.0030*** (0.0005)	0.0098*** (0.0014)	2.4571** (1.1693)
Income Diversification (ID)	-	-	-	-
Asset Growth (AG)	-	-	-	-
Bank Liquidity (LIQ)	-0.0026*** (0.0004)	-0.0026*** (0.0004)	-	-
Bank Deposits (DEPOSITS)	0.0424 (0.0692)	0.0424 (0.0692)	-0.0428** (0.0193)	-
Regulatory pressure (REGPRESS)	0.4399*** (0.0573)	0.4399*** (0.0573)	0.0132*** (0.0034)	12.0808***

				(1.3789)
Real GDP growth (GDP)	0.0046*** (0.0013)	0.0046*** (0.0013)	-0.0021*** (0.0008)	-0.2498 (0.6986)
Financial Sector Development (FSD)	-	-	-	-0.2342*** (0.0660)
Financial Sector Openness (OPENNESS)	-	-	-	-1.1581*** (0.6426)
Monetary policy (CBR)	-	-	0.0024* (0.0013)	-
Interest Rate (IR)	-	-	0.0004** (0.0002)	-
Inflation (INF)	0.0178*** (0.0029)	0.0178*** (0.0029)	-	-
Arellano-Bond (2) test	0.3160	0.3160	0.1289	0.1735
Sargan test	0.8456	0.8456	0.8531	0.2893
Wald test	8133.40***	8133.40***	208 598.25***	19 068.79***

Source: Own construction based on data obtained from Bankscope
***, **, * indicate significant level at 1%, 5% and 10% respectively
Standard errors are in parenthesis (brackets).

NOTE: HQLA/TA = High Quality Liquid Assets to Total Assets

LTWF/TF = Long Term Funding to Total Liabilities

DEPTF/TL = Retail Deposits to Total Liabilities

EQ/TL = Equity Funding to Total Liabilities

Appendix 3 (d): Robustness test results for Objective 5

Variable	Linear GMM	Alternative Credit risk measure (LLOSS)	Alternative liquidity measure (LAD)	Excluding liquidity linearity
	(1) Coefficient	(2) Coefficient	(3) Coefficient	(4) Coefficient
Lagged return on asset (ROA _{ic,t-1})	-	0.4873*** (0.0184)	0.5661*** (0.0313)	0.6134*** (0.0336)
Bank Liquidity (LIQ)	-0.0802* (0.4526)	0.0992** (0.0410)	0.0479 (0.0451)	-0.1255*** (0.0146)
Bank Liquidity squared (LIQ ²)	0.0001 (0.0007)	-0.0019*** (0.0005)	-0.0006 (0.0290)	
Bank size (SIZE)	0.9409 (0.8720)	0.0510 (0.2321)	0.4929** (0.2178)	-1.0754*** (0.3123)
Bank capital (CAP)	-0.1261*** (0.0390)	-0.0480*** (0.0817)	-0.0046 (0.0290)	-0.0846*** (0.0189)
Management Efficiency (COST_INC)	-0.0098*** (0.0025)	-0.0088*** (0.0026)	-0.0055* (0.0030)	0.0079* (0.0046)
Credit Risk (CR)	-0.0791*** (0.0101)	-0.1030*** (0.0402)	-0.1135*** (0.0052)	-0.1444*** (0.0010)

Business Model (BM)	9.0896*** (3.1431)	7.3669*** (2.5300)	0.5404 (2.3758)	4.3021** (2.1209)
Bank deposits (DEPOSITS)	11.1707*** (2.8660)	2.7395*** (0.6778)	3.0090** (1.1874)	7.2650*** (2.2728)
Regulatory Pressure (REGPRESS)	0.9962*** (0.1191)	0.4760*** (0.1749)	0.4722*** (0.1609)	1.2612*** (0.2405)
Economic Conditions (GDP)	0.1288*** (0.0481)	-0.0603 (0.0478)	0.0079 (0.0658)	-0.1670** (0.0676)
Monetary Policy (CBR)	0.1844*** (0.0298)	-0.0339 (0.0638)	-0.0302 (0.0435)	-0.2924*** (0.0645)
Inflation (INF)				-0.0460 (0.0421)
Arellano-Bond (2) test	0.3066	0.5982	0.2690	0.2944
Sargan test	0.8865	0.8865	0.1314	0.3733
Wald test	222 018.36***	222 018.36***	126 733.71***	32 198.62***

Source: Own construction based on data obtained from Bankscope
***, **, * indicate significant level at 1%, 5% and 10% respectively
Standard errors are in parenthesis (brackets).