

COLLEGE OF HUMANITIES

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EXPLAINING BANK LIQUIDITY IN GHANA

BY

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DECLARATION

This is to certify that this thesis is the product of research undertaken by NA-IHMATU SUMAILA towards the award of a MASTER OF PHILOSOPHY IN FINANCE in the Department of Finance, College of Humanities, University of Ghana, Legon. All references used in this work have been accordingly acknowledged.

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DEDICATION

This work is dedicated to my husband, parents, siblings, lecturers, MPhil colleagues, friends and all those who in diverse ways and efforts, contributed to the success of this work.

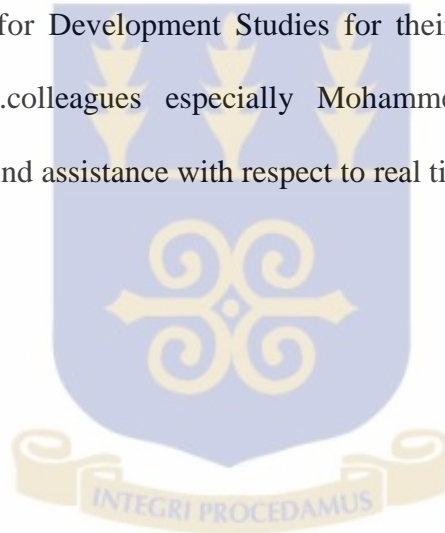


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ABSTRACT

Holding adequate liquidity is very crucial for the survival of banks. Nevertheless, reserving liquidity in excess hinders the development of interbank markets and suggests that banks are forgoing financial intermediation (hence, returns) and are inefficient. It is against this background that this study sought to find explanations on why bank liquidity in Ghana has for about a decade now remained above global average levels.

In attaining this objective, I argued that a more complete liquidity indicator will be a better measure than the traditional measures. With an unbalanced data set of 22 banks over a 7-year period spanning 2007 to 2013, the ratio of liquidity created to total assets is constructed. This ratio captures illiquidity and as such, is employed as an indirect measure of bank liquidity. Subsequently, based on the Hausman's test, the random effects model is utilized in estimating the factors that explain bank liquidity in Ghana.

Findings of the study confirmed that, indeed, Ghanaian banks are highly liquid. Capital, size, ratio of loans to total assets and annual average inflation showed a positive and significant relationship with liquidity. Net interest margin, industry concentration and GDP growth rate exhibited a negative significant relationship with liquidity of banks. Growth in money supply was insignificant in explaining liquidity of banks.

The study recommended that, the Central Bank considers the more comprehensive way of measuring liquidity as it quantifies liquidity creation, which is an important function of banks. It is also a good predictor of financial crunches and is a more complete measure of bank liquidity unlike the traditional measures. It is also recommended that banks decrease their equity, net interest margins and the ratio of loans to total assets to cut down excess liquidity reserves. Policies that enhance competition should also be enacted if the need be to further boost liquidity.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Creating liquidity is traditionally considered the preeminent function of banks, but also the primary source of their vulnerability and a justification for their fortification from liquidity crisis. (Bryant, 1980; Diamond and Dybvig, 1983). The financial intermediation role of banks is the bed-rock of the two major functions of universal banks namely deposits mobilization and credit extension. Indeed, an important role of banks in the economy is to provide liquidity by funding long-term, illiquid assets with short-term, liquid liabilities. Thus, banks hold illiquid assets while providing cash to the economy at large.

Banks are therefore, vulnerable to liquidity risk if some liabilities invested in illiquid assets are claimed at short notice. The subprime crisis well illustrates how quickly and severely illiquidity or liquidity risk can crystallize. In particular, it shows how some sources of funding can evaporate, compounding concerns about capital adequacy rules (BIS, 2009).

Liquidity is the ability of bank to fund increases in assets and meet obligations as they fall due, without incurring unacceptable losses (BIS, 2008). The International Accounting Standards (IFRS, 2005) indicates that, liquidity risk is the risk that an entity will encounter difficulty in meeting obligations associated with financial liabilities. For Bessis (2009), it is the ability of a bank to meet at any time its own obligations that become due, repay payable deposits to creditors in the requested form, or to make such a payment from the account following the client's authorized order.

The aftermath of the 2007/2009 global financial meltdown caused liquidity crisis and overwhelmed virtually all world economies and corporate entities. According to Acharya, Shin and Yorulmazer (2009), the financial crisis led to balance sheet problems (i.e. decline in

liquidity and capital) and reduced banks' ability to honour their existing commitments and provide new credit commitments to the business sector (Brunnermeier 2009; Ivashina and Scharfstein 2010; Huang, Zhou and Zhu 2009). This has compounded concerns about liquidity of banks in all economies, including Ghana.

Aside that, the intense competition among banks themselves and between the banks and other non-bank financial institutions in Ghana, such as microfinance institutions and credit unions for deposits and lending is actually slowing down the rate of bank liquidity creation. This has provided even more evidence for banks to pay extra attention to their liquidity levels and ensure they maintain adequate liquidity levels at all times.

Since the last three decades, there has been an increasing interest in bank liquidity internationally given the importance of bank liquidity. "A strong and resilient banking system is the foundation for sustainable growth as banks are at the centre of the credit intermediation process between savers and investors. Moreover, banks provide critical services to consumers". (Basel Committee on Banking Supervision 2010, pp.5).

Banks perform valuable activities on either side of their balance sheets. On the asset side, they make loans to illiquid borrowers, thus enhancing the flow of credit in the economy. On the liability side, they provide liquidity on demand to depositors. This role makes banks inherently vulnerable to liquidity risk as they have to transform short-term deposits into long-term loans (Bank for International Settlements, 2008). In practice, banks regularly find imbalances (gaps) between the asset and the liability side that need to be equalized because, by nature, banks accept liquid liabilities but invest in illiquid assets. If a bank fails to balance such a gap, liquidity risk might occur, followed by some undesirable consequences such as insolvency, government bailout and reputation risks.

Such situation could arise when depositors, out of fear, rush in to withdraw their deposits prematurely even though they may not have liquidity needs. This then causes all depositors to withdraw, precipitating a bank run. It is impossible for banks to prevent such an event by keeping all deposits as cash in vault as this will only make them mere safe-deposit box, rather than banks that make liquidity available on demand.

Diamond and Dybvig (1983) argue that federal deposit insurance can eliminate bank runs, thereby ridding banks of the prospect of the large-scale deposit withdrawals that characterize such runs. But of course, the intent of deposit insurance (non-existent in Ghana) and other forms of protection against illiquidity, is to help banks deal with panic runs and not to substitute for the liquidity banks need to keep at hand in meeting their day-to-day routine deposit withdrawals.

Consequently, even with the option to borrow from various sources, including the central bank's discount window, banks in Ghana need to worry about having enough liquidity on hand to meet the normal liquidity needs of depositors. Because the level of even routine withdrawals on any given day is stochastic, the liquidity reserves a bank keeps may either be too high or too low in light of the realized level of withdrawals.

The ability of banks to obtain with immediacy, the needed funds at a reasonable cost as and when necessary reflects that a bank is keeping appropriate levels of liquidity. Thanks to the risk of contagion through interbank settlements, liquidity crisis at a single bank can have negative ramifications over the entire banking system. Maintaining sufficient amount of liquidity is thus extremely important to the entire banking system.

Banks may need to borrow from the market even at an exceptionally high rate during a liquidity crisis ultimately causing a decline in the banks' earnings. What is more, a bank's further borrowing to honour depositors' demand places the bank's capital at stake and

consequently, a rise in the debt equity ratio. This affects the bank's efforts to sustain an optimal capital structure (Ariff and Anees, 2012).

A bank can utilise a number of sources to meet its liquidity needs. These include new deposits, maturing assets, borrowed funds and or using the discount window (borrowing from the central bank). Given that access to these facilities may not always be obtainable and their use incurs cost, prudent liquidity measurement and management is an important activity to banks in general.

Firms need liquidity to honour their contractual obligations and undertake valuable investment projects when they arise (Keynes 1936). By enabling banks to meet their financial obligations promptly, Bernstein and Wild (2004), argue that, a liquid bank instils a sense of confidence in the customers which goes further into building customers' loyalty and satisfaction. Adebayo et al. (2011) maintains that commercial banks (universal banks in Ghana) have overtime become very important institutions in the financial system as they function as retail banking units facilitating the transfer of financial assets that are well desired from some part of the public (Fund Lenders) into other financial assets which are more widely preferred by greater part of the public (fund seekers).

Studies such as Almeida and Campello (2004) and Lins et al., (2008) show that firms tend to hold liquid assets to ensure the capability to invest when both internally generated cash flows are too low to finance planned investments and when outside funds are expensive. Accurate liquidity measurement enables banks to determine their liquidity requirement and enhances their ability to meet up depositors' demand and other financial obligations. Inability to meet short-term liabilities may affect the company's operations and in many cases it may impinge on its reputation too.

For Kumar and Yadav (2013), holding liquid funds is basically a cost-benefit trade off, because a financial institution will be able to obtain funding provided it is willing to pay the prevailing market prices, or has the choice of selling or committing its assets. In like manner, a bank can hoard a stock of liquid assets to ensure some liquidity (liquidity warehousing), although at the expense of some returns.

Freedman and Click (2006) show that banks in developing countries choose to channel only a modest portion of their funds to private sector borrowers, while keeping a sizeable percentage of their deposits in liquid assets, such as cash, deposits with other banks, central bank debt, and short-term government securities. This finding applies to Ghana too, as the banks in Ghana continue to hold sizeable amount of liquid funds. However, Repullo (2005) cautions that, the existence of Lenders of Last Resort (LOLR) result in banks holding a lower level of the liquid asset as they rely on the LOLR for liquidity since liquid assets usually have lower returns than illiquid assets.

A bank is likely to face liquidity risk problems if it fails to balance the asset and liability side of its balance sheet, does not have sufficient liquidity reserves, and fails to obtain funds from external sources. Ismail (2010) argues that the important discussion in liquidity risk management is to balance the demand for liquidity on the liability side with the supply of liquidity on the asset side.

Emphasizing illiquidity is natural for emerging markets like Ghana because of their limited access to world capital markets. However, managing liquidity risk, is more challenging because significant financial innovations and global market developments have transformed the nature of liquidity risk (BIS, 2008). These conditions have made banks more susceptible to financial market issues such as excessive loans, leading to a deep depreciation in currency (Asian economic crisis 1997-1998) as well as the issues associated with sub-prime mortgage (global financial crisis 2008-2009). Moreover, banks should not see the problem of liquidity risk in

isolation because liquidity problems in one bank could impact the entire banking industry and the financial system, and could even disentangle the overall economy.

Liquidity ratios are usually used to measure and manage liquidity in every organization in the form of current ratio, quick ratio and Acid test ratio which greatly impacts the profitability of organization (Saleem and Rehman, 2011). Other ratios which have been developed to measure liquidity of banks are the ratios of liquid assets to total assets; liquid assets to total deposits; loans and advances to deposits.

The official indicators used by Bank of Ghana, the central bank is the ratio of liquid assets to total assets and the ratio of liquid assets to total deposits. These ratios serve as a useful planning and control tool for the central bank in liquidity management. Universal banks also use it as a guide in granting loans, making investment decisions, and to make a total evaluation of their liquidity status. Nevertheless, these ratios have been subject to various criticisms and thereby, making it difficult to reach a consensus on the most accurate measure of liquidity.

This study argues that a more comprehensive measure of liquidity gives a broader picture and is more detailed and accurate than the simple and incomplete measures mentioned above. In this vein, the study attempts to construct a comprehensive liquidity indicator following Berger and Bouwman (2009), henceforth, the BB-measure and then use this indicator in determining what factors explain bank liquidity in Ghana especially when the industry continues to be adjudged as liquid by the central bank.

1.2 Problem Statement

The theory on financial intermediation proposes that liquidity creation is one of banks' *raison d'être* (Diamond and Dybvig, 1983; Holmstrom and Tirole, 1998, Kashyap, Rajan and Stein 2002, Berger, Bouwman, Kick and Schaeck 2010). This financial intermediation role of banks

enable them invest idle borrowed funds in different asset portfolios. Nonetheless, this all-important business activity of banks is not without risks.

The reason being that, such borrowed funds (deposits) from their clients may be recalled or demanded at a time when the bank is not in position to honour its financial obligations. Considering the intensity of competition in the Ghanaian banking industry due to the upsurge of new banks and non-banking financial institutions, every universal bank must endeavour to maintain adequate liquid funds at all times to meet the financial demands of its depositors and borrowers. Crowe (2009) adds more emphasis to the importance of liquidity by positing that, a bank having good asset quality, strong earnings and sufficient capital may still fail if it is not maintaining adequate liquidity.

Despite the fact that maintaining adequate liquidity is imperative for banks, holding excess liquidity can hinder growth of economies because holding liquid assets in excess would imply that banks are forgoing their primary role as financial intermediates. Such circumstance does not augur well for any economy as access to credit facilities is hampered.

For monetary and supervisory authorities, ensuring that banks hold adequate amounts of high-quality liquid assets is essential for financial stability, as highlighted during the global financial crisis. However, if liquidity holdings are much above legal requirements, this may be costly in terms of foregone financial intermediation and hence, profitability. Excess liquidity, according to Gray (2011) also hinders the development of interbank markets in all countries, and acts as “sand in the wheels” of the monetary transmission mechanism in countries with a monetary policy.

Again, a high liquidity ratio may be interpreted as inefficiency, as keeping too much liquid assets on the balance sheet results in lesser net interest margins. There is the need to therefore,

optimize liquidity whiles at the same time, trying as much as possible to reduce opportunity cost to banks.

Figures from the World Development Indicators show that for a decade now, the liquidity ratio, measured by the ratio of liquid reserves to bank assets in Ghana has continuously been above the world average. Table 1.1 provides the details.

Table 1.1 Liquid reserves to bank assets ratio of Ghana and the world

YEAR	GLOBAL AVERAGE (%)	GHANA (%)
2013	20.6	28.3
2012	18.6	28.6
2011	17.0	27.0
2010	19.2	23.5
2009	19.4	19.1
2008	15.4	16.8
2007	17.4	18.5
2006	16.2	19.8
TOTAL AVERAGE	18.0	22.7

Source: World Development Indicators

Again, according to the September, 2014 Financial Stability Report of the Monetary Policy Committee, in Ghana, the banking industry's liquid assets has increased sharply between 2007 and 2014. In July 2007, liquid assets was GHC 1.55 billion, GHC 3.71 billion in July 2010 and by July 2014 has reached GHC 11.3 billion.

This study therefore seeks to find explanations for this trend. In achieving this objective, I contend that using a comprehensive measure of liquidity is better. Given the importance of liquidity to banks in performing their fundamental intermediation role, it is imperative to have a comprehensive measure of liquidity unlike most studies of research and policy issues in banking which typically focus only on some components of liquidity creation, such as bank lending, which may yield incomplete results.

Analyses of banks' role in creating liquidity and thereby spurring economic growth have a long tradition, dating back to Adam Smith in the sixteenth century. Nonetheless, the question of what liquidity measure is most accurate continues to be a bone of contention for managers and researchers. Consequently, there is no consensus on the best way to measure liquidity. Indeed, the only consensus is that liquidity is a slippery concept and is hard to measure (Bai, Krishnamurthy and Weymuller, 2014).

Some measures of liquidity only capture banks' lending activity (e.g., credit-to-total asset ratio). Others capture liquidity emanating from only one side of the balance sheet (e.g. liquid assets to total assets ratio and liquid assets to total deposits ratio). Thus, these ratios are limited and moreover, focus on only on-balance sheet items.

The current and quick ratios have been recognized as the traditional appropriate measures of a firm's liquidity. However, both of these ratios are characterized as static and have been questioned for their appropriateness. Basel III in response to the global financial crisis of 2007-2009, introduced universal minimum liquidity standards to safeguard the resilience of banks to short-term disruptions in accessing funding and to solve longer term liquidity mismatches. These are the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).

According to BCBS, The LCR requires banks to retain sufficient high quality liquid assets to be able to withstand a 30-day stressed funding scenario specified by supervisors. The NSFR which was observed from 2012 and will be introduced in 2018 is a long-term structural ratio designed to address liquidity mismatches. It covers all balance sheet activities and affords incentives for banks to use stable sources of funding.

These two ratios which are included in the few comprehensive measures have been criticized. Some researchers have argued whether Basel III was really necessary and if it will bring prudent risk management in the banking sector. Amediku (2011), for instance maintains that,

the provisions of Basel III have not wholly tackled the causes of the financial crisis and the fundamental problems identified with Basel I and Basel II. He adds that, Basel III attempted to capture all risks in a prudent manner. However the developments in the financial system create new set of risks which the current framework might not envisage.

The liquidity proposal also favours more non risky assets to be maintained. Some countries' sovereign bonds are risky and to treat all government bonds as non-risky may impact on the solvency of banks. This situation may impact on the profitability of banks and consequently their franchise value. The main deficiency of the NSFR is that, it relies on banks' and supervisors' ability to model investor behaviour.

In order to assess a bank's liquidity position accurately, it is essential to take an all-inclusive look at the bank's consolidated balance sheet information to examine where banks invest and how they fund themselves rather than to evaluate simple liquidity ratios, such as the ratio of cash and balances with the central bank plus securities over total assets (Barrell, Davis, Liadze and Karim (2010) and the loans-to-deposits ratio (Gambacorta and Paolo, 2004). The Liquidity Transformation Gap is an intuitive step forward, but Berger and Bouwman (2009) do not believe it is sufficiently comprehensive. Deep and Schaefer (2004) define the Liquidity Transformation Gap as $(\text{liquid liabilities} - \text{liquid assets}) / \text{Total assets}$

It is against this background that this study intends to measure liquidity of the Ghanaian banking industry using a comprehensive measure adapted from Berger and Bouwman (2009). The BB- measure as I call it in this study is deemed to be a better measure for liquidity because of three reasons; First and foremost, it quantifies an important function of banks in the economy, which is liquidity creation. It also aids research on financial crises as too much bank liquidity creation may form the basis of financial crises and too little bank liquidity creation may aggravate them. This liquidity creation measure is also a good predictor of financial crunches even after controlling for other macroeconomic factors. Finally, the BB-measure is a

more complete measure of bank liquidity other than the traditional measures of total assets as it includes assets, liabilities, and equity and off-balance sheet activities.

It is worth noting that, few comprehensive liquidity measures taking into account all on-balance sheet as well as off-balance sheet items exist. The most commonly used liquidity indicators do not cover off-balance sheet (OBS) activities which are equally important because, banks also create liquidity off-balance sheet. For instance, a client can access cash under a loan commitment almost as easily as with a current account deposit. Berger and Bouwman (2009) provide empiric evidence that banks created about half of their liquidity off-balance sheet in the U.S between 1993 and 2003.

Kashyap, Rajan, and Stein (2002) also alluded to the fact that banks also create liquidity off the balance sheet. Kashyap, Rajan, and Stein (2002) for example, note similarities between some off-balance-sheet (i.e., contingent) assets and on-balance-sheet assets. In particular, an off-balance-sheet loan commitment becomes an on-balance-sheet loan when the borrower chooses to draw on the commitment.

More interestingly, Bunda and Desquilbet (2008) and Angora and Roulet (2011) found a positive relationship between the Berger and Bouwman (2009) measure which this study is going to adapt and the Net Stable Funding Ratio of Basel III, providing more empirical evidence that the BB-measure is a better choice. Consequently, it is expected that the BB-measure will provide different results from the traditional measures as applied in Ghana.

Having argued the importance of keeping adequate levels of liquidity, the negative impacts of holding excess liquidity and the fact that a more complete liquidity indicator is better, it is worth noting that, most of the empiric studies on liquidity employ the ratio of liquid assets to total assets and the ratio of liquid assets to total deposits, to measure liquidity of a banking industry, much to the neglect of the more complete BB-measure.

This study, therefore intends to fill a gap in literature by adopting the more comprehensive Berger and Bouwman (2009) liquidity measure, as an indicator of liquidity risk of Ghanaian banks and subsequently, use this measure to ascertain the factors driving the highly liquid banking industry in Ghana. The study becomes even more prominent given the fact that, persistent hoarding of excess liquidity can have serious repercussions for a banking industry.

1.3 Research Objectives

The following specific objectives are intended to be achieved after the study.

- i. To construct a comprehensive liquidity measure following Berger and Bouwman (2009).
- ii. To find out what factors drive the excess liquidity held by banks in Ghana using the liquidity measure constructed.

1.4 Research Questions

Following the research objectives, the study anticipates to answer the following questions among others, relevant to the topic:

- i. Using a more comprehensive liquidity measure, what is the liquidity status of banks in Ghana?
- ii. What are the driving factors behind the high liquidity levels of banks in Ghana?

1.5 Significance of the Study

Among other things, the findings of this study aim to:

- i. Provide new insights and information on broader measures of liquidity.
- ii. Help the Central bank in formulating policies on liquidity requirements of the banking industry in Ghana.

- iii. Assist banks in determining how various factors affect their liquidity levels so they can best strategize in maintaining adequate amounts of liquid funds or even cut down on the amount of liquidity they hold if necessary.
- iv. Provide guidelines to other similar developing nations in Africa in measuring and managing bank liquidity.

1.6 Limitations of the Study

The study exclusively concentrates on universal banks in Ghana. It employs data on 22 universal banks in Ghana excluding banks that weren't in operation during the study. It uses cross-sectional data to explain bank liquidity. The author also acknowledges that data unavailability limits analysis of the study. Nonetheless, this does not affect carrying out the study as well as its results. Again, findings of the study may not be generalized to other jurisdictions.

1.7 Overview of the Ghanaian Banking Industry

In Ghana, the financial system currently consists of 29 universal banks, 135 rural and community banks, 49 non-banking financial institutions including savings and loans, and leasing and mortgage firms. In addition, there are over 400 credit unions and financial cooperatives as well as thousands of susu collectors.

Table 1.2 Selected indicators of banking penetration (financial intermediation)

Year	2007	2008	2009	2010	2011	2012	2013	2014
Assets to GDP	29.6	29.7	32.3	32.7	34.2	43.3	34.9	38.5
Private sector credit to GDP	12.0	13.8	15.4	13.2	13.0	15.4	18.6	17.7
Total credit to GDP	14.8	16.7	18.3	15.3	14.0	16.7	21.0	19.3
Deposits to GDP	17.4	19.3	21.7	21.6	24.2	25.2	27.8	24.0

Source: BoG (2014)

Table 1.2 reports on the selected indicators for banking penetration. The figures show that, much more needs to be done regarding banking penetration (financial intermediation) in Ghana. Nevertheless, the Ghanaian banking sector has been well capitalised in the past decade, with the Capital Adequacy Ratio (CAR), as measured by the ratio of risk-weighted capital to risk-weighted assets above the 10% prudential and statutory requirements.

The ability of the banking sector to remain well capitalised has been influenced by regulatory requirements that have sought to increase capital of banks in Ghana. The recapitalisation exercise that was executed between 2009 and 2012 boosted the CAR of the Ghanaian banking sector from 14.7% in July 2009, 15.5% in July 2012 and 16.2% in July 2014.

Liquidity remains high in the Ghanaian banking system for the past decade owing to the high deposit growth rate which has supported loan growth. Additionally, Ghanaian banks' practice of holding large amounts of Government Treasury bills because of their attractive yields has also contributed to high liquidity levels.

Table 1.3 Liquidity ratios of banking industry in Ghana from 2006-2013

Year	Liquid assets /Total assets (%)
2006	46
2007	41
2008	39
2009	48
2010	52
2011	54
2012	51
2013	50

Source: Financial Stability Report (2014).

The liquidity of the industry was further enhanced when Tema Oil Refinery (TOR) debt was restructured in 2010. This strengthened the liquidity of Ghana Commercial Bank, hence, the industry.

Liquidity of the Ghanaian banking sector has ranged between 39.4% and 54.9% over the past seven years. However, the liquidity ratio fell from 54% in 2011 to 51.0% in 2012 owing to acceleration in loan book growth in 2012. Table 1.2 shows this trend.

In Ghana, off-balance sheet activities (contingent liabilities) keep growing as the Financial Stability report (2014) of the Monetary Policy Committee reveals. Table 1.3 shows the trend. The report adds that, the increase in off-balance sheet exposures suggests an increase in trade finance over the period. For example, it grew from 5.4% in year-on-year terms in 2007 to 60.7% by the end of 2012.

Table 4 Annual growth in off-balance sheet activities of banks in Ghana

Year	Amount (millions of GHC)	Year-on-Year % growth	% share in total liabilities
2007	915.9	5.4	16.1
2008	1253.8	36.9	16.4
2009	1750	39.6	10.5
2010	2101.2	(15.6)	12.1
2011	3377.2	42.2	15.3
2012	3640.4	60.7	15.7

Source: Financial Stability Report (2014)

The top five banks by assets (namely Ecobank, GCB, Standard Chartered, Barclays, and Stanbic) collectively accounted for 45.8% of the total assets of the sector by the end of 2013.

The growth of the Ghanaian banking sector has also accelerated due to the influx of foreign banks, including leading Nigerian and Asian banks, into the country in the past decade.

The top five banks by loans in 2013 (Ecobank, Standard Chartered, GCB, Agricultural Development Bank, and CAL Bank) collectively accounted for 36.3% of the total industry loan book as at end of 2013. Ghanaian banks prefer to extend credit to the commercial and financial sectors (26.5%), the services sector (26.3%), and the manufacturing sector (11.0%), which collectively accounted for the major part of outstanding credit in Ghana in 2012.

The aggregate deposits for the Ghanaian banking sector jumped from GHC 2 .38 billion in 2005, GHC 17.5 billion in July 2012 and reached 27.5 billion in July 2014. The arrival of new banking players plus branch expansion remains a key which has boosted the deposit mobilisation capacity of banks.

The deposit mix for the Ghanaian banking sector is also favourable, with nearly 80% of deposits consisting of demand and savings deposits, which helps to keep down the cost of funding. Deposits also have the largest percentage in total liabilities of banks. The Ghanaian banking sector operates with a deposit-based funding strategy, which is reflected in the fact that the deposit-to-asset ratio has been kept within a 63-72% range in the past decade.

In conclusion, the Ghanaian banking sector is highly liquid with high Capital Adequacy Ratio. The future also looks bright and better for the industry with competition, legislation and regulations, technology, and the performance of the domestic economy expected to be the most influential in transforming banking in Ghana (Ghana Banking Survey, 2014).

1.8 Organization of the thesis

This study is organized into five chapters:

Chapter one, presents the introduction which includes the background, problem statement, research objectives and research questions, significance, scope and limitations of the study, an overview of the banking industry and ends with the chapter disposition.

Chapter two reviews literature on the concept of bank liquidity and how banks create liquidity; discusses various measures of liquidity and the theoretical and empirical evidence on determinants of bank liquidity.

The next chapter deliberates in detail, the required methodology, data sources, the dependent and independent variables.

Chapter four analyzes the data collected to meet the set objectives. It also discusses the results of the analysis.

Chapter 5 summarizes the results of the study, concludes and offers policy recommendations. It also discusses the possible future research that needs to be undertaken in the area of bank liquidity.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Insight

2.1.1 Concept of liquidity and the liquidity creation theory

According to the modern theory of financial intermediation, banks perform two central roles in the economy, the first role is liquidity creation (e.g. Diamond and Dybvig 1983; Kashyap, Rajan, and Stein, 2002), and the second is risk transformation (Diamond, 1984). More empirical research has focused mainly on banks' role as risk transformers. Diamond and Dybvig (1983), for example pointed out that one of the key reasons why banks are fragile, is their role in transforming maturity and providing insurance with regard to depositors' potential liquidity needs.

Standard textbooks on financial intermediation (e.g., Greenbaum and Thakor, 2007; Freixas and Rochet, 2008) explain that banks are institutions that make loans funded by a mixture of equity provided by banks' stockholders and deposits from the public. More formally, banks engage in liquidity creation, which is a form of "qualitative asset transformation." In Diamond and Dybvig (1983), this liquidity creation makes the banks vulnerable to withdrawal risk, hence, liquidity risk.

Liquidity is an intuitive concept that is difficult to precisely describe and even more problematic when it comes to its appropriate measure. Olagunju, Adeyanju and Olabode (2011) add to this argument by stating that liquidity is a relative concept because there is no specific level of any balance sheet ratio that indicates that a firm is no longer liquid. Extant academic literature on bank liquidity creation is huge as compared to literature on its empirical measurement which is now evolving (Berger and Bouwman 2009; Brunnermeier, Gorton and Krishnamurthy 2011).

After the financial meltdown which compelled governments to intervene on a large and extraordinary scale to circumvent the collapse of the financial system, the concept of liquidity has become crucial to financial institutions, regulators and academia. Yet, a standardized definition and understanding of the concept of liquidity is still missing. According to Crockett (2008), “Liquidity is an elusive notion. It is easier to recognize than to define.” Nonetheless, a closer scrutiny shows that most of the various definitions of liquidity allude to time, immediacy, cost and flow concept.

Diamond and Dybvig (1983) propounded a model of bank runs and liquidity crises which is extensively considered by academia as the most influential in the field. They demonstrated bank’s business model in which daily activities of accepting inherently illiquid assets (e.g. mortgages) and granting liquid liabilities (e.g. deposits) predisposes banks to runs. In the Diamond and Dybvig (1983) model, the elementary ground for depositors’ withdrawals is a swing in expectations.

In other words, a run on a bank or a liquidity crisis occurs because bank’s assets, which are liquid but not secure, are not enough to cover fixed liabilities (i.e., demand deposits), and, as a consequence, depositors withdraw their monies to reduce the anticipated losses. The models of Diamond and Dybvig (1983) and Gorton (1988) recognize that banks create liquidity by issuing short-term debt claims.

Diamond and Dybvig (1983) is the canonical model that lays emphasis on the importance of “funding liquidity” in understanding financial crises. More broadly, the banking literature concludes that when the financial sector holds illiquid assets financed by short-term debt, there is the possibility of a run surface which, in turn, can precipitate a crisis.

However, some researchers have criticized the model saying that, Diamond and Dybvig did not explicitly state in their model that, it is not realistic to imagine and to anticipate every possible

event that may precipitate liquidity crisis especially when contemporary banking business is extremely complex. Moreover, liquidity itself has proved to be a consequential risk.

Bryant (1980) and Diamond and Dybvig (1983) as cited by Berger (2013) define 'liquidity creation' as the fact that banks provide illiquid loans to borrowers while giving depositors the ability to withdraw funds at par value at a moment's notice. Banks also create liquidity off the balance sheet through loan commitments and similar claims to liquid funds (Holmstrom and Tirole, 2000; Kashyap, Rajan, and Stein, 2002; Thakor, 2005; Berger and Bouwman 2009).

Kashyap, Rajan, and Stein (2002) for example, note similarities between some off-balance-sheet (i.e., contingent) assets and on-balance-sheet assets. In particular, an off-balance-sheet loan commitment becomes an on-balance-sheet loan when the borrower chooses to draw on the commitment.

Literature also describes a feedback system between capital problems and liquidity problems. (Allen and Gale, 2004). When the financial sector runs into liquidity problems, triggered by runs, the sector sells assets whose prices then replicate an illiquidity discount. This low asset prices results in losses that drain capital, compromising liquidity further.

As maintained by Ioan and Dragos (2006), the management of liquidity risk presents two main perspectives both of which have an effect on a bank's profitability. They indicated that an inadequate level of liquidity may lead to the need to attract additional sources of funding associated with higher costs that will result in the reduction of the profitability of the bank and ultimately lead to insolvency. On the other hand an excessive liquidity may lead to a fall in net interest margins and in consequence poor financial performance. The empirical suggest that, liquidity problems are often triggered by concerns that the bank is insolvent due to poor asset quality (Gorton, 1988).

Brunnermeier and Pedersen (2009) model the interaction between an institution's ability to raise funds ("funding liquidity") and the liquidity of the assets when it sells them ("market liquidity"). Here, when funding liquidity goes down, an institution provides less liquidity in the assets it trades, reducing the market liquidity of the assets. When these assets themselves serve as collateral for the loans taken on by the institution, the situation can precipitate an unfavourable feedback sphere, as declined market liquidity stiffens funding liquidity conditions, and vice versa.

Liquidity risk, according to the Basel Committee for Banking Supervision, includes two types of risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that, a bank will not be able to meet efficiently both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm. Market liquidity risk, first introduced by Keynes in the eighteenth century, is the risk that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption.

A number of researchers have also defined market liquidity as an asset's ability to be traded promptly without significant price movement and at a price close to its value. (Brunnermeier and Pedersen, 2009; Deutsche Bundesbank (2008); Chordia, Sarkar and Subrahmanyam, 2003).

Nikolaou (2009) maintains that market liquidity risk is the systematic, non-diversifiable element of liquidity risk while Vento and La Ganga (2009) note that market liquidity risk is the risk that a financial institution such as a bank will be unable to easily offset or close out a position without considerably affecting the market price because of deficient market depth or market disruption.

In its standards aimed at reinforcing sound liquidity risk management and supervision, the Basel Committee on Banking Supervision defines funding liquidity as the ability to pay off or

refinance liabilities and settle trades as and when they mature. The Global Financial Stability Report (2010) of the International Monetary Fund (IMF) also integrated the concept of solvency in its definition of funding liquidity risk. Although solvent, funding liquidity refers to the capability of an organization to raise funding and to honour agreed-upon payments on time.

Consequently, a bank is illiquid if it is unable to settle obligations. It is important to note, that these various definitions complement each other and also necessary to point out that funding liquidity is neither a ratio nor an amount. Rather, it conveys the extent to which an establishment is capable of satisfying its respective obligations.

2.1.2 Why hold liquid funds?

The significance of holding adequate levels of liquid assets cannot be overemphasized. As originally proposed by Keynes (1936), a major advantage of a liquid balance sheet allows firms to undertake valuable projects when they arise. However, the importance of balance sheet liquidity is influenced by the extent to which firms have access to external finance.

Economics and finance literature provide four potential reasons for firms to hold liquid assets; the transaction motive (Miller and Orr 1966), the precautionary motive (Opler, Pinkowitz, Stulz, and Williamson 1999), the tax motive (Foley, Hartzell, Titman, and Twite 2007) and finally the agency motive (Jensen, 1986).

A number of theoretical papers have also examined the motivation for banks to reserve liquid assets. For example, banks may decide to reserve liquidity for precautionary reasons if they believe they will be unable to obtain interbank loans when they are affected by temporary liquidity shortages (Allen and Gale, 2004). Diamond and Rajan (2009), and Acharya, Gale and Yorulmazer (2011) modelled a framework for the precautionary motives of holding liquidity as banks' response to fear of forced asset liquidation.

In Diamond and Rajan (2001) banks hoard liquidity anticipating future asset liquidation which, in the context of severe market disruptions, affords high expected return from holding cash. In the model of Acharya, Gale and Yorulmazer (2011), banks store liquidity to protect themselves against future liquidity shocks (precautionary motive) or to take advantage of potential sales (strategic motive).

Almeida, Campello and Weisbach (2004) modelled a firm's liquidity demand and argue that firms save cash out of cash flows (i.e., reserve liquidity) only if it anticipates being financially constrained in the future. Banks can hold liquidity for various reasons such as the "precautionary" motive of insuring against their depositors' uncertain liquidity needs and the "strategic" motive of being able to take advantage of profitable opportunities when they arise. They also argue that banks hold more liquid assets in those countries that have (i) less developed accounting standards; (ii) lower total market capitalization relative to GDP; and, (iii) lower liquidity in stock markets.

Olagunju, Adeyanju and Olabode (2011) also indicated that, banks hold adequate liquidity so as to meet three risks, namely: funding risk (the ability to replace net out flows of funds either through withdrawals of retail deposits or non-renewal of wholesale funds), Time risk (the ability to recompense for non-receipt inflows of funds if the borrower fails to meet their commitment at a specific time), and lending risk (ability to meet requests for funds from clienteles). Rochet (2008) in his study has stated some uses of funds (liquidity needs):

Table 2.1: Liquidity needs of banks

Asset Side	Liability Side
New application of loans	Large volume of deposit withdrawals
Expiry of financial instrument sold	Large number of depositor withdrawals
Off-balance sheet activities	Repayment of bonds sold

Source: Rochet (2008).

Banks give great attention to the stability of their funding sources such as equity capital, deposits, access to funds on the interbank markets and the Central Bank's discount window, when it comes to managing their liquidity. The efficient management of the broader measure of liquidity, working capital, and its narrower measure, cash, are both important for a bank's profitability and well-being.

Banks often find imbalances between their assets and liabilities. Circumstances that could cause asset-liability imbalance and maturity mismatch risks are liquidity gap and liquidity need. These are influenced by one of the following: (i) the intention of depositors to place their funds in the short-term tenure of deposits; (ii) the downturn of business conditions that cause the inability of entrepreneurs to repay the high credit rate from banks and; (iii) the asymmetric information among depositors, banks, borrowers and regulators.

According to Aspachs, Nier and Tiesset (2005), there are three mechanisms that banks can use to insure against liquidity crises: (i) Banks hold buffer of liquid assets on the asset side of the balance sheet. A large enough buffer of assets such as cash, balances with central banks and other banks, debt securities issued by governments and similar securities or reverse repo trades reduce the probability that liquidity demands threaten the viability of the bank. However, Cash reserves will not be sufficient if depositors withdraw simply because they are afraid that the bank will shut down due to a run by others on its deposits. (ii) The second strategy is connected with the liability side of the balance sheet. Banks can rely on the interbank market where they borrow from other banks in case of liquidity demand. However, this strategy is strongly linked with market liquidity risk. (iii) The last strategy concerns the liability side of the balance sheet, as well. The central bank typically acts as a Lender of Last Resort to provide emergency liquidity assistance to particular illiquid institutions and to provide aggregate liquidity in case of a system-wide shortage (Acharya et al., 2009).

Koch and MacDonald (2006) maintain that, there is a short-run trade-off between liquidity and profitability. The more liquid a bank is, the lower are its return on equity and return on assets, all other things being equal. In a bank's loan portfolio, the highest yielding loans are typically the least liquid. They add that, illiquidity risk for a poorly managed bank closely follows credit and interest rate risk. Banks that experience large deposit outflows can often trace the source to either credit problems or earnings declines from interest rate gambles that backfired. Potential liquidity needs must reflect estimates of new loan demand and potential deposit losses

Koch and MacDonald (2006) define banks' liquidity needs as:

Forecasted change in loans + change in required reserves – forecasted change in deposits.

Liquidity can be measured as a stock or as a flow. From the stock perspective, liquidity management requires an appraisal of holdings of assets that may be turned into cash. The determination of liquidity adequacy within this framework requires a comparison of holding of liquid assets with expected liquidity needs. Stock concept of liquidity management has been criticized as being too narrow in scope.

The flow concept of liquidity measurement views liquidity not only as the ability to convert liquid to assets into cash but also the ability of the economic units to borrow and generate cash from operators. This approach recognizes the difficulty involved in determining liquidity standards since future demands are not known. It also recommends accurate forecast of cash needs and expected level of liquidity assets and cash receipts over a given period of time for there to be a realistic appraisal of a bank's liquidity position.

Between the two concepts, the stock concept is the widely used and involved in the application of financial ratios in the measurement of liquidity positions of commercial banks. One of the popular financial ratios used in such measurement is liquidity ratios which measures the ability of the bank to meet its current obligations.

2.1.3 Characteristics of Liquidity

Liquidity, according to Olagunju, Adeyanju and Olabode (2011), has three features or characteristics, namely, Marketability, Stability and Conservatism. Liquid assets should be more marketable or transferable. That means, they are expected to be converted to cash easily and promptly, and be redeemed prior to maturity. All assets that cannot be redeemed at maturity are said to be illiquid.

Another quality of liquid asset is price stability. Based on this characteristic, bank deposits and short term securities are more liquid than equity investments such as common stocks and real estate due to the fact that the prices of the former are fixed and have lesser variability than the prices and value of the latter which experiences considerable fluctuation

They add that, the conservatism quality of liquidity refers to the ability of the holders of liquid assets to recoup the cost of the asset at the time of resale. Common stocks might not be considered highly liquid despite their ready marketability, going by this quality. This can be ascribed to the fact that there are periods when current prices of stock are lower than their initial prices. Considering these three qualities, therefore, people and firms choose to hold cash which is the only perfectly liquid asset.

2.1.4 Measures of liquidity

Various liquidity indicators have been developed to measure how liquid banks are. From the traditional current ratio, we now have the new liquidity standards, Liquidity Coverage ratio (LCR) and the Net Stable Funding ratio (NSFR) formulated by the Basel Committee.

The importance of accurate liquidity measurement cannot be over stressed as it reveals the liquidity positions of the banks through which the operators of the financial market, including regulators and other creditors adjudge liquidity status and the credit worthiness of the banks (Brunnermeier, Gorton and Krishnamurthy, 2011).

The question remains, what makes a good liquidity measure? Bai, Krishnamurthy and Weymullar (2014) argue that a liquidity measure should be beneficial for macro-prudential purposes. It should measure liquidity imbalances in the financial system, offering an early indicator of financial crises. It should also quantitatively describe the liquidity condition of the financial sector, and the amount of liquidity the Central Bank may be called upon to provide during financial crisis, hence, the power of forecasting liquidity demands.

Though liquidity can be measured by taking into account a bank's liquidity transformation gap, liquidity ratios are more famous and widely used. Researchers identify two approaches to measuring bank liquidity; liquidity gap/flow approach and liquidity ratio/stock approach (Bessis, 2009). Among the extensively used ratios of liquidity are the ratio of liquid assets to total assets, the ratio of liquid assets to total deposits, ratio of liquid assets to customer and short term funding, ratio of loans to total assets and the ratio of net loans to customer and short term funding.

Liquidity ratios have not been without criticisms even though they serve as a useful planning and control tool in liquidity management. The disadvantage of these liquidity ratios lies in the fact that they do not always capture all, or any of liquidity risk. These measures may give wrong signals, contradictory signals, or no signals at all of actual changes in liquidity position (Scherr, 1989).

Furthermore, Poorman and Blake (2005) cautioned that adopting just the practice of using liquidity ratios would not be the solution to threats of liquidity risk. Their basis stemmed from the fact that, Southeast Bank, a large regional bank, utilized over 30 liquidity ratios for measuring liquidity, but failed eventually due to liquidity problems. It is therefore, of essence that beyond simple liquidity ratios, banks develop new forms of measuring liquidity risk.

While the Basel Committee on Banking Supervision (2000) proposed the maturity laddering method for measuring liquidity risk; Saunders and Cornett (2006) gave a strong suggestion that, banks could use the liquidity index, financing gap and the financing requirement, sources and uses of liquidity, peer group ratio comparisons and liquidity planning to measure their liquidity exposure. More to the point, Matz and Neu (2007) also indicated that banks could apply maturity mismatch, balance sheet liquidity analysis and the cash capital position approach to gauge liquidity.

Focusing on the ratios, the traditional Current ratio measures a bank's short term solvency and is calculated by dividing current assets by current liabilities. Even though it is difficult to authoritatively set one standard for all firms, a current ratio that is greater than one is adjudged satisfactory for most business firms. The problem associated with current ratio is that, it is a test of quantity and not quality of the assets and hence, it does not reveal the true position of a firm's liquidity. Current ratio just gives a rough idea of the firm's liquidity. Besides, it mixes assets and liabilities which are quite different in terms of their maturity.

Other ratios which have been developed to measure liquidity are the ratios of liquid assets to total assets; liquid assets to total deposits; loans and advances to deposits. Calculating the ratio of liquid assets to total assets explains the importance of a bank's liquid assets among its total assets. It indicates the proportion of a banker's total assets that can be converted into cash at a short notice. The ratio of liquid assets to total assets normally gives information about the broad liquidity shock absorption capacity of banks.

As a general rule, the higher the share of liquid assets in total assets, the higher the capacity of a bank to take in a possible liquidity shock, given that market liquidity is the same for all banks. Nonetheless, a high value of this ratio may be also interpreted as inefficiency, as keeping too much liquid assets on the balance sheet results in lower net interest margins. There is the need to therefore, optimize liquidity whiles at the same time, trying as much as possible

to reduce opportunity cost to the bank. Studies that have used this ratio to measure liquidity include Molyneux and Thornton (1992) and Barth, Nolle, Phumiwasana and Yago (2003), Demirguc-Kunt et al. (2003), Aspachs, Nier and Tiesset (2005) Rauch, Steffen, Hackethal and Tyrell (2010), Vodova (2013). The setback of this ratio is that, it ignores the flow of funds from repayments, increases in liabilities and the demand for bank funds.

The ratio to liquid assets to total deposits (deposits of enterprises, individuals and other financial institutions) is more focused on banks' sensitivity to particular types of funding. It captures banks' vulnerability to liquidity risk in correspondence to their funding sources. When the ratio is more than one, it signifies that, a bank has high volume of liquid assets, enough to honour deposit withdrawals and is thus, able to meet its obligations in terms of funding. Ratios lower than this value signals a bank's susceptibility to liquidity risk with respect to the withdrawal of deposits. Previous studies that have used this ratio include Shen, Chen, Kao and Yeh (2009), Aspachs, Nier and Tiesset (2005) and Vodova (2013).

The Central Bank of Ghana uses the ratios of liquid assets to total assets and the ratio of liquid assets to total deposits as indicators of liquidity, where liquid assets includes cash and assets that are comparatively easier to convert to cash, e.g., investments in government securities, equity investments in subsidiaries and associated companies, quoted and unquoted debt and equity investments. However, this study argues that, these ratios are not comprehensive enough to cover all balance sheet items, yet alone off- balance sheet items. It is important to recognize that banks create liquidity not only from their assets but also from their liabilities, equity and even off-balance sheet activities.

These ratios also fail to indicate the quality of portfolio and its liquidity characteristics. Not all assets in any particular grouping have the same degree of liquidity. They also fail to provide the cedi amount of liquidity, hence cannot be used to forecast future liquidity demands of various banks and the entire banking industry.

Loans to total assets ratio measures the proportion of total assets made up of net loans, thus a relative measure of illiquidity of a bank's total assets. This means that the lower this ratio, the more liquid a bank is. The ratio of loan and advances to deposits reflects the quantity or proportion of the customers' deposits that has been given out in form of loans and the percentage that is retained in the liquid forms. Again, this ratio is limited to measuring liquidity arising from loans and advances (which is the most illiquid of banks' assets) only, although deposits and other items affect liquidity as well.

The ratio of loans and advances to deposits reflects the quantity or proportion of the customers' deposits that has been given out in form of loans and the percentage that is retained in the liquid forms. The ratio serves as a useful planning and control tool in liquidity management as it guides universal banks in their lending and investment decisions. When the ratio rises to a relatively high level, banks are encouraged to lend and invest and vice versa, to take some benefit of profitability. The drawback to this measure is that loans and advances constitute the most illiquid of banks' assets. Also, it does not consider other assets available for conversion into cash.

Cash ratio i.e. ratio of cash to total deposits or assets is another measure of bank liquidity. Its drawback is that a substantial part of the cash assets is not really available to meet most liquidity demands even though it measures liquidity stemming from cash which is the most liquid asset.

Let us now look at more comprehensive measures than the above mentioned. Comprehensive empirical measures of liquidity creation were non-existent until 2009 when Berger and Bouwman pioneered the cause. Although Deep and Schaefer (2004) advocated the Liquidity Transformation Gap (LTG), Berger and Bouwman (2009) argued that this measure was not comprehensive enough. Deep and Schaefer (2004) define the Liquidity Transformation Gap as

(liquid liabilities – liquid assets)/Total assets. Al-Khouri (2012) made use of the LTG method in his study.

Berger and Bouwman (2009), having argued that the LTG is not comprehensive enough, recognized and pioneered the importance of measuring liquidity comprehensively in academic literature and proposed a theoretically-motivated liquidity measure. They took a broader look at how liquidity should be measured, including off-balance sheet activities, and came up with four different liquidity creation measures. The ‘cat fat’, ‘cat nonfat’, ‘mat fat’, and the ‘mat nonfat’ measures. The ‘fat’ measures include off-balance sheet items while the ‘nonfat’ measures exclude off-balance sheet items. In three steps, they arrived at the ratio of Liquidity created to total assets as an indicator of illiquidity (liquidity risk) or liquidity creation. These terms are used interchangeably in this study.

They calculate liquidity creation following these three steps. In the first stage, all assets, liabilities, equity and OBS items are categorised into one of three groups, namely, liquid, semi-liquid and illiquid. This is done based on the relative ease, cost and time it takes a bank to honour its obligations in meeting liquidity needs and also, how easy, costly and timely it takes a client of the bank to withdraw liquid funds from the bank.

At stage two, the various classes of assets, liabilities and equity are weighted using the Liquidity Creation Theory, which postulates that, banks create liquidity when they finance illiquid assets with liquid liabilities. Thus, illiquid assets and liquid liabilities are weighted positive because they contribute to creating liquidity and because they contribute equally to create liquidity, the magnitude of their weights are $+1/2$ each. Liquidity is destroyed when liquid assets are financed with illiquid liabilities and so, these items are given negative weights and because they equally contribute to destroying liquidity, are weighted $-1/2$.

At the final stage, each class of assets, liabilities equity and OBS items are summed up and multiplied by their respective weights and then, the weighted sums also summed across to obtain the total liquidity created for each bank. This can be aggregated for the entire banking industry. This measure has been, and continues to be widely used in literature after Berger and Bouwman (2009). Among the researchers that have used this measure are, Chen, Chou, Chang and Fang (2015), Lei and Song (2013), Choi, Park and Ho (2013), Fungacova, Ariss and Weill (2013), Ariff and Anees (2012), Varotto (2011), Pana and Query (2009).

This measure is considered to be an improved indicator for bank liquidity because of the following reasons; firstly, it quantifies liquidity creation, which is an important function of banks in the economy. Furthermore, it aids research on financial crises as too much bank liquidity creation may form the basis of financial crises and too little bank liquidity creation may aggravate them. This liquidity creation measure is a good forecaster of financial crises even after controlling for other macroeconomic dynamics. Lastly, the BB-measure is a more complete measure of bank liquidity other than the traditional measures of total assets as it includes assets, liabilities, equity and off-balance sheet activities.

Brunnermeier, Gorton and Krishnamurthy (2011), also developed the Liquidity Mismatch Index (LMI), which is conceptually similar to Berger and Bouwman (2009) measure even though it measures the exact opposite: the LMI is a liquidity measure whereas the Berger and Bouwman (2009) measure captures illiquidity (creating liquidity for the public reduces liquidity of banks). An important feature of the LMI is that, it can be aggregated across banks to measure the liquidity mismatch of a whole financial sector. Overall, firm i 's liquidity position is $\wedge_{\omega}^i \equiv \wedge_{\omega}^{A,i} - \wedge_{\omega}^{L,i}$, which is a function of the state ω . Where, $\wedge_{\omega}^{A,i}$ is firm i 's asset liquidity and $\wedge_{\omega}^{L,i}$ represents firm i 's liabilities liquidity for the different states of the economy.

The Basel Committee on Banking Supervision (BCBS) in the “Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring,” published in December 2010 (BCBS 2010), defined two minimum standards for funding liquidity: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding ratio (NSFR). This news will have big impact on banks, because they are required to hold a level of capital and liquidity higher than in the past and will without doubt, also have an impact on the liquidity creation function performed by banks. (Horvath, Seidler and Weill, 2012).

The LCR aims to promote short-term resilience of banks' liquidity profile by ensuring that it has sufficient high-quality liquid assets (cash or cash-equivalent), specified by supervisors, to endure a significant stress scenario lasting for 30 days. The LCR is calculated as the stock of high-quality liquid assets/total net cash out-flows over the next 30 calendar days ≥ 100 per cent. Put differently, to meet funding requirements and draws on contingent liabilities over the next 30 days, the LCR requires banks to hold a stock of unencumbered high-quality liquid assets equal to or greater than stressed net cash outflows. This requirement must be satisfied constantly and reported to supervisors at least, on a monthly basis, with not more than two weeks ultimate time lag. A drawback of the LCR of Basel III is that, it cannot be aggregated across banks. Besides, getting monthly data to calculate LCR will prove difficult especially in Ghana.

The Net Stable Funding ratio promotes resilience over a longer time period by matching long-term assets with stable funding sources over a one-year horizon (BIS, 2010). The NSFR is a longer-term structural ratio designed to address liquidity mismatches, covers the entire balance sheet and provides incentives for banks to use stable sources of funding. The NSFR is designed to encourage an increased reliance on medium and long-term funding, thus, increasing the average maturity of banks' liabilities. It is structured to ensure that long-term assets are funded

with a minimum amount of stable long-term funding. It is measured as the ratio of the required amount of stable funding to the available amount of stable funding.

The required amount of stable funding corresponds to the amount of a particular asset that could not be monetised through the sale or the use as collateral in a secured borrowing on an extended basis during a liquidity event lasting one year. The available stable funding corresponds to the total amount of an institution's: (i) capital; (ii) liabilities with effective maturities of one year or more; and (iii) a portion of "stable" non-maturity deposits and / or term deposits with maturities of less than one year that would be expected to stay with the institution for an extended period in an idiosyncratic stress event.

Bunda and Desquilbet (2008) and Angora and Roulet (2011) confirm the similarity of the liquidity creation indicator of Berger and Bouwman (2009) and the Net Stable Funding Ratio of Basel III, and show that, the two exhibit a strong linear and positive relationship. Angora and Roulet (2011) and Cucinelli (2013) employed these ratios in their various studies.

2.2 Empirical Review on Factors Explaining Bank Liquidity

The main literature on the determinants of liquidity is comparatively scant. In general, liquidity risk is considered as a determinant of other risks, such as credit risk (Bissoondoyal-Bheenick, and Treepongkaruna, 2011) or a determinant of bank performance (Barth et al, 2003; Pasiouras and Kosmidou, 2007; Kosmidou, 2008; Shen et al., 2009; Olagunju et al., 2011; Arif and Anees, 2012).

According to Deléchat, Henao, Muthoora and Vtyurina (2012), the determinants of banks' liquidity buffers, as identified in the theoretical and empirical literature, can be classified into four broad categories. These are the opportunity costs of and shocks to funding, bank characteristics, macroeconomic fundamentals, and moral hazard motives.

Cucinelli (2013) analyzed the type of relationship that exists between liquidity risk, measured with the liquidity coverage ratio and the net stable funding ratio, and some specific bank structure variables (size, capitalization, assets quality and specialization). The sample is composed of 1080 listed and non-listed Eurozone banks and the methodology applied in the analysis is OLS regression. The results highlight that bigger banks have a higher liquidity risk exposure, while banks with higher capitalization present a better liquidity on long horizon. Asset quality impacts only on the measure of the short term liquidity risk. With regard to the specialization, banks more specialized on the lending activity show a more vulnerable funding structure. Finally, during the crisis, the liquidity risk management changes only on the short term horizon. This study is rather limited as it only includes bank-specific variables in its model, neglecting the effects of macroeconomic drivers.

Lei and Song (2013) explore liquidity creation in China and the relationship between liquidity creation and bank capital using the BB-measure. They test the so-called “financial fragility-crowding out” hypothesis and the “risk absorption” hypothesis on Chinese banks. Their results support the “financial fragility-crowding out” hypothesis for Chinese banks. They also found that, bank capital is negatively related to liquidity creation in general.

For foreign banks, however, the “risk absorption” hypothesis nullifies the financial- fragility effect as the negative relationship of bank capital and liquidity creation is reduced. These results are in line with Berger and Bouwman's (2009) findings for large US banks. The information asymmetry in the recent years between banks and investors has declined substantially, especially for listed large banks, thus reducing the financial fragility that leads to lower liquidity creation (Diamond and Rajan, 2001).

The “financial fragility-crowding out” hypothesis (Diamond and Rajan, 2000, 2001; Gorton and Winton, 2000) and the “risk absorption” hypothesis (Berger and Bouwman, 2009) explain the relationships between the bank capital ratio and liquidity creation. Banks' financial fragility-

crowding out hypothesis argues that under a fragile bank structure (i.e., with lower bank capital), banks expend more effort to provide funds and therefore create more liquidity or are more exposed to liquidity risk.

Also, higher capital ratios reduce liquidity creation by shifting investors' funds from liquid deposits to relatively illiquid bank capital. The risk absorption hypothesis argues that higher capital ratios expand banks' risk-bearing ability, and thus banks can create more liquidity or are more prone to liquidity risk. (Bhattacharya and Thakor, 1993; Coval and Thakor, 2005; Repullo, 2004; Von Thadden, 2004). This study did well to measure liquidity creation using a comprehensive measure.

Vodova (2013) identified the determinants of liquidity of Hungarian commercial banks using a panel data regression analysis for three liquidity ratios. These ratios include the ratio of liquid assets to total assets, ratio of liquid assets to total deposits and the ratio of liquid assets to deposits and short-term borrowing. Results of the panel data regression analysis showed that bank liquidity is positively related to capital adequacy of banks, interest rate on loans and bank profitability and negatively related to the size of the bank, interest margin, monetary policy interest rate and interest rate on interbank transaction. The relation between the growth rate of Gross Domestic Product and bank liquidity is ambiguous. The liquidity ratios employed in this study are however limited in measuring liquidity as argued earlier on.

Vodová (2013) again, in analysing the determinants of liquidity of Czech commercial banks found that bank liquidity increases with higher capital adequacy, higher interest rates on loans, higher share of non-performing loans and higher interest rate on interbank transaction. In contrast, financial crisis, higher inflation rate and growth rate of Gross Domestic Product have negative impact on bank liquidity. The relation between the size of the bank and its liquidity is ambiguous. Also, unemployment, interest margin, bank profitability and monetary policy interest rate have no statistically significant effect on the liquidity of Czech commercial banks.

Vodova incorporated both bank-specific and macroeconomic factors in his analysis. This enriches the model. He however failed to use a more complete measure of liquidity.

Kamau, Erick and Muriithi (2013) also proved that variations in liquidity level are caused by both internal and external factors. Internal factors found significant in determining liquidity level of commercial banks in Kisumu, Kenya, are contingency planning, profitability, banks' major obligations and management policies. On the other hand, external factors found significant in determining liquidity level of banks in Kisumu are credit rating, monetary policies, government expenditure and Balance of Payment status. The study also supports observations by Baumol and Blinder (2001) that banks will want to squeeze the maximum possible money supply out of any given amount of cash reserves. Findings for Kenya cannot however be generalized to other African countries.

Al-Khouri (2012) employed the Liquidity Transformation Gap (LTG) method on a sample of 43 banks operating in 6 of the GCC region (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) over the period 1998-2008. The author examined empirically, the effect of bank capital and other micro and macro-characteristics on liquidity creation. The author found a positive and significant relationship between bank capital and liquidity, consistent with the literature that bank capital increases bank liquidity through its ability to absorb risk.

The results also showed that bank size and the level of previous liquidity are significant in determining the liquidity created by these banks. The larger the bank size, and the higher the liquidity created by the bank in previous period, the higher the liquidity created. Results also show a negative and significant relationship between bank profitability as measured by return on assets and banks' liquidity created. The LTG method, as argued by Berger and Bouwman (2009) is not a comprehensive enough liquidity measure even though it is better than the traditional measures.

For the macroeconomic factors, none of the indicators chosen showed a significant relationship to liquidity created by the banking sector. The coefficient on stock market capitalization is negative although insignificant. This implies that stock markets in the GCC region do not complement the banking sector. Government ownership also does not seem to affect the liquidity of the banks and that large banks with high capital seem to produce most of the liquidity in the GCC market. The author used a simple measure and also ignored off-balance sheet items, thus, the method was not comprehensive enough as asserted by Berger and Bouwman (2009).

Angora and Roulet (2011) underlined the relationship between liquidity risk measured with the two new liquidity indicators proposed by the Basel Committee (LCR and NSFR), some balance sheet indices (ROA, the natural logarithm of total assets, the ratio between loans to customers and total loans, etc.) and some macroeconomic indicators (GDP annual growth rate, the spread between the interbank rate and central bank policy rate, etc.). In general, the study highlights that the liquidity risk ratio has a negative relationship with most of the indicators analysed including size and the ratio between regulatory capital and total assets, whereas the liquidity measure has a significant and positive relationship with macroeconomic variables such as GDP and the central bank policy rate. The authors' measures of liquidity provide insight into liquidity risk using Basel III recommendations which is more updated and better.

Bonfim and Kim (2011) in a study on European and North American banks in the 2002-2009 period show how banks manage liquidity risk. In particular, using a panel regression analysis, the authors consider three different measures of liquidity risk and attempt to comprehend whether banks have a tendency to take more risks during crisis and if the strategies they adhere to, in these periods are similar. The authors also estimate the determinants of liquidity risk. The results highlight that the type of relationship between liquidity risk and performance, size, and the ratio between loans and deposits depends on the type of liquidity risk measure used. Bank

size generally has a positive impact on bank liquidity, while the performance measure has an ambiguous relationship with liquidity risk. Drawing samples from two different continents was a good attempt by the authors. However, leaving out macroeconomic determinants was a limitation of the study.

Brunnermeier, Gorton and Krishnamurthy (2011), proposed the Liquidity Mismatch Index (LMI), which is conceptually similar to the BB-measure even though it measures the exact opposite: the LMI is a liquidity measure whereas the Berger and Bouwman (2009) measures capture illiquidity (creating liquidity for customers makes the bank illiquid). They calculate liquidity mismatch for the universe of bank holding companies (BHCs) in the U.S. and show that the banking sector's liquidity state is largely determined by the top 50 BHCs. The LMI index is obviously a better measure of liquidity compared to traditional liquidity ratio. This yields more robust results.

Cornett, Mcnutt, Strahan and Tehranian (2010) also tested how banks managed shocks to loan demand stemming from pre-existing unused loan commitments (held off the balance sheet). They studied how banks managed the liquidity shock that occurred during the financial crisis of 2007-2009 by adjusting their holdings of cash and other liquid assets, and how these efforts to weather the storm affected credit availability. Their results showed that unused commitments expose banks to liquidity risk, which became manifest when take-down demand increased following the collapse of Lehman Brothers.

They also documented that banks with higher levels of unused commitments increased their holdings of liquid assets (i.e., their precautionary demand for liquidity increased) and also cut back on new credit origination (measured by summing on-balance-sheet loans with off-balance-sheet loan commitments). Loan commitment draw-downs thus displaced new credit origination during the crisis. They extended their analysis in three ways. First, they show that liquidity-risk exposure is not only negatively correlated with loan growth during the crisis, but

is also positively correlated with the growth in liquid assets. These parallel results support the interpretation that efforts to build up balance-sheet liquidity displaced funding to support new lending.

Rauch, Steffen, Hackethal and Tyrell (2010) studied the determinants of liquidity risk and attempted to identify the determinants of liquidity creation using multivariate dynamic panel model on all 457 German savings institution from the period 1997 until 2006. Using three ratios including the ratio of liquid assets to total assets, which is limited, their results highlighted that the most important determinants are macroeconomic variables and monetary policy, while not showing a significant relationship between liquidity creation and bank specific variables such as size and performance. The authors acknowledged the effects of both micro and macro-economic variables on liquidity risk. Their sample also covered all banks in the industry, which is good although we might not have the same results for other jurisdictions in Europe, yet alone other continents entirely.

Berger and Bouwman (2009) using their preferred ‘cat fat’ measure, find that roughly half of the liquidity creation at commercial banks occurs through off-balance-sheet commitments. Thus, banks stand ready to supply liquidity to both borrowers and insured “retail” depositors and can enjoy synergies when depositors fund loan commitments. Recent evidence lends supports to this notion. Gatev and Strahan (2009) find deposits effectively hedge liquidity risk inherent in unused loan commitments and the effect is more evident during periods of tight liquidity.

Berger and Bouwman (2009) constructed and applied four measures of liquidity creation to data on U.S. banks over the period 1993-2003. They find that bank liquidity creation increased every year and exceeded \$2.8 trillion in 2003. Large banks, multibank holding company members, retail banks, and recently merged banks generated the most liquidity. Bank liquidity

creation is positively correlated with bank value. The researchers also find that the relationship between capital and liquidity creation is positive for large banks and negative for small banks.

They argued that, for large banks, the relationship between capital and liquidity creation is positive, consistent with the expected empirical dominance of the “risk absorption” effect. In sharp contrast, for small banks, the relationship between capital and liquidity creation is negative, consistent with the expected dominance of the “financial fragility- crowding out” effect for these institutions. The relationship is not significant for medium banks, suggesting that the two effects cancel each other out for this size class.

Capital absorbs risk and expands banks’ risk-bearing capacity (Bhattacharya and Thakor 1993; Repullo 2004; Thadden 2004; Coval and Thakor 2005), such that, higher capital ratios may allow banks to create more liquidity. The liquidity creation measure is arguably more comprehensive and better at measuring liquidity. The authors also did well comparing different categories of banks.

Determinants of liquidity risk of banks from emerging economies with panel data regression analysis were analysed by Bunda and Desquilbet (2008). They run two random effect models on their data, using bank specific factors, market factors and also macroeconomic factors. They quote bank specific factors to be capital adequacy, market factors to be prudent regulations, lending rates and exchange rates. Last of all, macroeconomic factors include GDP, economic growth, inflation rate and financial crisis.

They studied 1107 commercial banks in 36 emerging economies from the year 1995 to 2000 and find that, capitalization measured by the ratio of equity to total assets has a significant and positive relationship with all liquidity measures considered in their study and a significant relationship with inflation rate and growth rate. The sample size for this study is large enough such that we can generalize the findings for other emerging nations.

2.3 Conclusions

The above extant literature proves that most studies on bank liquidity used non-comprehensive liquidity indicators in their analysis and also, did not incorporate OBS items in measuring liquidity. Given this development, it is intriguing to note that there are no known evidence-based studies (to the best of the writer's knowledge) which have investigated the factors that explain why bank liquidity in Ghana is high using a more complete liquidity measure.

This study therefore, endeavours to fill this gap and contribute to present literature on the subject, providing current evidence for Ghana.

CHAPTER THREE

METHODOLOGY

3.1 Data Sources

To investigate the factors explaining the current high levels of liquidity held by universal banks in Ghana, data was mainly collected from secondary sources. Since the study required historical financial data, which can be acquired from the financial reports of the banks, accessing publicly available data was presumed to be the most appropriate data collection method. Moreover, it was envisaged that this method will ensure accuracy of data. Bank-specific data on assets, liabilities and equity as well as off-balance sheet activities were gleaned from the Bankscope database and the annual financial statements of the selected banks.

Data on macroeconomic variables including annual growth in GDP and inflation was retrieved from the World Development Indicators (World Bank Online, 2015) via Google search engine. Data also emanated from scholarly journals, published text books, business and financial newspapers and other economic and financial reports, survey reports, various websites and past dissertations.

3.2 Sample Description

To create the comprehensive liquidity measure and also ascertain the factors explaining bank liquidity, the study made use of an unbalanced panel data on 22 banks in Ghana spanning the period 2007 to 2013. The time period chosen is based on the availability of data and the reason that it provides recent time series observations.

To ensure that our sample only reflects “true,” ‘feasible’ universal banks, the following restraints were observed. Banks (1) with zero deposits; (2) not in operation during the period of analysis (3) with zero or negative equity capital are disregarded. The sample comprises 154 bank-year observations

3.3 Constructing the Liquidity Measure (Dependent Variable)

In three steps, two illiquidity (liquidity creation) measures are created following Berger and Bouwman (2009). It is important to note that ‘these measures capture illiquidity (creating liquidity for customers make banks illiquid)’ as Bouwman (2013), a co-proponent of these measures puts it.

Stage 1 groups all activities into three classes, namely, liquid, semi-liquid and illiquid. The next stage weights these class of activities and finally, the weights are multiplied by the cedi amount of activities in each class and then summed up for each category. These amounts are then summed across to obtain the total amount of liquidity created for each bank. It is then summed across the banks to obtain the total liquidity created by the industry.

Due to the unavailability of detailed data required for creating the four measures as in Berger and Bouwman (2009), I resorted to constructing only two measures. Hence, in Berger and Bouwman’s (2009) terminology, I consider the “cat fat” and the “cat nonfat” liquidity creation measures. The next section outlines the process in detail.

3.3.1 Step 1: Grouping activities as liquid, semi-liquid, or illiquid

In the first step, all activities are classified into one of the three groups; liquid, semi-liquid and illiquid. One would like to know the criteria used to classify the various activities. Put differently, what is the criterion for determining the class of various activities? The criteria for the classification at this stage, is based on the ease, cost, and time for clienteles to obtain liquid funds from the bank, and the ease, cost, and time for banks to honour their commitments in order to meet these liquidity demands.

The use of just three liquidity classifications (liquid, semi-liquid, and illiquid) is a necessary simplification – ‘any finer distinctions would have to be made rather arbitrarily’. (Berger and Bouwman, 2009).

- Classifying loans

In examining loans for example, we follow Berger and Bouwman (2009) and consider corporate and commercial loans and fixed assets as illiquid, because these items typically cannot be sold easily without incurring major costs. Loans and advances to banks are comparatively easier and less costly to sell or dispose off, typically because the counter parties are relatively large and transparent. These assets are therefore, classified as semi-liquid, including consumer/Retail loans. Other loans are classified as illiquid.

Table 3.1 Classifying and weighting assets

Liquid Assets Weight = 1/2	Semi-liquid Assets Weight=0	Illiquid Assets Weight = 1/2
Cash and cash equivalents from other banks Statutory reserves Government securities Other securities	Consumer/Retail loans Loans and advances to banks Residential loans Other earning assets Reverse repos and cash collateral	Corporate and commercial loans Other loans Fixed assets Goodwill Other intangibles Other assets Investment in property

Source: Author's own classifications

- Classifying assets other than loans

Assets other than loans, for example, fixed assets, investment in property, goodwill and other intangible assets are classified as illiquid, because usually these items cannot be sold quickly without incurring major losses. Cash and due from banks, government securities and other securities the bank can use to honour its liquidity needs quickly without suffering major losses are considered liquid assets. Repurchase agreements and other earning assets are classified as semi-liquid as they can be easily converted to cash at lesser cost and time than fixed assets, goodwill and investments in property. Table 3.1 above depicts the various classifications.

- Classifying Liabilities and equity

On the liability side, there are two broad categories: claims of banks, claims of other clients other than banks. Bank claims are readily obtainable and so, fall into the liquid liabilities category. Claims of the non-banking segment are of two classes. The first category includes the settlement accounts of clients (domestic and foreign firms, government, and households) like current deposits and savings deposits. These are classified as liquid because customers can easily withdraw these funds without high penalty. The second category includes term deposits which are classified as semi-liquid because it is less easy and is more costly to withdraw immediately without a penalty compared to current and savings deposits.

Other deposits and liabilities are grouped likewise. Short and long term deposits are not separated since all term deposits are borrowed against some penalty regardless of maturity. Liabilities that cannot be revoked easily are classified as illiquid.

- Classifying equity

Equity is categorised as illiquid because investors cannot easily demand their investment from the banks. Besides, its maturity is in the long-term. Although some banks are listed on the Ghana Stock Exchange and thus, their equity may be sold relatively easier, the investors are able to retrieve liquid funds through the capital market, not from the bank. Thus, while traded equity may be liquid from an individual investor's point of view, such liquidity is provided by the capital market, rather than the bank. Table 3.2 shows the various groupings.

Table 3.2 Classifying and weighting liabilities

Illiquid Liabilities Weight = -1/2	Semi-liquid liabilities Weight = 0	Liquid liabilities Weight = 1/2
Equity Other liabilities Long term funding Senior debt maturing after a year Deferred tax liabilities Reserves for pension Subordinated borrowing	Term deposits Other deposits and short term funding Other funding Deposits from banks Repos and cash collateral	Current deposits Savings deposits Short term borrowing Loan impairment reserves Repurchase agreement

Source: Author's own compilation

3.3.2 Step 2: Assigning weights to the activities classified in step 1

At this stage, weights are assigned to the classes of liquid, semi-liquid, and illiquid assets, liabilities plus equity, and off-balance sheet activities as shown in Tables 3.1 and 3.2. As in Berger and Bouwman (2009), weighting is done based on the Liquidity Creation Theory. According to this theory, liquidity is created on the balance sheet when banks finance illiquid assets with liquid liabilities. The idea is that banks honour the liquidity needs of the general public although they hold illiquid items.

Going by this theory, full liquidity is created when illiquid assets (e.g. commercial loans) are financed by liquid liabilities (e.g. current deposits) and maximum liquidity is destroyed when liquid assets (e.g. securities) are transformed into illiquid liabilities or equity. As such, illiquid assets and liquid liabilities (items that enhance liquidity creation) are given positive weights and because each category contributes equally towards liquidity creation, they are both weighted +1/2. Liquid assets and illiquid liabilities plus equity are assigned negative weights because they subtract from liquidity creation. Using the same logic, are weighted -1/2 each.

Put differently, positive weights are assigned to both illiquid assets and liquid liabilities such that when illiquid assets (such as corporate and commercial loans) are financed by liquid

liabilities (such as current deposits), liquidity is created. Following similar reasoning, negative weights are applied to liquid assets, illiquid liabilities, and equity, so that when illiquid liabilities or equity is used to finance liquid assets (such as government securities), liquidity is damaged. The intuition behind weighting semi-liquid assets and liabilities is that, because they fall in between $+1/2$ and $-1/2$, they are allocated zero weight.

Berger and Bouwman (2009) argue that the negative weight on equity only captures the direct effect capital has on liquidity creation. Any indirect (positive or negative) effects on liquidity creation are attributed to the individual items that are affected. For instance, if capital allows banks to extend more illiquid loans, this positive effect is captured by the positive weight applied to illiquid loans multiplied by the related increase in loans.

The magnitudes of the weights are based on simple cedi-for-cedi adding-up constraints, so that GHC1 of liquidity is created when banks finance GHC1 of illiquid assets with GHC1 of liquid liabilities. In the same way, when a bank finances GHC1 of liquid asset with a GHC1 of illiquid liability, liquidity is damaged. Based on these constraints, a weight of $1/2$ is allocated to both illiquid assets and liquid liabilities and a weight of $-1/2$ to both liquid assets and illiquid liabilities. Thus, when a cedi of liquid liabilities (such as current deposits) is used to fund a cedi of illiquid assets (such as commercial loans), liquidity created equals $1/2 * \text{GHC1} + 1/2 * \text{GHC1} = \text{GHC1}$, thus, creating maximum liquidity of GHC1.

Note that, both the source and use of funds are needed to create liquidity and so the amount of liquidity created is half determined by illiquid assets and liquid liabilities so that, the weight of $1/2$ applies to both illiquid assets and liquid liabilities. Similarly, when a cedi of illiquid liabilities or equity is used to finance a cedi of liquid assets (such as government securities), liquidity destroyed equals $-1/2 * \text{GHC1} + -1/2 * \text{GHC1} = -\text{GHC1}$, as maximum liquidity is destroyed.

Based on the notion that semi-liquid activities fall halfway between liquid and illiquid items and that, they approximately have neutral effect, the intermediate weight of 0 is assigned to semi-liquid assets and liabilities. This implies that the use of term deposits to fund consumer loans would produce zero net liquidity creation approximately. This is because, the ease, cost, and time with which term depositors may access their funds is roughly equivalent to the ease, cost, and time with which the bank can retrieve its funds from consumers. Off-balance sheet activities are weighted using the same principle.

In tables 3.1 and 3.2, Liquid assets, illiquid liabilities plus equity which are assigned a weight of $-1/2$, are grouped to the left. Activities that are assigned a weight of $1/2$ —illiquid assets, liquid liabilities, and illiquid off-balance sheet items are also on the right. Lastly, semi-liquid assets, liabilities with zero weights are grouped in the centre.

- Off-balance sheet activities

Berger and Bouwman (2009) also documented that, banks in U.S created almost half of their liquidity off-balance sheet through loan commitments and similar claims to liquid funds. This provides the reason why the researcher thought it prudent to include OBS items in measuring liquidity especially in Ghana where the banking industry's involvement in OBS transactions has been on the rise.

Data available on off-balance sheet activities are limited, hence cannot be classified as done above. Bankscope provides data on 'other off-balance sheet activities' for Ghanaian banks but no detailed report on activities like derivatives and guarantees. Thus, following Berger and Bouwman classification, these items are categorized as illiquid and weighted positive as these items are obligations that are illiquid from the point of view of the bank. As well, in most cases, banks cannot quickly sell these items.

3.3.3 Step 3: Constructing liquidity measure by combining step 1 and step 2

Here, the activities classified and weighted in steps 1 and 2 are combined to construct the liquidity creation measures. The measures differ in that, alternatively off-balance sheet items are included or excluded—to gauge how much liquidity banks create off-balance sheet. Hence, I have two measures: “LIQTA2,” and “LIQTA,” The formulae are shown in Table 3.3.

The weights of 1/2, -1/2, or 0, respectively, are multiplied for each measure by the cedi amounts of the corresponding bank activities and the weighted amounts are then added to attain the total value of liquidity created for an individual bank. Next, it is summed across all banks to obtain the total cedi value of liquidity created by the entire industry.

$$\text{GHC liquidity creation} = \Sigma (\text{weight} * \text{GHC activity})$$

Liquidity created by a bank is the summation of the weighted sum in each category

Table 3.3 Liquidity creation measures

Liquidity Created (Plus OBS) =	1/2*Illiquid assets 1/2*Liquid liabilities + off-balance sheet activities	+0*Semi-liquid assets +0*Semi-liquid liabilities	-1/2*liquid assets -1/2*Illiquid liabilities -1/2 Equity
Liquidity created=	1/2*Illiquid assets 1/2*Liquid liabilities	+0*Semi-liquid assets +0*Semi-liquid liabilities	-1/2*liquid assets -1/2*Illiquid liabilities -1/2 Equity

Source: Author’s own estimation

It is important to acknowledge that the liquidity creation measures are rough approximations. Differences in liquidity obviously exist within each of the three classifications of liquid, semi-liquid and illiquid. However, data limitations largely do not permit much finer distinctions, and there are no other unambiguous weights to apply. The use of 1/2, -1/2, and 0 represent clear-cut distinctions of full liquidity, full illiquidity, and neutrality, respectively, and no other clear choices present themselves (Berger and Bouwman, 2009).

The “LIQTA2” measure is preferred to the “LIQTA” measure because it includes off-balance sheet activities and these activities provide liquidity in functionally similar ways to on-balance sheet items. The dependent variable is the cedi amount of liquidity a bank generates calculated using the three-step procedure described above, relative to its total assets.

$$LIQTA2 = \frac{\text{Liquidity created (Plus OBS)}}{\text{Total Assets}}$$

$$LIQTA = \frac{\text{Liquidity created}}{\text{Total Assets}}$$

At this juncture, it is important to note that these measures capture illiquidity (liquidity risk) and therefore, are indirect measures of bank liquidity. The higher the ratio, the less liquid a bank is or put differently, the higher the liquidity risk.

3.4 Regression Framework

Next, I focus on the second objective of estimating the factors that explain liquidity levels of banks in Ghana, using a panel regression. Panel regression arises when we measure the same collection of objects overtime. In the words of Brooks (2008), ‘the situation often arises in financial modelling where we have data comprising both time series and cross-sectional elements, and such a dataset would be known as a panel of data or longitudinal data’. Panel data, also known as longitudinal data, embodies information across time and space. Importantly, a panel maintains the same entities and measures some quantity about them over time.

According to Gujarati (2004), panel data gives more informative data, variability, degrees of freedom, efficiency and less colinearity among variables by combining time series of cross-sectional observations. By studying the repeated cross section of observations, panel data are better suited for studying the dynamics of change.

First, and perhaps most importantly, Brooks (2008), posits that we can tackle a broader range of issues and handle more complex problems with panel data than would be possible with pure time-series or pure cross-sectional data alone.

Second, it enables us examine variables, the relationships between these variables and how it changes dynamically (over time). This is often difficult to do using pure time series data. By combining cross-sectional and time series data, one can increase the number of degrees of freedom, and thus the power of the test, by employing information on the dynamic behaviour of a large number of entities at the same time. Conversely, one requires a long run of data simply to get a sufficient number of observations to be able to conduct any meaningful hypothesis tests with only cross-sectional or time series data. The additional variation introduced by combining data in this way can also help to mitigate problems of multicollinearity that may arise if time series are modelled individually.

Third, by structuring the model in an appropriate way, we can remove the impact of certain forms of omitted variables bias in regression results. Panel data can better detect and measure effects that simply cannot be observed in pure cross-section or pure time series data and thus enrich empirical analysis in ways that may not be possible if only cross-section or time series data is used. Since panel data relates to entities over time, heterogeneity among entities is inevitable. That is, the same relationship may not hold for all the data. However, panel regression technique allows for individual-specific variables.

The panel used here is an unbalanced panel. Let us distinguish between a balanced and unbalanced panel. An unbalanced panel would have some cross-sectional elements with fewer observations or observations at different times to others whereas a balanced panel has the same number of time-series observations for each cross-sectional unit (or equivalently but viewed the other way around, the same number of cross-sectional units at each point in time). (Brooks, 2008).

3.5 Justification for Including Independent Variables

The explanatory variables included in the model are capital adequacy ratio, share of loans to total assets ratio, interest rate margin, bank size, concentration, growth in GDP, inflation and money supply growth.

3.5.1 3.5.1 Bank-Specific Variables

Capital adequacy ratio (CAR): Measured by the ratio of equity to total assets is expected to have either a positive or negative relation with liquidity. Recent theories in the literature provide contradictory predictions on the effect of bank capital on its liquidity creation. One strand of literature argues that bank capital increases bank liquidity through its ability to absorb risk. Under the “risk absorption” hypothesis, higher capital increases the ability of banks to create liquidity. Diamond and Dybvig (1983) and Allen and Gale (2004) for example argue that liquidity creation exposes banks to risk. The more liquidity that is created, the greater is the probability of losses associated with having to dispose of illiquid assets to meet the liquidity demands of customers.

Additionally, Bhattacharya and Thakor (1993) and Coval and Thakor (2005) accentuate the fact that bank capital absorbs risk and increases banks’ risk-bearing capacity. Based on this argument, higher capital ratios may allow banks to create more liquidity. Other theories like Diamond and Rajan (2000) predict that bank capital reduces bank liquidity creation. Gorton and Winton (2000) also show that capital requirements may have an important social cost because they reduce the ability of banks to create liquidity. They show that capital ratio might reduce liquidity creation through the crowding out of deposits. Skander and Heuvel (2007) argue that since capital requirements limit the fraction of bank assets that can be financed by issuing deposit-type liabilities, capital requirement regulation imposes important cost because it reduces the ability of banks to create liquidity by accepting deposits.

Net Interest Margin (NIM): This measures the opportunity cost of holding liquid assets as there is a trade-off between liquidity and profitability. NIM measures the gap between what the bank pays savers and what the bank receives from debtors. Thus, according to Shen, Chen, kao and Yeh (2009), NIM focuses on the traditional borrowing and lending operations of the bank. It is expected to be negatively related to bank liquidity because higher NIM will convince banks to give out more loans and hold less liquid funds. NIM is the difference between interest income generated (by banks) from loans and interest expense paid out to depositors, relative to average earning assets.

Bank size (SIZE): SIZE is measured by the natural log of total assets. Size is included due to the “too big to fail” position of large banks which could lead to excessive risk exposure. In addition, it captures the impact of complexity in large institutions that is likely to impact bank liquidity. The log of total assets is considered a proxy of bank size. Findings are mixed as to the relationship between bank size and liquidity. For example, Lyroudi and Bolek (2012) found the relationship to be negative whereas Lucchetta (2007) found a positive relationship. To control for bank size, we include the natural log of bank size. The natural log is used for all continuous exogenous variables that may take on large values to avoid potential specification distortions.

Share of loans to total assets (LOTA): This is a measure of risk-taking behaviour of banks, where it is expected that liquid banks have more averse risk-taking behaviour. As banks increase their risk taking behaviour, liquidity levels also fall. Thus, the expected co-efficient sign is negative.

3.5.2 Industry-specific variable

Concentration (CONC): This is measured using the Herfindal-Hirschman Index (total assets). It is conjectured that as concentration deepens, hence, competition falling, banks will create more

liquidity in trying to maintain their market share by giving out more loans and ‘fighting’ for more deposits. A negative sign is thus expected between liquidity and concentration.

3.5.3 Macroeconomic variables

The existing empirical literature about liquidity creation outlines the relevance of macroeconomic indicators concomitantly to microeconomic indicators (Rauch et al., 2008; Pana et al., 2009; Chen et al., 2010). Indeed, macroeconomic context is likely to impact bank activities and investment decisions.

Money and quasi money growth rate (GMON): Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2. Change in money supply is measured as the difference in end-of-year totals relative to the level of M2 in the preceding year. A positive association is envisaged between the dependent variable and this independent variable as increase in money supply expands the available cash for banks to create more liquidity, thereby raising liquidity risk of these banks and diminishing liquidity.

Growth in GDP (GGDP): GDP is the total value of final goods and services produced in the country for a given period. As an indicator of business cycle, it measures the total economic activity in the economy. GGDP is expected to be either positively related or negatively related to bank liquidity. A rise in GDP signals growth in the economy and tends to translate as an increase in productivity.

Inflation (INFL): Annual average Inflation as measured by the Consumer Price Index, CPI, tells us the changes overtime, in the general price level of goods and services that household acquire for the purpose of consumption, with 2002 as the reference base year. Previous

research works like Bunda and Desquilbet (2008), documented a positive relationship between inflation and liquidity. Inflation reflects changes in the consumer price index and increases in cost of living. As cost of living increases, consumers would need more money to enjoy the same level of consumption. This forces them to borrow more, decreasing liquidity of banks. Inflation also reduces the value of liquid funds lent out to the public by banks. The expected coefficient sign is positive with liquidity.

3.6 Panel Estimator Approach

There are broadly two classes of panel estimator approaches that can be employed in financial research: fixed effects models and random effects models. In literature, the fixed effects (FE) model is a statistical model that represents the observed quantities in terms of explanatory variables that are treated as if the quantities were non-random. The fixed effects model allows the partial regression coefficients to be common across cross-sectional units, but the intercepts in the regression model are taken to be distinct among individual banks.

The simplest types of fixed effects models allow the intercept in the regression model to differ cross-sectionally but not over time, while all of the slope estimates are fixed both cross-sectionally and over time. This model centres on the assumption that, the individual specific effect is correlated with the independent variables. Gujarati (2004) makes the assumption that the intercept and slope coefficients are constant (time invariant) across time and space and the error term captures differences over time and individuals.

On the other hand, the random effects model (RE), also known as the Error Components Model, assumes a common mean value for the intercepts and the cross-sectional differences in the intercept values of each bank are reflected in the error term. The random effects assumption (made in a random effects model) is that the individual specific effects are uncorrelated with the independent variables.

The question then is when is it appropriate to use the FE or the RE? According to Brooks (2008), it is often said that the random effects model is more appropriate when the entities in the sample can be thought of as having been randomly selected from the population, but a fixed effect model is more plausible when the entities in the sample effectively constitute the entire population (for instance, when the sample comprises all the banks in a particular country).

He adds that, more technically, the transformation involved in the GLS procedure under the random effects approach will not remove the explanatory variables that do not vary over time, and hence their impact on Y_{it} can be enumerated. Also, since there are fewer parameters to be estimated with the random effects model (no dummy variables or within transformation to perform) and therefore degrees of freedom are saved, the random effects model should produce more efficient estimation than the fixed effects approach.

However, the random effects approach has a major drawback which arises from the fact that it is valid only when the composite error term ε_{it} is uncorrelated with all of the explanatory variables. This assumption is more stringent than the corresponding one in the fixed effects case, because with random effects we thus require both i and Y_{it} to be independent of all X_{it} . This can also be viewed as a consideration of whether any unobserved omitted variables (that were allowed for by having different intercepts for each entity) are uncorrelated with the included explanatory variables. If they are uncorrelated, a random effects approach can be used; otherwise the fixed effects model is preferable. (Brooks, 2008).

With this basic difference between the two approaches in mind, Gujarati (2004) make these helpful observations in choosing between the two:

1. If T (the number of time series data) is large and N (the number of cross-sectional units) is small, there is likely to be little difference in the values of the parameters

estimated by FE and the RE. Hence the choice here is based on computational convenience. On this score, FE may be appropriate.

2. When N is large and T is small, the estimates obtained by the two methods can differ significantly. With the RE, $B_{it} = \beta_1 + \varepsilon_i$ where; ε_i is the cross-sectional random component, whereas in FE, it is treated as fixed and not random. In the latter case, statistical inference is conditional on the observed cross-sectional units in the sample and this is appropriate if it is believed strongly that the individual, or cross-sectional, units in the sample are not random drawings from a larger sample, making the FE more preferable in this case. However, if the cross-sectional units in the sample are regarded as random drawings, then RE is appropriate, for in that case statistical inference is unconditional.

Thus, the choice between the FE and the RE centres on the assumption one makes about the likely correlation between the individual, or cross-section specific, error component ε_i and the X-regressors. If it is assumed that ε_i and the X's are uncorrelated, RE may be appropriate, whereas if ε_i and the X's are correlated, FE is suitable.

Subsequently, the choice of either the fixed effects model or the random effects model is based on the Hausman test. (Baltagi, 2001). The Hausman test determines whether the estimates of the coefficients, taken as a group, are significantly different from the two regressions (fixed effects and random effects). In simple terms, the null hypothesis in the Hausman tests is that the preferred model is random effects as opposed to the alternative which says the preferred model is the fixed effect.

3.7 Model Specification

The standard linear specification for a panel regression model is econometrically specified as:

$$L_{it} = \beta X_{it} + \mu_{it}$$

Where:

L_{it} is the dependent(endogenous) variable, with $i=1 \dots N$ (number of observations) and $t=1 \dots T$ (time periods),

X_{it} is a vector of explanatory variables for bank i at time t ,

β ' are the coefficients which represent the slope of variables

To ascertain the factors that explain liquidity of universal banks in Ghana, the Random Effects panel regression analysis is used. For each liquidity indicator, the following model is estimated:

$$L_{it} = \beta_1 CAR_{it} + \beta_2 NIM_{it} + \beta_3 SIZE_{it} + \beta_4 LOTA_{it} + \beta_5 CONC_t + \beta_6 GMON_t + \beta_7 INFL_t + GGDP_t + \gamma_i + \lambda_t + \varepsilon_{it}$$

Where:

L_{it} is one of the liquidity ratio for bank i at time t

β_i is the parameter of independent variables to be estimated

γ_i represents the unobserved individual effect that varies across banks but not over time,

λ_t is the time-varying effect

ε_{it} is the error term.

Table 3.4 provides the definition of variables, their measurements, expected coefficient signs and source of data. It is apparent that the most important task is to choose the appropriate explanatory variables. The selection of variables was based on previous relevant studies. Particular variables that apply to the Ghanaian context were selected.

Table 3.4: Independent variables, their measurements, expected coefficient signs and so data source.

Variable	Measurement	Expected sign with liquidity risk	Source
CAR Capital adequacy ratio	Ratio of equity to total assets	+/-	Bankscope
NIM Net Interest Margin	Interest income - Interest expense/Average Earning assets	-	Bankscope
SIZE Bank size	Natural logarithm of total assets	+/-	Bankscope
LOTA Loans to total Assets ratio	Ratio of Loans to total Assets	+	Bankscope
CONC Concentration	Herfindal-Hirschman Index (total assets)	+	Bank of Ghana
GMON Money supply	Annual growth in money and quasi money	+	World Development Indicators
INFL Inflation	Annual percentage change in Consumer Price Index	-	World Development Indicators
GGDP Growth in Gross Domestic Product	Annual growth rate of GDP	+/-	World Development Indicators

3.8 Multicollinearity

Multicollinearity occurs when variables in a model are correlated with each other. It can be detected in various ways. It can be detected by comparing the sign of explanatory variables obtained from the model with prior expectation. It is possible that multicollinearity problem is present in a model if the expected sign for an independent variable is inconsistent with theory or prior expectation. Another way to go about the detection is to examine the correlation matrix. If the researcher finds that there is any correlation between two variables of more than 70%, the existence of multicollinearity problem is likely.

Again, when a model has a high R-squared but with only few or no significant independent variables found to have effects on the dependent variable, it is likely that there are multicollinear variables in the model.

The Variance Inflation Factor (VIF) will be used to detect the seriousness of multicollinearity. VIF is undefined if R^2 is equal to 1. It indicates that, there is perfect multicollinearity between two independent variables. There is serious multicollinearity if VIF is equal to or more than 10 whereas there is no serious multicollinearity if VIF is less than 10 or equal to 1. There is no multicollinearity if R^2 is equal to 0. Variables with VIF of 10 or more will hence, be dropped.

3.9 Heteroscedasticity

Heteroscedasticity occurs when the variance of the error term is not constant across a number of observations. It is essential to ensure that the model is free from heteroscedasticity to obtain a precise and interpretable result. A hypothesis test is carried out using Stata 13 software and observing the p- value that is obtained to detect the heteroscedasticity problem.

H_0 : Error term has constant variance (homoscedasticity)

H_1 : Error term has no constant variance

Decision Rule: Reject H_0 if p-value is less than 5% significance level. Otherwise, do not reject H_0 .

3.10 Conclusions

This chapter presented the detailed methodology used to construct two liquidity measures. Next, a panel data on banks in Ghana from various data sources is used to achieve the objectives of estimating the factors that explain the high liquidity of banks in Ghana. This estimation is done using a Random-Effects model.

Bank – level data is used to estimate equations relating liquidity risk to capital adequacy ratio, net interest margin, bank size and ratio of loans to total assets and competition whiles controlling for some crucial macroeconomic variables. Our unbalanced panel is constructed from data on 22 banks over the period of 2007 to 2013. The Stata 13.0 Statistical Package was used for all the estimations.

CHAPTER FOUR

ESTIMATION OF RESULTS

4.1 Discussion on Descriptive Statistics – Explaining Liquidity

Table 4.1: Descriptive statistics of variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
LIQTA2	125	0.2048	0.4024	-0.9225	0.8947
LIQTA	126	0.1489	0.3977	-0.9250	0.9446
CAR	116	0.1557	0.1322	0.0089	0.9622
NIM	137	0.0985	0.0304	0.03090	0.1841
SIZE	140	20.1619	1.0515	16.1636	22.4715
LOTA	114	0.4220	0.1367	0.0301	0.6588
CONC	154	0.6984	.0836	0.6069	0.8236
GMON	154	0.3017	0.0670	0.1950	0.3920
INFL	154	0.1239	0.0369	0.0870	0.1930
GGDP	154	0.0833	0.0311	0.0400	0.1500

Table 4.1 reports the mean and standard deviation of all the variables explaining liquidity over the period of study. It also reports the minimum and maximum score of the dependent and independent variables. The mean score for the ratio of liquidity created to total assets (with OBS) as the first measure of liquidity is 0.2048 with minimum and maximum values of -0.9225 and 0.8947 respectively. A standard deviation of 0.4024 accounted for the variation between the minimum and maximum values mentioned earlier. These figures suggest that banks created not much liquidity both on and off-balance sheet (20.48%) and thus, held on average, about 80% of their total assets as liquid funds during the period under study.

The second dependent variable which excludes off-balance sheet items, as an alternative indicator of liquidity risk also shows that a mean value of 0.1489 for liquidity created and hence 83.7% of banks' total assets are liquid. The minimum and maximum score of -92.50%

and 94.46% show that while some banks created liquidity almost 100% of their total assets, hence highly illiquid, others held liquidity of about 93% of their total assets. Generally, liquidity risk of the industry is on the low side.

The Capital Adequacy ratio (CAR), registered an average of 15.57% which is above the prudential and statutory requirement of 10%. This means, equity represents 15.57% of the total assets of banks. CAR showed a standard deviation of 13.22%, minimum of zero and a maximum of 96.22%. Some banks have as much as 96.22% share for equity out of their total assets while others have less than 1% equity out of their total assets. This tells us that banks in Ghana hold adequate capital.

An average Net Interest Margin of 9.85% was recorded for banks with a variation of 3.04% and a minimum and maximum of 3.09% and 18.41% respectively. This illustrates that, averagely, banks made 9.85% of their earning assets as net interest income during the period of study. While some banks gained as little as 3.04% net interest income from their earning assets, others made six times more than that amount.

The size of banks (SIZE), measured by the natural logarithm of banks' total assets registers an average score of 20.16 with a variation shown by the standard deviation as 1.0515 and a minimum and a maximum score of 16.16 and 22.47 respectively.

The ratio of loans to total assets, as a measure of risk taking behaviour of banks shows a variation of 3.04%, depicts a mean of 42.20%, minimum of 3.01% and a maximum of 65.88%. The mean value tells that on average, Ghanaian banks do not have high risk appetite and thus, their risk taking behaviour is low. Some banks gave as low as 3% of their total assets as loans whereas the highest risk taking bank gave out about 66% of total assets as loans.

Again evidence is given of high concentration (less competition) in the banking industry with an average of 69.84% concentration within a range of 60.69% and 82.36% and variation of

13.67%. This implies that the top 5 banks in the industry hold an average of 69.84% of the total assets of the banking sector. Nevertheless, banking concentration has gradually weakened over time with the influx of new banks into the Ghanaian financial system. This means, competition has gradually picked up.

Furthermore, growth in money supply between 2007 and 2013 is at an average of 30.17%, minimum of 19.50%, and maximum of 39.20 and a standard deviation of 6.7%. The figures suggest that growth in money supply is on the increase. Within a space of seven years, the least annual growth is pegged at almost 20% and the highest at 39%.

GDP annual growth rate showed an average of 8.33%, minimum of 4% and a maximum of 15% with a standard deviation of 3.11%. The Ghanaian economy is not doing so well as the figures clearly show. An average annual GDP growth rate of 8.33% for a seven-year period does not the best.

Annual average inflation rate (INFL), recorded an average of 12.39% with a minimum and maximum score of 8.7% and 19.3% respectively within the period of study. Variation was 3.69% for INFL.

4.2 Liquidity Created by the Ghanaian banking industry from 2007-2013

Generally, liquidity created (illiquidity) of the Ghanaian banking industry has declined over the period. This means that vulnerability of banks with regards to liquidity risk has subsided. Liquidity risk increased from GHC4.57 billion in 2007 to GHC5.42 billion in 2008 probably because of the global financial crisis that started in 2007. In 2009, liquidity risk fell sharply to GHC 3.33 billion. It increased slightly in 2010 and 2011 and by 2012, had reached GHC 4.83 billion. In 2013, there was a sharp decline in liquidity created by banks such that liquidity was destroyed up to nearly 3 billion Ghana Cedis. That is, in 2013, illiquidity was negative, meaning liquidity risk fell drastically, implying that banks were highly liquid in that year. The

likely explanation is that by 2013, most banks had met the central bank's directive which required banks to increase their stated capital.

Table 4.2: Liquidity created by the Ghanaian banking industry from 2007-2013

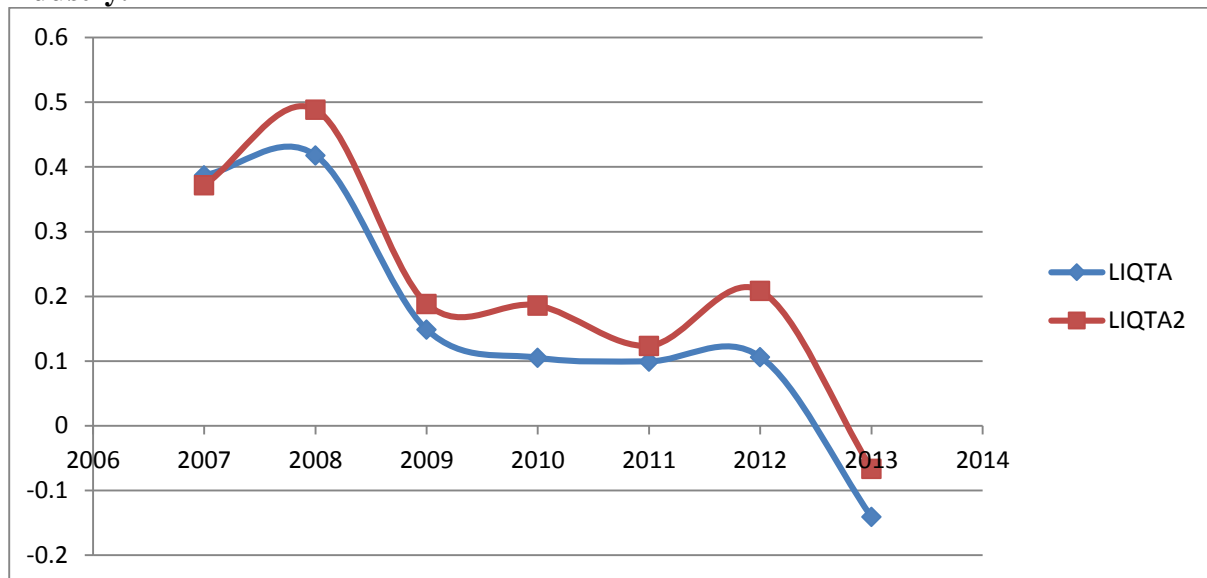
YEAR	LIQUIDITY CREATED (Millions of GHC)	LIQUIDITY CREATED/TOTAL ASSETS RATIO (%)
2007	4572	38.71
2008	5419.5	41.79
2009	3329.5	14.87
2010	3562.5	10.52
2011	3910.5	9.97
2012	4829	10.65
2013	-2994	-14.06
TOTAL	22,629	

Source: Author's estimations

In the graph below, the red line depicts the ratio of liquidity created to total assets (including OBS items) while the blue line excludes OBS items. The graph shows that, between 2007 and 2008, banks increased the amount of liquidity created out of their total assets, while reducing the amount of liquidity they held. Thus, liquidity risk increased. It is hypothesized that the Global Financial Crisis that started in 2007 led to the increase in liquidity risk.

Then, from 2008, illiquidity of banks in Ghana began to fall and kept falling until 2009. It continued to fall in the early months of 2010 but rose again with the liquidity indicator that incorporates off-balance sheet items until 2010. However, with the measure that excludes OBS items, illiquidity or liquidity risk of banks fell from 2009 until mid-2009 when it became stable, up until the end of 2010. Between 2009 and 2010, OBS activities increased illiquidity of banks in Ghana. This shows that indeed, OBS activities do affect liquidity levels of banks.

Figure 1: Line graph showing trend of liquidity created/Total assets by the banking industry.



From 2010, liquidity risk began to fall using our first liquidity indicator until the end of 2011, while it remained stable when we rule out OBS items. In 2011, liquidity risk again began to rise, continued rising, till it reached its peak in 2012 using our first measure. With the second measure, illiquidity again rose but not as sharp as the first measure. It reached its peak late 2011 and again started dropping.

From 2012, liquidity risk fell until the end of 2013. The central bank directive requiring all banks to increase their stated capital from GHC7mn in 2008 to GHC60mn by the end of 2012 is likely to have been the reason for the decline in liquidity risk especially in 2013 when most of the banks had met the requirement.

In total, banks created twenty-two point six billion Ghana Cedis worth of liquidity, including off balance sheet activities between 2007 and 2013 and sixteen point three billion Ghana Cedis when OBS activities are ignored. This reflects a 28% representation of OBS activities.

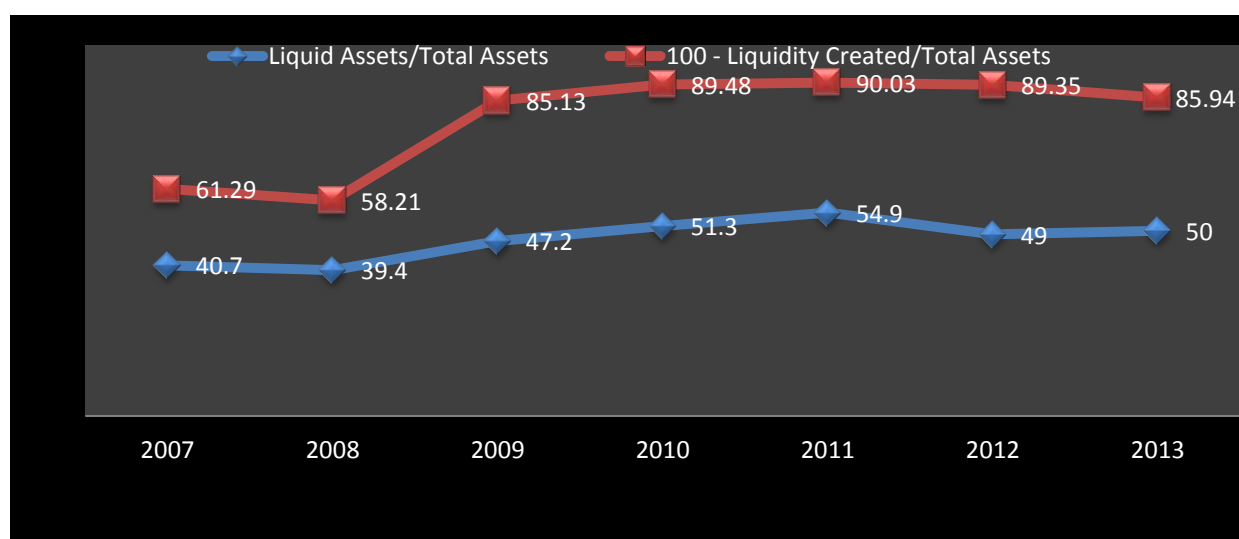
Table 4.3: Comparing the ratio of liquid assets to total assets to the more comprehensive indicator constructed.

Year	Liquid Assets/Total Assets (%)	100-Liquidity Created/Total Assets (%)
2007	40.7	61.29
2008	39.4	58.21
2009	47.2	85.13
2010	51.3	89.48
2011	54.9	90.03
2012	49.0	89.35
2013	50	85.94
Average	47.57	79.57
Average % difference = 32%		

Source: BoG and author's estimates

Although not the focus of the study, it will be interesting to compare to the measure used by the Central Bank (ratio of liquid assets to total assets) and the more comprehensive ratio adopted in this study for robustness tests. Both measures portray Ghanaian banks as liquid. However, our more comprehensive measure depicts a more liquid banking industry by about 32% average more.

Figure 2: Liquidity measured by liquid assets to total assets ratio and the liquidity creation measure



This figure shows liquidity as measured by the two ratios. It is clear that our liquidity indicator is higher than the official BoG measure, telling us that the banking industry is more liquid than reported if we consider a more comprehensive measure. Because the liquidity creation measure constructed captures illiquidity, we subtract illiquidity from 100% to arrive at liquidity.

4.2 Correlation Matrix

Appendix 1 presents the correlation matrix for all the variables integrated into the models. The correlation coefficients and their signs provide an indication of the direction and the extent or degree of the relationship between two variables without implying causality.

Correlation matrix is beneficial, in that, it reveals the presence of multicollinearity in the model. Multicollinearity arises where some or all the independent variables are highly correlated. This makes it unclear as to which of these multicollinear variables actually has some bearing on the dependent variable. An instance where all p-values of regression coefficients are insignificant but the F-statistics is significant shows severity of multicollinearity.

The Pearson's Product Moment of Correlation showed huge value of coefficients between LIQTA2 and LIQTA, but this is expected. Moreover, both are never used at the same time in the same regression model. Apart from these, all other coefficients fall within the tolerance level (the Variance Inflation Factor). Even though there is a correlation between GDP and INFL, it is not too strong as to cause multicollinearity. Thus, none of the variables is dropped after the VIF test. (See Appendix II for VIF test).

4.3 Hausman Test

Going on, the Hausman Specification Test shown in Appendix III is conducted, where we failed to reject the null hypothesis of random effects, hence The Random Effects Model was best suited.

H₀: Random effect model is better than fixed effect model

H_a: Fixed effect model is better than random effect model

Decision Rule: Reject H₀ if p-value is less than significance level. Otherwise, do not reject H₀.

Decision: Do not reject H₀ since the p-value is higher than the significance level of 0.05 (5%).

Conclusion: There is sufficient evidence to conclude that the Random Effects Model is better suited than the Fixed Effects model.

However, autocorrelation and heteroscedasticity were present after running tests of autocorrelation and heteroscedasticity. (See Appendix IV and V). A plot of the residuals showed that the residuals follow a pattern which means that the errors are correlated. This is not what we expect. It is expected that, the plots are scattered so that we cannot trace a pattern through them. In the Breusch Pagan test for heteroscedasticity, the null hypothesis of constant variance was rejected since the P-value was less than the 5% significance level

To correct these two problems identified, the Prais-Winsten Regression model was adopted. This regression model corrects problems of heteroscedasticity and autocorrelation and does not consider lags. This method uses the Generalized Least-Squares method to estimate the parameters in a linear regression model in which the errors are serially correlated.

4.4 Regression Results-Factors Explaining Liquidity

Table 4.4 presents the regression results for factors explaining liquidity using LIQTA2 (OBS inclusive) as the measure for liquidity. An adjusted R² of 52.36% provides how well the independent variables explain the variations in liquidity of banks in Ghana, while a significant Wald Chi² (8) of 63.14 shows the overall fitness of the model.

All bank-specific variables, including capital, net interest margin, size and the ratio of loans to total assets have a significant relationship with liquidity risk. CAR shows a negative relationship with liquidity risk, consistent with the literature. This means that as capital

increases, liquidity risk falls, thus, banks become more liquid. This backs the “financial fragility crowding-out” hypothesis which predicts that higher capital reduces liquidity creation (liquidity risk) and supports the findings of Diamond and Rajan (2000), Al-Khourri (2012) and Vodova (2013). While this theory applies to banks of all sizes, Berger and Bouwman (2009) argue that they are most applicable to small banks.

NIM also shows a positive significant relationship with liquidity risk. This implies that as banks make more interest income from their earning assets, they create more liquidity by giving out more loans to the public and consequently, hold less liquid funds which increase vulnerability to liquidity risk. This is consistent with the findings of Vodova (2013). Overall, net interest margin reduces bank liquidity.

Table 4.4: Factors explaining Liquidity using liquidity creation measure (with OBS) as dependent variable

LIQTA2	Exp. Sign	Coefficient	Std. Error	z	P-Value
CAR	+/-	-2.5517***	0.6230	-4.1000	0.0000
NIM	+	2.4578*	1.3703	1.7900	0.0703
SIZE	+/-	-0.0363*	0.0193	-1.8800	0.0600
LOTA	+	-0.3493**	0.1782	-1.9600	0.0500
CONC	+	2.2923*	0.8398	2.7300	0.0060
GMON	+	-1.4995	1.1606	-1.2900	0.1960
INFL	-	-1.4792*	0.8350	-1.7700	0.0760
GGDP	+/-	3.3413*	1.7414	1.9200	0.0550
Adj. R-squared =		0.5236	Wald chi2 (8) =		63.14
Prob > chi2 =		0.0000			

NB: * ** *** means significant at 10%, 5% and 1% respectively

The negative and significant association size has with liquidity risk indicates that banks that are bigger in size, are disincentivized to create more liquidity than smaller banks, hence are more

liquid. This finding does not concur with Bunda and Desquilbet (2008) and Cucinelli (2013) that as banks grow in size, their exposure to liquidity risk increases. Nonetheless, it agrees with the view held by Angora and Roulet (2011) that, liquidity creation (illiquidity) is negatively linked to size. This may be due to the fact that larger banks need less liquidity in the long time horizon.

The ratio of loans to total assets is significant and negative suggesting that as banks' risk-taking behaviour increases, banks create less liquidity, thereby holding on to more liquid funds. That is to say that, as general risk level increases, banks raise their liquidity levels to commensurate the increased levels of risks taken so that exposure to liquidity risk reduces.

The only industry-specific variable in the regression is also significant and positive. This proves that concentration is also paramount in explaining liquidity of banks in Ghana. As concentration in the banking sector increases (and competition lessens) liquidity creation also increases, thus, shrinking the liquid funds of banks. Put differently, higher concentration reduces liquidity of banks in Ghana.

This contrasts the results of Hovarth et al., (2014), who find that competition destroys liquidity creation, thus, increasing available amount of liquidity held. Documented hypothesis in literature argues that high market concentration causes less competition between banks, which leads, consequently to higher profitability. This hypothesis referred in the literature as the 'Structure Conduct Performance hypotheses'. (Gilbert, 1984).

Growth in money supply is negative but insignificant in explaining liquidity of banks. As money supply grows, banks create less liquidity (liquidity risk falls). This does not conform to our expectation. The likely explanation is that increased money supply reduces demand for loan, thereby reducing liquidity creation.

GDP growth rate is also positive and has a significant relationship with illiquidity. This means, as the economy booms and is doing well, banks create more liquidity and are thus, less liquid. A flourishing economy entices banks to lend out monies which are more profitable than holding cash. The idea is that if the economy is booming borrowers are more probable to pay back the principal and interest accrued on their loans.

Annual inflation rate also shows a negative significant relationship with liquidity created by banks. This infers that as general price levels increase, liquidity created falls, so that banks tend to hold large amounts of liquid funds. The probable explanation to this could be that during periods of rising inflation, banks hoard liquidity to ensure they do not lose the real value of the monies lent out.

4.5 Robustness Tests

To test the robustness of the results, I again measure liquidity using the ratio constructed but this time, excluding off-balance sheet activities. Additionally, the official Bank of Ghana liquidity indicator, which is the ratio of liquid assets to total assets, is also employed to establish the factors that explain liquidity of banks in Ghana.

4.5.1 Regression results - explaining liquidity using liquidity measure without OBS as dependent variable

Table 4.5 presents the regression results of the factors explaining liquidity using LIQTA (without OBS) as the measure for liquidity. An adjusted R^2 of 39.64% provides how well the explanatory variables explain the variations in liquidity of banks in Ghana, while the Wald Chi2 (8) of 55.54% shows the overall fitness of the model. Only bank-specific variables are significant in explaining liquidity if we exclude off-balance sheet items. These are capital and bank size and both are negatively related to liquidity risk, consistent with the first measure. This suggests that a key driver of bank liquidity in Ghana is capital and that as capital

increases, the liquidity banks create lessens, denoting a rise in the amount of liquidity held by banks. This means capital and liquidity are positively related for banks in Ghana. This measure therefore, supports the ‘financial fragility crowding-out effect’.

Table 4.5: Regression results Factors explaining Liquidity using liquidity measure without OBS items.

LIQTA	Exp. Sign	Coefficient	Std. Error	z	P-Value
CAR	+/-	-1.0487*	0.3860	-2.7200	0.0070
NIM	+	-1.1721	0.9060	-1.2900	0.1960
SIZE	+/-	-0.0280*	0.0163	-1.7100	0.0870
LOTA	+	0.0441	0.1477	0.3000	0.7650
CONC	+	0.9828	0.6824	1.4400	0.1500
GMON	+	0.6034	0.9334	0.6500	0.5180
INFL	-	-0.0957	0.7022	-0.1400	0.8920
GGDP	+/-	0.9659	1.3930	0.6900	0.4880
R-squared	=	0.4803	Wald chi2 (8)	=	55.54
Adj. R-Squared	=	0.3964	Prob. Chi2 >		0.0000

NB: * ** *** means significant at 10%, 5% and 1% level of significance respectively

The negative relationship bank size has with liquidity risk provides proof that large banks create less liquidity, hence are more liquid than smaller banks. Net Interest Margin and the ratio of loans to total loans also show a negative and positive relationship with liquidity created. However, both are insignificant in explaining bank liquidity. This is in sharp contrast to the first measure.

Competition, the only industry-level variable is also statistically insignificant but positive. As concentration gets stronger, banks tend to create more liquidity to be able to maintain existing customers and attract new ones, while maintaining or increasing their market share in the

industry. This widens exposure to liquidity risk. These findings also concur with the measure that includes off-balance sheet items.

Using this measure, all the macroeconomic variables chosen for the analysis are insignificant. All, but inflation is positive. This supports the explanation that, growth in money supply, GDP growth rate and average annual inflation do not influence liquidity risk. As GDP growth rate and growth in money supply increases, liquidity creation rises, dwindling liquidity. On the other hand, liquidity levels escalate with increased annual average inflation as banks reduce the amount of liquidity they generate. Banks would not want inflation to devalue the amounts of liquidity they give out to the public and so will rather hold their cash. These results are not in accordance to the initial results which presents a positive relationship for only GDP.

4.5.2 Regression results - explaining bank liquidity using ratio of liquid assets to total assets.

Capital, size, concentration and bank risk taking behaviour are significant using this measure. Nonetheless, the coefficient signs are the same as that of our measure. Given that capital, size, concentration and bank risk-taking behaviour are significant for both measures, it can be said with some degree of confidence that these four variables mostly explain why banks in Ghana have remained highly liquid.

One might argue that the regression model that employs the ratio of liquid assets to total assets has a higher Adjusted R-Squared (68.01%) than the model that utilizes the measure constructed in this study (52.36%). However, the overall fitness of the model that uses the more comprehensive liquidity measure constructed is higher (63.14%) compared to that of the ratio of liquid assets to total assets (21.73%).

Table 4.6: Results- Explaining bank liquidity using Ratio of liquid Assets to total Assets.

LATA	Coefficient	Std. Error	z	P-Value
CAR	-0.3390**	0.1508	-2.2500	0.0280
NIM	-0.3407	0.5714	-0.6000	0.5530
SIZE	0.0541***	0.0104	5.1900	0.0000
LOTA	0.1720*	0.0896	1.9200	0.0590
CONC	-1.1034***	0.4238	-2.6000	0.0110
GMON	0.8928	0.5827	1.5300	0.1300
GGDP	-1.1468	0.8474	-1.3500	0.1800
INFL	0.2860	0.3922	0.7300	0.4680
R-squared = 0.7129				
Adj. R-squared = 0.6801			Wald Chi (8) = 21.73	

NB: * ** *** means significant at 10%, 5% and 1% level of significance respectively

4.6 Conclusion

The more comprehensive liquidity measure constructed in this study confirmed that, generally Ghanaian banks are highly liquid. However, the results show that liquidity levels are higher than global average, using the ratio of liquid reserves to banks' total assets.

Again, the random effects regression results revealed that, using the ratio of liquidity created (plus OBS items) to total assets, Net Interest Margin and concentration have a negative and a statistically significant relationship with liquidity while capital, bank size, loans to total asset ratio and annual inflations and GDP growth rate show a positively significant relationship with liquidity of banks. Growth in money supply is insignificant but show positive relationship with liquidity.

With respect to the liquidity creation measure that excludes off-balance sheet activities, only Capital Adequacy ratio and bank size are statistically significant. These two variables are also

negative, implying that, increases in capital and size makes bank less illiquid. Although insignificant, loans to total assets ratio, industry concentration, growth in money supply and GDP growth rate are negatively related to liquidity while Net Interest Margin and annual inflation have positive relationship with liquidity, hence improve liquidity.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Maintaining adequate levels of liquidity is imperative for banks in ensuring their ability to meet the financial demands of depositors and borrowers. It is also essential for financial stability of the banking industry, vibrant interbank markets and the economy at large. Nonetheless, holding excess liquidity can hinder growth of economies. This is because, holding liquid assets in excess may be costly in terms of foregone financial intermediation and hence, lesser net interest margins which could be interpreted as inefficiency. It is therefore important that at any point in time, banks hold appropriate levels of liquid assets while ensuring that they reduce the opportunity cost associated with hoarding liquidity as much as possible.

Liquidity of the Ghanaian banking industry has for about a decade now continued to remain above the average level globally. It is in light of this and the ramifications holding liquidity in excess could have on the industry and the economy at large that this study sought to find explanations for the current trend.

In attaining this objective, I argued that a more complete measure of liquidity ensure banks assess and manage their liquidity levels better than the traditional measures do. This study therefore, sought to achieve two main objectives; construct a more comprehensive liquidity measure following Berger and Bouwman (2009) and use this measure to ascertain the factors that explain the high liquidity levels of banks in Ghana. The study employed data for 22 banks for a seven-year period spanning 2007-2013 with 154 bank-year observation.

The random effects regression results disclose that when off-balance sheet items are included in measuring liquidity of Ghanaian banks, net interest margin, concentration and growth rate of GDP have a negative and a statistically significant relationship with liquidity. That is to say

that these factors reduce liquidity of banks. On the other hand, capital, bank size, loans to total asset ratio and annual inflations exhibit a positively significant relationship with bank liquidity. This implies that these factors boost bank liquidity. Growth in money supply is the only insignificant factor in explaining bank liquidity.

5.2 Conclusions

The study confirms that Ghanaian banks are highly liquid using the more comprehensive liquidity creation measure and that, capital, size, bank risk taking behaviour and competition in the Ghanaian banking industry are the major factors explaining the large amounts of liquidity held by banks.

The study established that, while Net Interest Margin, concentration and growth in Gross Domestic Product revealed a positive relationship with liquidity risk or illiquidity, measured by the ratio of liquidity created (plus OBS) to total assets, capital, size, the ratio of loans to total assets exhibited a negative relationship with the same measure.

With respect to the alternative liquidity measure which excludes off-balance sheet activities, only Capital Adequacy ratio and bank size are statistically significant. These two variables are also positively related to liquidity, implying that, increases in capital and size makes bank more liquid. Although insignificant, loans to total assets ratio, industry concentration, growth in money supply and GDP growth rate are negatively related to liquidity while Net Interest Margin and annual inflation have positive relationship with liquidity, hence, enhance liquidity.

5.3 Policy Recommendations

Based on the results derived and the conclusions made, the following recommendations are suggested for consideration:

For the most part, the Central Bank should consider a more comprehensive way of measuring liquidity as this measure quantifies an important function of banks in the economy, which is,

liquidity creation. The liquidity creation measure is also a good predictor of financial crunches even after controlling for other macroeconomic factors. Moreover, the BB-measure is a more complete measure of bank liquidity other than the traditional measures of total assets as it includes assets, liabilities, equity and off-balance sheet activities. Finally, this measure can serve as a forecasting tool for the prediction of the cedi amount that individual banks and the entire industry will need during periods of emergency liquidity shortfall.

The finding that the relationship between bank capital and liquidity risk is negative raises interesting policy issues. It is eminent that, regulators impose capital requirements on banks for safety and soundness reasons. This is because, capital acts as a buffer against illiquidity. However, because Ghanaian banks hold excess liquidity, it will be advisable that they reduce their equity so that liquidity levels at least reach a moderate level.

Regulators should also note that, even though capital injection into distressed banks aims at lessening risk, the effect on liquidity creation may go either way. Berger , Bouwman, Kick and Schaeck (2010) for example, find that capital support for German banks diminishes liquidity creation during normal times, but not during financial crises.

The statistically significant negative relationship between Net Interest Margin and inflation growth rate and liquidity risk suggests that liquidity levels rises with increased Net Interest Margins and inflation growth rates and vice versa. Banks should therefore be alert when their Interest margin growth rate and annual inflation begin to fall and take precautions to that effect. Banks should reduce their net interest income to at least a level where liquidity will not be in excess. On the positive relationship between loans to total assets ratio and liquidity, banks should also reduce their risk-taking behaviour by giving out fewer loans in proportion to total assets so as to cut down the amount of liquid reserves at least, to the global average.

The significant and positive relationship between concentration (negative for competition) and liquidity creation for both measures of liquidity sends the message that, competition should be increased to reduce liquidity risk. Put differently, regulators should set policies that increase competition when it is desired that liquidity levels rise. A competitive banking industry is good for banking clienteles as it boosts their welfare. However, regulators should be conscious of the fact that, intense competition can be detrimental to financial stability as documented in literature by Berger et al., (2009), Beck et al., (2013), and Fungacova and Weil (2013). Thus, there is a trade-off between increased welfare of consumers and financial stability.

Finally, banks could anticipate falls in liquidity levels during times of economic boom and take steps accordingly. From the study, taking the various factors that explain bank liquidity risk into consideration, efficient management of liquidity risk would not only inure to the benefit of banks but also to individuals, business entities and the whole nation at large.

More generally, banks should note that, holding too much liquidity means trading off more profitability and so they should reconsider the amount of liquid funds held so as not to forgo too much profit.

5.4 Future Research Directions

Other interesting research questions and issues that could be addressed using this measure in future works on bank liquidity include: How does bank liquidity creation differ across bank types, bank- versus market-based systems, and legal frameworks around the world? ,Bank liquidity creation and mergers and acquisitions and lastly, Basel III capital rules and bank liquidity creation.

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APPENDICES

Appendix I: Correlation Matrix For factors explaining Bank Liquidity

	LIQTA2	LIQTA	CAR	NIM	SIZE	LOTA	CONC	GMON	INFL	GGDP
LIQTA2	1.0000									
LIQTA	0.9027	1.0000								
CAR	-0.4569	-0.3945	1.0000							
NIM	-0.0910	-0.1727	0.3879	1.0000						
SIZE	0.0653	-0.0472	-0.2841	0.1793	1.0000					
LOTA	0.0946	0.1572	-0.1033	-0.0287	-0.0687	1.0000				
CONC	0.3332	0.3365	-0.3320	-0.1450	-0.4120	0.0796	1.0000			
GMON	0.2174	0.2680	-0.1546	-0.2718	-0.3790	0.0269	0.5262	1.0000		
INFL	0.1776	0.1896	-0.2497	-0.0168	-0.0989	-0.0234	0.5553	-0.0767	1.0000	
GGDP	-0.1253	-0.0763	0.1964	-0.1397	0.0884	0.0478	-0.5146	0.3664	-0.6934	1.0000

Appendix II: Variance Inflation Factors for explanatory variables

Variable	VIF	1/VIF
CAR	2.05	0.488611
NIM	1.49	0.670700
SIZE	1.98	0.505836
LOTA	1.11	0.904320
CONC	7.87	0.127082
GMON	6.46	0.154904
INFL	2.20	0.455395
GGDP	6.92	0.144561
Mean VIF	3.76	

Appendix III: Hausman Specification Test-Factors explaining bank liquidity (liqta2)

---- Coefficients ----

	(b)	(B)	(b-B)	sqrt (diag (V_b-V_B))
	modfe	modre	Difference	S.E.
CAR	-.7341542	-1.444444	.7102861	.4304669
NIM	.2124119	.7002369	-.487825	.5967808
SIZE	.0760646	.0803457	-.0042811	.0671154
LOTA	-.000872	-.068218	.067346	.0984762
CONC	1.633738	1.673567	-.0398288	.2668215
GMON	-.0604852	-.0852257	.0247405	.3895353
INFL	-.276062	-.310826	.0347639	.1971731
GGDP	1.689567	1.442341	.2472261	.6067854

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\text{chi2 (8)} = (b-B)'[(V_b-V_B)^{-1}](b-B)$$

$$= 9.69$$

$$\text{Prob}>\text{chi2} = 0.287$$

Appendix IV: Breusch and Pagan Lagrangian multiplier test for random effects

Estimated results:

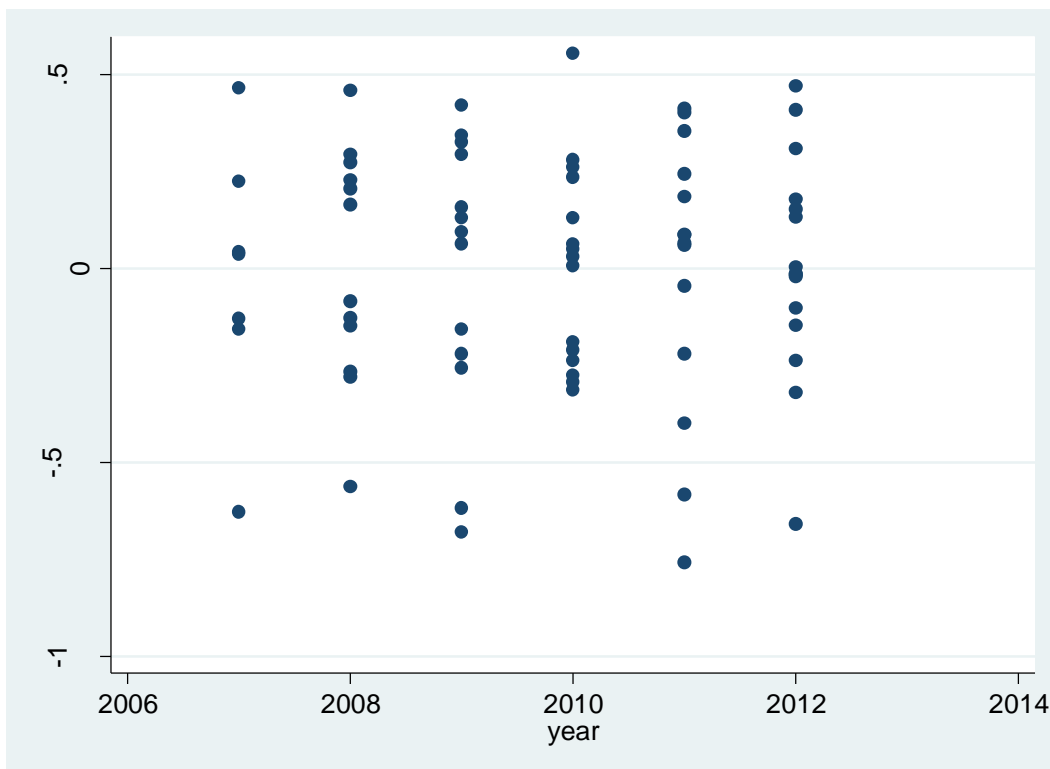
	Var	sd = sqrt (Var)
liqta2	.1278419	.3575499
e	.0532151	.2306839
u	.0560553	.2367601

Test: $\text{Var}(u) = 0$

chibar2 (01) = 16.51

Prob > chibar2 = 0.0000.

Appendix V: Test for autocorrelation



Appendix VI: Test for normality

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj	joint ----- Prob>chi2
R	128	0.0000	0.1593	15.11	0.0005

Appendix VII: Regression results - using liquidity measure with OBS.

Group variable: bcode	Number of obs.	=	76
Time variable: year	Number of groups	=	20
Panels: heteroskedastic (unbalanced)	Obs per group: min	=	1
Autocorrelation: panel-specific AR (1)	avg	=	3.8
	max	=	6
Estimated covariances	=	20	R-squared = 0.5236
Estimated autocorrelations	=	20	Wald chi2 (8) = 63.14
Estimated coefficients	=	8	Prob > chi2 = 0.0000

	Het-corrected					
LIQTA2	Coeff.	Std. Err.	z	P> z	[95% Conf. Interval]	
CAR	-2.551728	.6229516	-4.10	0.000	-3.772691	-1.330766
NIM	2.457844	1.37033	1.79	0.073	-.2279543	5.143642
SIZE	-.0362583	.0192528	-1.88	0.060	-.0739931	.0014766
LOTA	-.3492733	.1781608	-1.96	0.050	-.698462	-.0000846
CONC	2.292345	.8398018	2.73	0.006	.6463635	3.938326
GMON	-1.499521	1.160638	-1.29	0.196	-3.774329	.7752877
INFL	-1.479216	.8350279	-1.77	0.076	-3.115841	.1574082
GGDP	3.341329	1.741358	1.92	0.055	-.0716706	6.754329
Rhos =	1	.5355137	1	.9349844	-.02151636738828
