KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Measurement of Liquidity Risk and Bank Performance.

By

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Declaration

I hereby declare that this submission is my own work towards the award of the M.Sc. degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which had been accepted for the award of any other degree of the university, except where due acknowledgement had been made in the text.

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Dedication

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To

my wife Regina Ampah and my children.

Abstract

Liquidity risk is a decisive element of all the risk that affect the operations of banks. Banks must therefore appraise their liquidity risk continuously and in particular, in times of economic downturn. This thesis aims to study the impact of Liquidity risk on banks profit and a measure of the Liquidity-at-Risk. Datawere obtained from the annual audited financials of selected Ghanaian banks for the period between 2004 and 2013 inclusive. The methodology employed is the Generalized Least Square (GLS) unbalanced panel data analysis. The dataset used involves only the universal banks. Results show that Liquidity Gap and Deposits have significant positive effects on Profits while Non-Performing Loans have negative effect. The impact of Net loans to Deposit and Leverage Ratios were found to be statistically insignificant.

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List of Abbreviations

LG – Liquidity Gap

Dep – Deposits

Lev. Ratio - Leverage ratio

PBT - Profit Before Tax

PBT'' - Expected PBT

NLD - Net loans to Deposit Ratio

NPL - Non-Performing Loans

(H_0) - Null Hypothesis

(H_A) - Alternative Hypothesis

CFP - Contingency Funding Plan

GHS - Ghana Cedis.

Chapter 1

Introduction

1.1 Background of the Study

Liquidity was a vital issue during the immediate past financial predicaments. Several financial institutions found themselves in situations where they were not able to settle their financial commitments as they fall due. In severe situations, some financial institutions in some countries failed or were compelled to amalgamate. As a result, authorities in many countries, including Canada and the United States of America provided significant amount of liquidity in order to stabilize their respective financial systems. (Bernanke, 2008; Longworth, 2010).

In the aftermath of the financial predicaments, it became obvious that financial institutions generally, had not grasp the significance of liquidity risk management and its repercussions on themselves and the financial system as a whole. In furtherance of this, policymakers have advised that financial institutions ought to keep significant liquid assets than in the past. This was to act as buffer against potential funding difficulties. The experience has led to an international desire for common measures and standards for liquidity risk, paving the way for the ongoing work by the Basel Committee on Banking Supervision, 2010.

1.2 Statement of the Problem

Most banking activity depends on banks ability to make liquidity available to its customers. The banks generate liquidity through loans which are financed by a mixture of deposits from the public and equity contributed by the Shareholders (eg. Greenbrae and Taker, 2007; Ferias and Richet, 2008). Banks also offer their

customers and borrowers liquidity off their balance sheet through loans granted. (Kashyap, Rajan, and Stein, 2002; Thakor, 2005).

Banks liquidity creation is of great importance to the macro economy (Bernanake, 2008; Sahin & Yorulmazer, 2009). Policymakers have the choice to demand for the holding of significant liquid assets, for instance, if it is seen as a benefit to the stability of the overall financial system. Banks will hold liquid assets as far as it can help them to maximize profits.

In as much as the creation of liquidity may stabilize the financial system, what are the inherent risks which the banks are exposed to? How does it affect the general performance of the banks and the financial system as whole?

1.3 Objective of Study

The study seeks to analyze the relationship between Liquidity Risk and performance measures using deposits, Liquidity Gap, Non-performing loans, Net loans to Deposits Ratio and Leverage Ratios as indicators.
The specific objectives seek the following;

- To investigate the strength of relationship between Liquidity risk and performance.

- To measure the Liquidity-at-Risk (i.e VaR) aimed at estimating the appropriate capital provisioning.

1.4 Significance of Study

Findings and recommendations of this study will help:

- Policy makers in determining the level of liquidity risk that the banks can assume vis a vis performance.

- Help to determine the amount of liquidity required to avoid insolvency.

- Address research issues by checking how performance may be related to liquidity risk within the Ghanaian environment.

It is hoped that the study will arouse further research in the area of financial risk in the banking sector within the Ghanaian set - up and the sub-region as a whole in order to further improve the effectiveness of the sector.

1.5 Hypothesis

A hypothesis is usually a provisional supposition that one variable, known as the independent variable, has a causal effect upon another, the dependent variable. (Bowerman & O Connell, 2003).

Having relevant literature on liquidity risk and profits, the following hypothesis will be tested:

Null Hypothesis (H_0): Bank performance does not depend on liquidity risk

Alternative Hypothesis (H_A): Bank performance depends on liquidity risk.

1.6 Scope of the Study

It will be appropriate if the study covers all the banks (including both rural and community banks). However, due to limitation of time and inadequate logistics, the study will concentrate only on the commercial banks. The study covers a period of ten (10) years from 2004 to 2013.

Furthermore, the methodology, depth and findings of this study are also limited to the extent to which key information is obtained as necessarily required. It is however, expected that findings and recommendations deduced from the study

could be beneficial in other research areas within the banking and the general financial systems.

1.7   Organization of Study

For the purpose of clarification and standardisation, the study is arranged in five main chapters. Chapter One talks about the background of the study, problem statement, objective of the study , methodology , significance of study , scope as well as the organisation of the study. The second chapter talks about the relevant literature on liquidity risk and performance of banks in Ghana. It also examines works done by other researchers in relation to liquidity risk, the methods applied and its challenges.

Chapter three describes in detail the methodology employed to unravel the problemat hand. The models to be used were also discussed. Chapter Four deals with theanalysis and the interpretation of the data thereof, using the software package R.Lastly, chapter five summarises the piece of work. It also captures the findings ofthe study, conclusion and recommendations.

Chapter 2

Literature Review

2.1 Introduction

Banks are important financial institutions and play significant roles in distributing currency and wealth of the general population within the financial system. It is the banks that provide the long-term loans to individuals and firms alike, and is able to offer depositors demand deposits thereby creating liquidity.

The basic responsibility of banks in transforming short-term deposits into long-term loans make banks naturally exposed to liquidity risk, both of an institution-specific nature and that which affects markets as a whole. Practically all financial transaction or commitment has implications on the bank's liquidity (Basel Committee on Banking Supervision, 2008).

2.2 Liquidity

Liquidity is the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (Basel Committee on Banking Supervision, 2008).

2.3 Measurement of Liquidity

Liquidity of an institution is a key sign of its strength. It measures the capacity of the institution to transform its assets into cash faster without comprising any price. It is measured by means of liquidity ratios namely.

- Cash Ratio - The total value of cash and marketable securities divided by

current liabilities. The cash ratio measures the extent to which a company can quickly liquidate assets and cover short-term liabilities, and therefore is of interest to short-term creditors. It is also called Liquidity Ratio or Cash Asset Ratio.

- Current Ratio - The value of current assets divided by current liabilities. The current ratio measures a company's ability to meet short-term debt obligations; the higher the ratio, the more liquid the company is. If the current assets of a company are more than twice the current liabilities, then that company is generally considered to have good short-term financial strength. If current liabilities exceed current assets, then the company may have problems meeting its short-term obligations.

- Quick Ratio - A measure of a company's liquidity and ability to meet its obligations. Quick ratio, often referred to as acid-test ratio, is obtained by subtracting inventories from current assets and then dividing by current liabilities. Quick ratio is viewed as a sign of company's financial strength or weakness (higher number means stronger, lower number means weaker).

- Cash Conversion Cycle - The length of time between the purchase of raw materials and the collection of accounts receivable generated in the sale of the final product.

2.3.1 Liquidity Creation

The accepted notion of liquidity formation is that banks generate liquidity by converting illiquid assets into liquid liabilities. According to Diamond and Rajan (2000, 2001) and Gorton and Winton (2000), banks can produce more or less liquidity by simply changing the combination of their financing mixture on the liability side.

To Bryant (1980), Diamond and Dybvig (1983) banks create liquidity by pro-

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viding loans to customers while allowing depositors to withdraw funds at any time.

Banks also give borrowers liquidity off the balance sheet via loan commitments and comparable claims to liquid funds (Boot, Greenbaum, and Thakor, 1993; Holmstrom and Tirole, 1998; Kashyap, Rajan, and Stein, 2002; Thakor, 2005; Freixas and Rochet, 2008).

The formation of liquidity by banks is important for the macro - economy (Bernanke, 1983; Dell'Ariccia, Detragiache, and Rajan (2009), and becomes even more significant during periods of economic downturn (Acharya, Shin, and Yorulmazer, 2009). However, the creation of liquidity exposes the bank to different categories of risks, including liquidity risk.

2.4   Liquidity Risk.

Liquidity Risk arises from a banks inability to meet its financial commitments when they become due. The bank risk losing the belief of her customers / depositors if finances are not provided to them on time and puts the banks reputation at stake. It adversely affects the banks capital and earnings (Jenkison, 2008).

Liquidity risk is of two types: funding and market liquidity risks. Funding liquidity risk is the risk that the 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 is the risk that a bank cannot easily do away with a position at the market price because of inadequate market depth or market disruption. To Drehmann and Nikolau (2009), Liquidity Risk is the likelihood that over a given period, the banks will find it difficult to settle their financial commitments

promptly.

2.4.1 Causes of Liquidity Risk

The maturity conversion of short-term deposits into long-term credits makes banks naturally exposed to liquidity risk. (Basel Committee on Banking Supervision, 2008).

To Diamond & Rajan (2005), Liquidity Risk may occur as a result of breakdown or impediments from borrowers or stoppage of projects. Kumar (2008) , asserted that large amount of deposits withdrawal may cause a liquidity deception for banks.

Further, to Muranaga & Ohsaw (2002); Liquidity Risk may arise if banks are incapable to liquidate their assets on time at a realistic price. Further still, Liquidity Risk might come from the make-up of banking exogenous macro factors and operating policies that are endogenous (Ali, 2004).

Apart from maturity mismatch, liquidity risk arises due to economic downturn conditions, causing fewer resource creation. This situation may increase the request of depositors causing liquidity risk. This may cause the break down of the entire financial system due to contagion effect (Diamond & Rajan, 2005).

To Helmen, Simonson & Coleman (1994), the two main causes of liquidity risk are asset-liability imbalance and maturity mismatch which can happen because of two conditions:

1. When liquid assets are available in larger portions than volatile liabilities, a scenario known as liquidity gap, or

2. when the predicted amount of funds needed on the asset side is higher than the predicted amount of funds available on the liability side, a condition

known as liquidity need.

Identifying and mitigating these two causes of liquidity risk may eliminate:

1. the funding liquidity risk when the depositors withdraw their short-term deposits and

2. the market liquidity risk when there is a disruption in the financial markets which makes normally-liquid assets illiquid (Sharma, 2004).

One way to balance the asset and liability sides is by matching the maturities; this is commonly referred to as maturity mismatch risk anticipation (Greenbaum & Thakor, 1995). To match the maturities of assets and liabilities, the bank deposits should be allocated in well-organized maturities. Hence, the demand for liquidity from the matured deposits could be fulfilled from the liquidity of the matured assets. As a result there is neither a liquidity gap nor a liquidity need.

2.5 Factors causing Asset-Liability Imbalances and Maturity mismatch risk

The asset-liability imbalance potentially occurs because the short-term tenors of deposits are liquid, while the long-term investments are illiquid. When the depositors execute their short-term tenors of deposits, the banks may have to terminate their long-term investments in order to free up liquidity to meet the immediate demand. Indeed, the excessive reliance on short-term debts leaves the banks vulnerable to the occurrence of financial distress (Beakley & Cowan, 2004).

The second factor is the combination of a high deposit rate to attract more funds from depositors and the high credit rate imposed on entrepreneurs. However, when a business faces a downturn, the high credit rate reduces the entrepreneurs' ability to repay the interest and principal of the debts and leaves banks in a difficult position to repay the depositors' deposits. If banks continue not to have

access to funds from the money market, this asset-liability imbalance problem could trigger a liquidity run (Ismal, 2010).

The third factor occurs if big companies become the dominant depositors and locate funds in the short-term tenor of deposits. Banks would need immediate liquidity if the liquidity behaviour of big companies is uncertain and unpredictable and these companies redeem their deposits without prior notice or immediately at the same time (Ismal, 2010).

The fourth factor is an asymmetric or unequal distribution of information among depositors, banks, borrowers, and regulators (Greenbaum & Thakor, 1995). For example, where there is hidden information among parties involved in the bank's financing activities, or unorganized liquidity behaviours between depositors and banks, it is difficult to match the assets and liabilities. The final factor is the business cycle which plays an important role in causing asset-liability imbalance (Allen & Gallen, as quoted by Zhu, 2001). For example, the unfavourable business/economic conditions may disrupt the performance of the asset side which may eventually impact the balance between assets and liabilities.

2.6 Techniques to Mitigate Liquidity Risk

Gap Analysis technique assists the output of the assets side (particularly from the interest rate return of bank credits) and the liability side over a certain period of time (Heffernan, 2001). It suggests that banks maintain a higher return on the asset side than the liability side. In particular, the ratio of total return from bank credits to total payments of interest on deposits should always be positive. If it is found negative, the banks should:

- increase total equity or;

- increase interest on bank credit to prevent asset-liability imbalance and

maturity mismatch risk.

Increasing interest on bank credit might potentially increase NPL and interrupt performance of the asset side. As such, banks are to diversify their funding sources or increase the contingent liquidity sources (Bank for International Settlement (BIS), 2008).

To Greenbaum & Thakor (1995), liquidity risk can be mitigated by;

- investing more funds in liquid loans and/or keep more cash in hand.

- Diversifying sources of funding from various depositors.

- Using the central bank as the last resort to provide emergency liquidity to fulfill the regular demand for liquidity from depositors.

Banks should be able to identify a predictable irregular demand for liquidity. In order to estimate accurately,banks should find out from their clients details on the schedule of their intended deposit withdrawals (Helmen et al., 1994).

For unpredictable irregular type of demand for liquidity, there are various proactive actions that banks can adopt, including:

1. having a contingency funding plan (CFP),

2. a combination of cash flow matching and liquid assets,

3. a prudential allocation of assets,

4. an integrated structure of banking organization and,

5. employing the deposit insurance company.

Contingency Funding Plan (CFP) consist of policies, strategies, and procedures that serve as a plan for a bank to address liquidity shortfalls in emergency situations at reasonable costs (BIS, 2008). The main objectives of CFP are to ensure

that banks can prudently and efficiently manage extraordinary liquidity fluctuations and mitigate urgent liquidity needs both in the short and long-term periods.

CFP anticipates the needs for liquidity through three treatments (BIS, 2008). The first involves analyzing and making quantitative projections of all funds in both on- and off-balance sheets. CFP identifies, quantifies, and ranks all of the sources of funding based on their preference.

The second is matching the potential sources of cash flow and usage of the funds. CFP determines the strategies on the asset and liability in the case of liquidity crises, for example selling money market securities, selling longer-term assets (on the asset side), or pricing policies for funding, regulation for the early deposit redemption, and the usage of discount windows (on the liability side). The final strategy involves setting up indicators to alert the bank management concerning the predetermined level of potential liquidity risk problems.

2.6.1 Combination of Cash Flow matching and Liquid Asset

With this approach, cash outflows are match in each time period with a combination of contractual cash inflow and inflow from the assets sale, repurchase agreement, or secured borrowing (BIS, 2006). The most liquid assets are counted first in the earliest period of time s followed by the less liquid assets.

In order to have accurate and reliable results, banks could combine the projections of customer behaviours and the roll over expectation of deposits. Furthermore, banks should develop databases of types of depositors, deposits, and geographic diversification.

2.6.2 Prudential Allocations of Assets

This technique could reduce refinancing risk, redemption risk, or repurchasing the bank's borrowing prior to their contractual maturities. Some conditions must take place to implement this technique. These are:

1. Placing a substantial portion of deposits to the secured and short-term investment alternatives that are very liquid and may be repurchased before the maturity dates;

2. Requiring collateral from the debtors to secure long-term investments (BIS, 2008);

3. Joining syndication loans to share the risk of credit among parties involved;

4. Avoiding credit concentration on certain types of placements (debtors).

2.6.3 Deposit Insurance

Deposit insurance is another contemporary technique to mitigate liquidity risk (Zhu, 2001). For the depositors, deposit insurance increases their deposit costs, although it ensures the repayment of deposits if banks are in default. For the banks, deposit insurance reduces the liquidity risk exposures because there is now an external body (deposit insurance company) which covers the failure of deposits repayment.

2.6.4 Effects of Liquidity Risk

Liquidity challenges might influence a bank's capital and earnings. In severe cases, it might lead to the failure of the bank (Central Bank of Barbados, 2008). During liquidity predicament, banks may borrow from the market at exceedingly high rate causing a decline in profits. Further borrowing to meet customers or depositors demand may place the bank's capital at risk, leading to increase in debt-equity ratio. Liquidity risk may cause a financial institution to sell a large

number of its illiquid assets to meet her funding requirements. This may lead to the impairment of its capital base. (Diamond & Rajan, 2001; Falconer, 2001).

Again, to Diamond & Rajan, 2001; banks may refuse to lend to even a potential entrepreneur if it feels the liquidity needs of banks are quite high. This may lead to losses for the banks. Further, if bank/banks is /are unable to meet the requirements of demand deposits, there can be a bank run (Diamond & Rajan, 2005).

2.6.5 Measures or determinants of liquidity risk.

Liquidity risk is normally calculated in two separate ways. Firstly, liquidity is adjusted by size which includes the ratio of cash asset to total asset (Demirguc-Kunt, 1998; Barth, 2003), the ratio of cash asset to deposits or savings (Chen, 2010). In first type, the higher is the liquidity ratio, the higher the liquidity level, and therefore, it is less exposed against bankruptcy.

Second type includes the adjusted loan by the size and includes the ratio of total asset and/or the ratio of net loan to total asset (Kosmidou,Tanna & Pasiouras, 2005). The higher the values of ratios, it will represent that banks will undergo higher liquidity risk. To Saunders & Cornet (2007) liquidity risk is defined as the difference between loan and bank's core deposits. If financial gap is positive, the bank needs to bridge the gap by its cash funds via selling cash assets and borrowing from money market. Therefore, financial gap can be estimated by subtracting the borrowed funds from the cash assets. This financial gap represents financial needs of the bank after selling its cash assets. When the economy is in recession and financial market increasingly request for Cash funds, it is when the banks are more exposed to liquidity risk. For standardization of financial gap, the variable of financial gap is divided by total asset.

Liquidity risk in banking has been attributed to deposits transactions and their potential to spark fright or fears. This deposit-lending hedge becomes more powerful during periods of tight liquidity, when nervous investors move funds into their banks. The standard notion of liquidity risk at banks is the situation where runs from depositors had been seen as the cause of trouble (Diamond & Rajan, 1999).

2.6.6 Bank Performance / Profitability

Performance shows how effectively a bank or financial firm meets the objectives its owners or stockholders, employees, depositors and other creditors and borrowing customers identify. At the same time, the banks must find ways to keep government regulators satisfied that their operating policies among others are sound, protecting the public interest (Rose & Hudgins, 2005).

Accountant, Financial Analysts, Academics and Bank Supervisors among others have built a variety of standardized tools and methods that can be used in assessing the performance of financial institutions, including banks. These analytical tools include:

1. Ratio analysis

2. Statistical analysis

   - Regression analysis

   - Correlation analysis

3. CAMELS rating methodology

2.7   Ratio Analysis

A ratio is an expression of a mathematical relationship between one quantity and another. If a ratio is to have any utility, the elements that constitute the ratio

must express a meaningful relationship. Ratio analysis involves comparing one figure against another to produce a ratio, and assessing whether the ratio indicates a weakness or strength (BPP Publishing, 2005).

Ratios are generally not significant of themselves but assume significance when they are compared with:

- Previous ratio of the same institution

- Some predetermined standard

- Ratio of other institutions within the same industry

- Ratio of the industry within which the institution works or operates

Ratios generally are not the sole basis for decision-making. They are treated as additional evidence leading to a decision or solution. They are also relevant and reliable as the data that goes into them and can identify significant fundamental and structural relationship and trends.

For purposes of calculation and interpretation, a number of writers (for example Van Horne, 2002) have grouped ratios into various categories. These include:

- Liquidity ratio - allows assessment of whether a company is likely to be able to pay its bills/commitments as they fall due.

- Profitability ratio - indicate the efficiency of operation.

- Debt ratio - reflect the relative proportion of debt fund employed.

- Coverage ratio - give insight into the ability of a company to service its debt.

- Market-value ratio - market value of a company's stock to profitability.

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Bank profitability and performance has often been measured by the following parameters and or ratio among others:

- Profitability Index - The present value of future net cash flows over the initial cash outlay. It is estimated as the ratio of benefit to cost (Van Horne, 2002).

- Stock Price of the bank (Pettway & Sinkey; 1980)

- Profit Before Tax (Pettway & Sinkey, 1980)

- Real Growth in bank assets (Sinkey, 2002; Rose & Hudgins, 2005)

- Return on Assets (ROA) - Is a measure of the return on total investment in the enterprise. It is estimated as the net profits of the banks divided by the average assets (Bourke, 1989; Abdullah, 1994; Sinkey, 2002)

- Return on Equity (ROE) - A measure of the rate of return on stockholders' investment in the enterprise. It is calculated as Net profits divided by Equity Capital or Stockholders Funds (Sinkey 2002; Rose & Hudgins, 2005; Koch & Macdonald, 2006).

- Efficiency Ratio - The ratio of Non-Interest Expense to Net Operating Income.

- Net Interest Margin (NIM): It is defined as the difference between interest earned on loans & Advances and interest paid on deposits liabilities (net interest income) divided by average total assets. It shows how efficient management is using mobilized deposits to generate return on its assets. It is an indicator of efficiency of the overall portfolio management of the bank. (Beck, Dermirgue-Kunt & Levine, 1999; Sinkey, 2002).

- Equity Multiplier - degree of financial leverage employed by the bank and is measured by Total Assets divided by Total Equity or Stockholders Funds

(Rose & Hudgins, 2005; Koch & Macdonald, 2006).

- Spread - (Interest Income/Earning Assets) - (Interest Expense/Interest Bearing Liabilities) (Koch & Macdonald, 2006)

- Earnings Base - Earning Assets/Total Assets (Koch & Macdonald, 2006)

- Expense Ratio - Ability to control expenses and is measured by the ratio of total expenses to total income. (Koch & Macdonald, 2006).

Data availability however helps in making the right choice.

2.8 Statistical Analysis

This involves the use of statistical techniques such as regression and correlation analysis, multiple discriminate analysis etc, to measure the performances of financial institutions. (O'Byrne, 1996; Peterson & Peterson; 1999 , Biddle, 1997 & 1999). It should be noted that the above description does not cover the entire definition of Statistical Analysis as it is beyond the scope of this study.

2.9 Camels Rating Methodology

Most bank regulatory agencies utilized the internationally recognized CAMELS rating methodology to evaluate the performance and financial conditions of banks. (Banking Supervision Department of Bank of Ghana; Federal Reserve). CAMELS is an acronym measuring;

C - Capital Adequacy - measures bank's ability to maintain capital commensurate with the bank's risk.

A - Assets Quality - reflects the amount of credit risk with the loan and investment portfolios.

M - Management Quality - reflects management's ability to identify, measure, monitor, and control risks.

E - Earnings - reflects the quantity, trend and quality earnings.

L - Liquidity - reflects the sources of liquidity and funds management practices.

S - Sensitivity to market risk - reflects the degree to which changes in market prices and rates adversely affect earnings and capital.

2.10 Empirical studies on Liquidity Risk - Performance Relationship

In banking industry, liquidity risk has an opposite effect on profitability. Demirguc-Kunt (1998) examined the determinants of bank's profit and net profit margin by using the specific characteristics of bank, macroeconomic conditions, tax enactment, regulations, financial structure and legal parameters for 80 countries. In this research, they evaluated liquidity risk based on the ratio of loan to total asset. Their general results indicated that there is a positive relationship between net profit margin and liquidity risk and there is a negative relationship between return on internal asset and liquidity risk of bank.

In a study by Molyneux & Thornton (2004), on determinants of European Banks profitability, they found that liquidity risk has significantly negative effect on profitability of banks. Chen (2010) examined the pattern of liquidity risk of bank and its performance using imbalanced panel data set including commercial banks

in 12 advanced economic countries during the years 1994-2006. They found that liquidity risk is the endogenous determinant of bank performance.

A similar study by Arif & Anees (2012), of the banking systems in Pakistan showed that liquidity risk affects bank profitability significantly with Liquidity Gap and NPL as the two (2) factors aggravating liquidity risk.

In a study of the banking system in Malaysia, Sohaimi, (2013) found that Liquidity Risk impacted negatively on the performance of banks with NPL, Deposits, cash and Financial Gap being significant. Other study on the performance of Commercial Banks in Iran by Tabari, Ahmadi & Emami (2013) also found that Credit and Liquidity Risk had a negative impact on performance.

2.11   Overview of the Banking Sector

The Banking System can be defined as the national network of licensed and statutory financial institutions engaged in the business of banking under the Banking Laws of Ghana. The banking systems act as catalyst for initiating and sustaining the process of economic development and growth. A well functioning banking system is indispensable to the economic growth, development and poverty reduction. It leads to reduction in the spread between the lending and deposit rates and encourage borrowing and lending. Wide spread affects financial intermediation and impairs the ability of the banking system to play its vital roles. (Banking Supervision Department).

2.11.1   The Banking Laws

Among the law promulgated to strengthen the banking sector and for that matter the financial sector since independence were:

1. The Bank of Ghana Act, 1963 (Act 182)

2. The Banking Act, 1970

3. The Banking Law, 1989 (PNDC Law 225)

4. The Bank of Ghana Law, 1992 (PNDC Law 291)

5. The Non-Bank Financial Institution Law, 1993

6. The Bank of Ghana Act, 2002 (Act 612)

7. The Banking Act, 2002 (Act 612).

These frameworks were meant to ensure safe and sound banking system.

2.11.2 The Bank of Ghana Act, 1963 (Act 182)

The Act enjoined the bank of Ghana to regulate and direct the credit and banking system in accordance with the economic policy of the government. Under the provisions of the Act (i.e. Section 26), the bank was given the powers to hold, manage or control foreign exchange and the transfer of funds outside Ghana. It was also (i.e. Part IV) to apply minimum liquid ratios to restrict bank credits or investments either generally or by classes and to lay down maximum rates of interest and other charges on credit (Anin, 2000).

2.11.3 Banking Act, 1970

The provisions of the Act were modeled on UK and Commonwealth banking practice and principles. Banks operating in territorial Ghana had to be incorporated and licensed in Ghana. The Act empowers among others, the bank to ensure that 'at all times a Paid-Up Capital of not less than N750.006 or an amount not less than 5% of the deposit liabilities of the business whichever is the greater'. Foreign banking institutions had to maintain a Paid-Up Capital of not less than

N2,000,000. Part II of the Act also imposed among others the following statutory obligation on licensed banks:

- Maintenance of a Reserve Fund

- Guidelines relating to granting of loans to Directors

- Opening and closure of branches of licensed banks without prior permission from the Bank of Ghana (Aninn, 2000)

2.11.4   The Non-Bank Financial Institution (NBFI) Law, 1993

The Law designates and mandates the Bank of Ghana as the authority to:

- Issue licences to corporates in Ghana to undertake or engage in the business of NBFIs as well as to suspend/revoke licences in specified circumstances [Sections 4(I), 5(I) and 6 (III)];

- Make rules for the proper functioning of the licensed institutions, supplementing the regulation in the Law, that is, to frame supplemental regulation [Section 14 (1)];

- Issue directions on taking of public deposit by NBFIs, and in specified circumstances, to prohibit any deposit-taking institution from acceptance of deposits [Sections 11 [2&3] and 6 (II); and

- Exercise supervision "in all matters relating to the business of any non-bank financial institution licensed under this Law" [Section 13].

2.11.5   The Banking Law, 1989 (PNDC Law 225)

The Banking Law, 1989 empowers the Bank of Ghana to have overall supervisory authority in all matters relating to the business of banking in Ghana. The bank thus has the responsibility to ensure that the solvency of the banking system,

quality of assets, adequacy of liquidity and profitability are maintained and adherence to statutory and regulatory requirements is enforced. The Bank of Ghana through the Banking Supervision Department (BSD) plays its supervisory role by conducting Off-site supervision, On-site examination and Investigations and Follow-up.

2.11.6 The Bank of Ghana Act, 2002 (Act 612)

The Bank of Ghana Act (Act 612) was promulgated in January 2002. The new Act enshrines price stability as the primary goal of the bank and gives it operational independence. It also places a limitation on government borrowing from the Bank of Ghana.

2.11.7 The Banking Act, 2004 (Act 673)

With the passage of time, the dynamics of the Banking industry rendered the Banking Law, 1989, PNDC Law, 225 less effective. The new Banking Act 2004, Act 673 was thus promulgated to address the shortcoming and strengthen the legal and regulatory framework of the Bank of Ghana in line with the Core Principles of Banking Supervision advocated by the Basel Committee on Banking Supervision. The new legal framework has transformed many of the discretionary rules into specific ones thereby removing the uncertainty in compliance and enforcement of certain directives. This has enhanced decision making and foster healthy relationship between the bank of Ghana and the banks.

The Act incorporates current international standards and ensures more effective supervision and regulation of the banking industry. The Act, among other things, details the banking sectors licensing, regulatory regime and minimum capital requirements.

2.11.8   Liquidity Requirement

Currently, the universal banks are required to maintain a Primary Liquidity Reserve Ratio requirement of ten percent (10%).This reserve requirement obliges the banks to retain ten percent of their Deposits with the Central Bank which acts as buffer against liquidity risk capital. (Bank of Ghana Annual Report, 2015).

2.12   Developments in the Banking Industry

In the early 1980s, Ghana's banking system suffered from undue political influence, over - exposure to some customers, weak management, inadequate capital, large portfolios of non- performing loans, weak accounting and information systems, ineffective auditing and poor internal controls.

Consequently, the government with financial assistance of the International Development Association (IDA) introduced the Financial Sector Adjustment Programme (FINSAP) with the aim to:

1. Restructure banks that are distressed.

2. Improve deposit mobilization and enhance efficiency of credit allocation.

3. Reform the banking laws and

4. Improve supervision and regulatory framework

Again in 1990, the stock exchange was opened for business, primarily as a means of converting the nations savings into long-term capital for the industry. Since then, the commercial banks have, over the years, injected modern technology and business practices into the operations (Ghana Review International, 1999).

In March 2002, the Bank of Ghana introduced the Prime Rate as the policy rate. It provides an anchor for money market rates. The Bank of Ghana revised

the reserves requirements on foreign currency deposits held by banks in September 2002. Thus primary reserves for foreign currency deposits are now held in foreign currency instead of the previous requirements of providing for foreign currencies reserves in the local currency. The primary purpose of the change in policy was to encourage mobilization of foreign currency deposits. In an effort to deepen the financial intermediation process, the Bank of Ghana in 2002, modified the regulations governing the licensing of banks to allow universal banking. A universal banking allows the banks to engage in various types of banking business including investment, commercial and merchant banking (Bank of Ghana, 2002).

2.13   Structure of the Banking Industry

The Banking industry at the end of December 2014 comprised 28 banks (including the ARB Apex Bank) as well as 121 Rural and Community Banks. There were 15 foreign banks and 13 domestic banks. Representative offices for Ghana International Bank (GIB) continued to operate in the country. (Bank of Ghana, 2014)

Chapter 3

Methodology

3.1 Introduction

This chapter presents the source of the data that were used, the basis of sample selection, research design and the technique applied in the analysis of the data.

3.2 Data Collection

Data was collected from the annual Audited Profit & Loss Accounts and Balance Sheet statements of banks obtained from the Banking Supervision Department (BSD) of the Bank of Ghana. This covered the periods from year 2004 to year 2013.

From the financial statements, the researcher collected information on level of deposits, Liquidity Gap, Non- performing loans (NPL) and profit before tax (PBT) from the balance sheet of some banks. Net loans to deposits (NLD) and the Leverage ratios (Lev.) were also considered.

Information was also gathered from articles, reference books, and annual reports. In addition, all the banks that had operated between the period 2004 and 2013 within the Ghanaian banking sector were considered. The Rural and Community Banks as well as the Non-Bank Financial Institutions were however, excluded.

3.3 Research Design

Generalized Least Square unbalanced panel data regression was employed. I also used R-Statistical Package for modeling to generate the results for the analysis.

In order to evaluate the impact of Liquidity Risk on the Performance of the banking system , I used Profit Before Tax of each of the banks within the banking system and five (5) determinants of Liquidity Risk (Arif & Anees ,2012) and (Sohaimi, 2013). Using these measures, I tried to establish the relations between Performance and five (5) dimensions of Liquidity Risk (i.e. Liquidity Gap, Deposits, Net loans to deposits, Non-Performing Loans and Leverage Ratio).

The empirical model was thus defined as follows:

$$PBT_{it} = \beta_0 + \beta_1 Dep_{it} + \beta_2 LG_{it} + \beta_3 NPL_{it} + \beta_4 NDL_{it} + \beta_5 LEV_{it} + \xi_{it} \quad (3.1)$$

Where;

PBT_{it} - Profit before tax of bank i for year t

β_0, β_1, β_2, β_3, β_4 and β_5 are coefficient of the variables

Dep_{it} − Deposits level of bank i for year t

LG_{it} − Liquidity Gap of bank i for year t

NLD_{it} − Net loans to deposits of bank i for year t

NPL_{it} − Non-performing loans of bank i for year t.

Lev_{it} − Leverage ratio of bank i for year t

ξ_{it} − Random error term

In order to assess the significance of the Performance - Liquidity Risk model, the researcher tested the hypothesis for the significance of the panel regression relationship between Performance and Liquidity Risk factors at a significance level of 5%.

Thus for the model, I tested for the Null Hypothesis;

$$H_0 : \ \beta_1 = \ \beta_2 = \ \beta_3 = \ \beta_4 = \ \beta_5 = \ 0$$

(i.e. None of the Liquidity Risk factors is related to profit or the Panel regression relation is not significant) verses the Alternative Hypothesis

H_A: At least one of $\beta_i \neq 0$

(i.e. at least one of the Liquidity Risk factors is significantly related to profit or panel regression relation is significant).

The Decision Rule was:

Reject H_0 if the p-value of model is greater than the level of significance of 5%.

If H_0 is rejected, it means the panel regression relationship is significant. Otherwise the relationship is not significant at the specified significance level. This would imply that some of the Liquidity Risk factors characteristic were related (i.e. there is multicollinearity).

The p-value was used to determine the significance of the panel regression while the coefficient of determination, R^2, was used to determine how much variation in Profitability is explained by the dimensions of Liquidity Risk.

3.4 Cross-validation (CV) of the Panel Regression Model

Cross-validation is primarily a way of measuring the predictive performance of a statistical model.(Arlot & Celisse ,2010) Thus to test the predictive performance of the Liquidity Risk and Bank Performance Model, we subject it to Cross- Validation.

One way to measure the predictive ability of a model is to test it on a set of data not used in estimation. This is called a "Test Set". The data used for estimation is the "Training Set". The predictive accuracy of the model is then measured by the Root Mean Squared Error (RMSE) and /or Absolute Mean Error on the "Test Set". The model with the least or smaller RMSE and MAE estimates is taken as the best fit model.

$$The\ RMSE = \{\sum (Y_i^* - Y_i)/n_i\}^{\frac{1}{2}} \tag{3.2}$$

and

$$MAE = \{\sum (|Y_i^* - Y_i|)/n_i\} \tag{3.3}$$

where

Y_i^* is the predicted value.

Y_i is the original value.

n_i is the sample size.

3.4.1 Types of Cross Validation

2-fold Cross-Validation or Holdout Method

It is the simplest kind of cross validation. The data set is separated into two sets, called the Training set and the Testing set. The Panel Regression is run using

the Training set only. Then the resultant Regression Model is used to predict the output values for the data in the Testing set (it has never seen these output values before). The RMSE and MAE estimates are obtained. The process is repeated this time using the Training set as the Testing set and the Testing set as the Training set. The RMSE and MAE are again estimated.

K-fold Cross validation

The data set is divided into k subsets, and the holdout method is repeated k times. Each time, one of the k subsets is used as the Test set and the other k-1 subsets are put together to form a Training set. Then the average error across all k trials is computed. Every data point gets to be in a test set exactly once, and gets to be in a training set k-1 times. For this method, the training process has to be re-run from scratch k times, which means it takes k times as much computation to make an evaluation.

Leave-one-out cross validation

It is a K-fold cross validation taken to its logical extreme, with K equal to N, the number of data points in the set. That means that N separate times, the Regression Model is trained on all the data except for one point and a prediction is made for that point. As before the average error is computed and used to evaluate the model. It is very tiresome to compute.

For the purpose of this research work, I will use the Holdout Method to test the predictive performance of the Liquidity Risk and Bank Performance model.

3.5 Capital Provisioning for liquidity risks

Maturity gap analysis was used to analyze how the banks are exposed to liquidity risk (Bessis, 2002). In this direction, the assets and liabilities were distributed into time bands. The maturity profiles that were used for this analysis were: 0 - 3 months, 3 - 6 months, 6 - 12 months and Over 1 year.

3.6 Maturity Gap Calculation and Its Interpretation

Maturity Gap Analysis was computed by subtracting total outflows of the bank from the total inflows of the bank. A positive gap indicates that that total assets (total inflows) were greater than the total liabilities (total outflows) in a particular time bracket. Positive gaps affect profitability of banks positively. However, a negative gap indicate that total liabilities (total outflows) of the bank were greater than the total assets (total inflows) in time band. Negative gaps would adversely affect the profitability of banks.

3.7 Deriving Maturity periods for Assets and Liabilities

In arriving at the maturity periods for rate sensitive assets and Liabilities, weighted average of the maturity period are computed. For maturity bands; 0 - 3 months, 3 - 6 months, 6 - 12 months and 1 year and above, an average of each band is derived as 1.5 months, 4.5 months, 9 months and 18 months respectively.

Weighted average period of both assets and liabilities are computed as;

$$W_{Av} = \frac{\sum(AV_{mp} \times V_A)}{\sum V_A} \tag{3.4}$$

Where:

W_{Av} = Weighted Average maturity period for both Assets and Liabilities

AV_{mp} = Average maturity period for each maturity period in the band

V_A = Value of Assets and Liabilities

Estimating Value at Risk for Assets and Liabilities however, 1 year deposit rate, 6 months interbank rate, 6 months borrowing rate and 2 years borrowing rates were applied to rate sensitive liabilities including Deposits, Due to other Banks and Financial Institutions, Borrowings and Other Liabilities respectively.

For the above rates, average return, standard deviation and confidence interval are determined and used as the parameters for VaR computation. Before arriving at VaR, the rate of return with 99% and 95% probability and value of portfolio are determined.

The value of the new portfolio is then given by;

$$P_o[\ 1 + r] \tag{3.5}$$

The VaR is then computed as;

$$VaR_\alpha = P_o\ - P_o[\ 1 + r] \tag{3.6}$$

$$VaR_\alpha = P_o\ - P_o[\ 1 + \phi^{-1}(Z)] \tag{3.7}$$

Where:

VaR - Liquidity -at-Risk

α - Level of Significance

P_o - Initial Portfolio Value

r - minimum return

μ - Mean

σ - Standard Deviation

$z \sim N(\mu, \sigma)$

Chapter 4

Data Analysis and Results

4.1 Introduction

Data analysis play a crucial role in any research work as it enables the researcher as well as others to critically evaluate the data collected to measure its suitability and validity to stated objectives. In this chapter, I will present an overall review of data collected in the form of summarized tables. Generalized Least Square Panel data analysis was used to evaluate the data with the aid of R- Statistical Package.

Table 4.1: Descriptive Statistics 1

	PBT (GHS)	LG (GHS)	DEPOSITS (GHS)	NPL (GHS)	NLD (%)	LEV. RATIO (%)
MINIMUM	(47,879,000)	4,088	1,034,025	5,614	0	0
MAXIMUM	311,223,000	610,618,000	3,221,000,000	71,168,030	6.09	83.30
MEAN	21,902,111	65,077,142	361,700,000	8,011,553	0.55	2.16
STD. DEVIATION	33,399,690	82,231,779	427,889,552	12,077,982	0.49	7.17

Table 4.1 summarizes the parameters used in the analysis. The profit ranges from a loss of GHS 47.88 million to a profit of GHS 311.22 million. Overall, the mean profit was GHS 21.90 million, an indication that the banking system made significant profits over the period under study.

The level of deposits increased from GHS 1.03 million to GHS 3,221.00 million, averaging GHS 361.70 million over the period under study. This is an indication that mobilization within the banking system is on the ascendancy. The rise in the level of deposits could result in adequate liquidity within the banking industry.

Non-Performing Loans portfolio averaged GHS 8.01 million, with the least and maximum values of GHS 5,614 and GHS 71.17 million respectively. The growth in NPL indicates the quality of the industry's loan portfolio was on the decline and could have adverse affect on the liquidity position of the industry.

Liquidity Gap (LG) averaged GHS 610.62 million over the period under study.

4.2   Panel Regression Results

The panel regression results obtained with the aid of the R-Statistics Package is as shown :

Table 4.2: Regression Statistics

	Regression Statistics
Multiple R-Squared	0.74453
Adjusted R-Squared	0.72761
Standard Error	23,250,000
Observations	260
F-Statistic	150.38
Degrees of Freedom	5
P-Value	>2.22e-16

It was evident from Table 4.2 that the Multiple R-Squared, is 0.74453. This means 74.45% of the total variation in the 260 observed values of profit was explained by the overall panel regression model.

As a result, the Liquidity Risk factors are highly related to profit and gives evidence that the model will predict accurately.

Table 4.3: Regression Parameters 1

	Coefficient Estimates	Standard Error	t value	Pr(>Itl)
Intercept	-4.3997e+06	2.3489e+06	-1.8731	0.062185
LG	1.0099e-01	3.1037e-02	3.2537	0.001291
Deposits	6.8832e-02	6.3020e-03	10.9221	<2.2e-16
NPL	-6.9040e-01	1.3750e-01	-5.0211	9.592e-07
NLD	-1.1376e+06	2.9823e+06	-0.3815	0.703176
LEV.	1.5959e+05	2.2445e+05	0.7110	0.477708

Analysis 1

From Table 4.3, the regression model is given by:

$$PBT = 0.1LG + 0.07 Deposits - 0.69NPL - 1,137,600NLD + 159,590Lev. - 4,399,700$$

$$(4.1)$$

This means that Profit is positively correlated to Liquidity Gap, Deposits and Leverage Ratio but negatively correlated to Non-Performing Loans and the ratio of Net Loans to Deposits.

4.3   Significance of the model

In assessing the significance of the Profit $-$ Liquidity Risk model, the researcher tested the hypothesis for the significance of the regression relationship between Profit and Liquidity Risk factors at a significant level of 5%.

Model 2

For the test of significance of the Panel regression model, the Null (H_0) and Alternative (H_1) Hypothesis respectively is;

$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ (i.e. none of the Liquidity Risk factors is related to Profit or the Panel regression relation is not significant).

H_A : At least one of $\beta_i's \neq 0$ (i.e. at least one of the Liquidity Risk factors are significantly related to profit or the Panel regression relation is significant).

The Decision Rule was;

Reject H_0 if the P-Value is less than the Significance level, $\alpha = 5\%$.

Analysis 2

On examining Table 4.2, the P-Value $<$2.22e-16 is less than the significance level of 5%. Consequently, we reject the Null Hypothesis, H_0, and conclude that the

Panel Regression relationship is significant. This means that at least one of the Liquidity Risk factors in the model is significant. We next attempt to decide which factor(s) are significant and which are not.

4.3.1 Significant Factors

Model 3

H_0 : Performance does not depend on Liquidity

H_0 : Performance depends on Liquidity Gap

Decision Rule : If P-Value is less than the level of significance of 5%, reject H_0.

Analysis 3

From Table 4.3; Since the P-Value = 0.001291 is less than 5%, we reject H_0. Hence at a significant level of 5%, the Panel regression relationship between bank performance and Liquidity Gap is significant.

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Model 4

H_0 : Performance does not depend on Deposits

H_1 : Performance depends on Deposits

Analysis 4

From Table 4.3, the P-Value is 2.2e-16. This is less than 5% level of signifi-cance. As a result, we reject H_0. Consequently, the relationship between bank

performance and deposits is significant.

Model 5

H_0 : Performance does not depend on NPL

H_1 : Performance depends on NPL

Analysis 5

On examining Table 4.3, the P-Value of 9.592e-07 is less than the 5% significance level. Hence at a significance level of 5%, the relationship between performance and NPL is significant.

Model 6

H_0 : Performance does not depend on NLD

H_1 : Performance depends on NLD

Analysis 6

Again from Table 4.3, the P-Value of 0.703176 is greater than 5%. Consequently, H_o is accepted. This suggested that the ratio of 'Net Loans to deposits' appears to have no impact on the performance of the banking system.

Model 7

H_0 : Performance does not depend on Lev.

H_1 : Performance depends on Lev.

Analysis 7

On examining Table 4.3, P-Value of 0.7110 is greater than 5%. Thus H_o is accepted and concludes that "Lev. appeared not to have any meaningful impact on the performance of the banking industry.

4.4 Re-run of the Panel Regression Model

Table 4.4: Regression Parameter II

	Coefficient Estimates	Standard Error	t value	Pr(>Itl)
Intercept	-4.1103e+06	1.8489e+06	-2.2231	0.0270608
LG	1.0985e-01	3.0937e-02	3.5509	0.0004548
Deposits	6.6513e-02	6.2339e-03	10.6695	2.2e-16
NPL	-6.8151e-01	1.3459e-1	-5.0636	7.746e-07

.

The Panel regression was re-run without the insignificant parameters, Leverage Ratio and Net Loans to deposits ratios respectively. The results from Table 4.4 showed that the estimated p-values were all less than the 5% confidence level.

Consequently, the fitted model is:

PBT = 0.1 LG + 0.06 Deposits − 0.68 NPL − 4,110,300

This was in contrast to the assertions by Arif & Anees (2012) and Sohaimi (2013) that performance is dependent on Liquidity Gap, Deposits, NPL and Net loans to Deposits. The observed difference could be attributed to the presence of multicollinearity in the data obtained.

The results showed there is a positive relationship between profitability, Deposits and Liquidity Gap (Arif & Anees, 2003).

This implied that the more the Deposits mobilized, the better the performance of the banking system. Again, the more the banks do not register any mismatch (i.e.

negative Liquidity Gap), the better its performance. Profitability, however, had an adverse relation with Non-Performing Loans. This was affirmed by Sohaimi (2003) and Anbar & Alper (2011).

4.5   Cross-Vadilation of the Panel Regression Model

4.5.1   2-fold Cross-Validation or Holdout Method

The sample data of the banking industry was divided into two sets; data for year 2004 to 2008 and that for year 2009 to 2013. The Panel Regression was run for each data set and the results were as follows.

Table 4.5: Year 2004 to 2008

	Coefficient Estimates	Standard Error	t value	$P(>Itl)$
Intercepts	-3.7346E+05	1.1860E+06	-0.3149	0.7532035
LG	1.5015E-01	4.1183E-02	3.6459	0.0003467
Deposits	3.3398E-02	7.5971E-03	4.3962	1.859E-05
NPL	-3.1400E-01	9.6832E-02	-3.2427	0.001406

From Table 4.5, the fitted model for year 2004 to 2008 is:

$$PBT = 0.15\ LG + 0.03\ DEP\ -0.31\ NPL\ -373,460 \qquad (4.2)$$

The model in (4.2) was used to predict the PBT values for the data set for year 2009 to 2013. The Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE) estimates from the initial and resultant predicted values of PBT were:

RMSE = 37,092,263.42

MAE = 21,491,899.14

Table 4.6: Year 2009 to 2013

	Coefficient Estimate	Standard Error	t value	$P(>Itl)$
Intercepts	-9.3965E+06	3.5603E+06	-2.6393	0.0092434
LG	9.9074E-02	4.0654E-02	2.4370	0.0160544
Deposits	7.4050E-02	8.4758E-03	8.7366	6.333E-15
NPL	-7.1766E-01	2.0420E-01	-3.5145	0.0005928

From Table 4.6, the fitted model for year 2009 to 2013 is:

$$PBT = 0.10 \ LG + 0.74 \ DEP - 0.72 \ NPL - 9,396,500 \qquad (4.3)$$

The model in (4.3) was used to predict the PBT values for the data set for year 2004 to 2008. The Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE) estimates from the initial and resultant predicted values of PBT were:

RMSE = 198,302,896.70

MAE = 128,903,379.70

Since the RMSE and MAE of the predicted values for year 2004 to 2008 were smaller or less than that for year 2009 to 2013, then the best fit for the model is:

$$PBT = 0.15 \ LG + 0.03 \ DEP - 0.31 \ NPL - 373,460 \qquad (4.4)$$
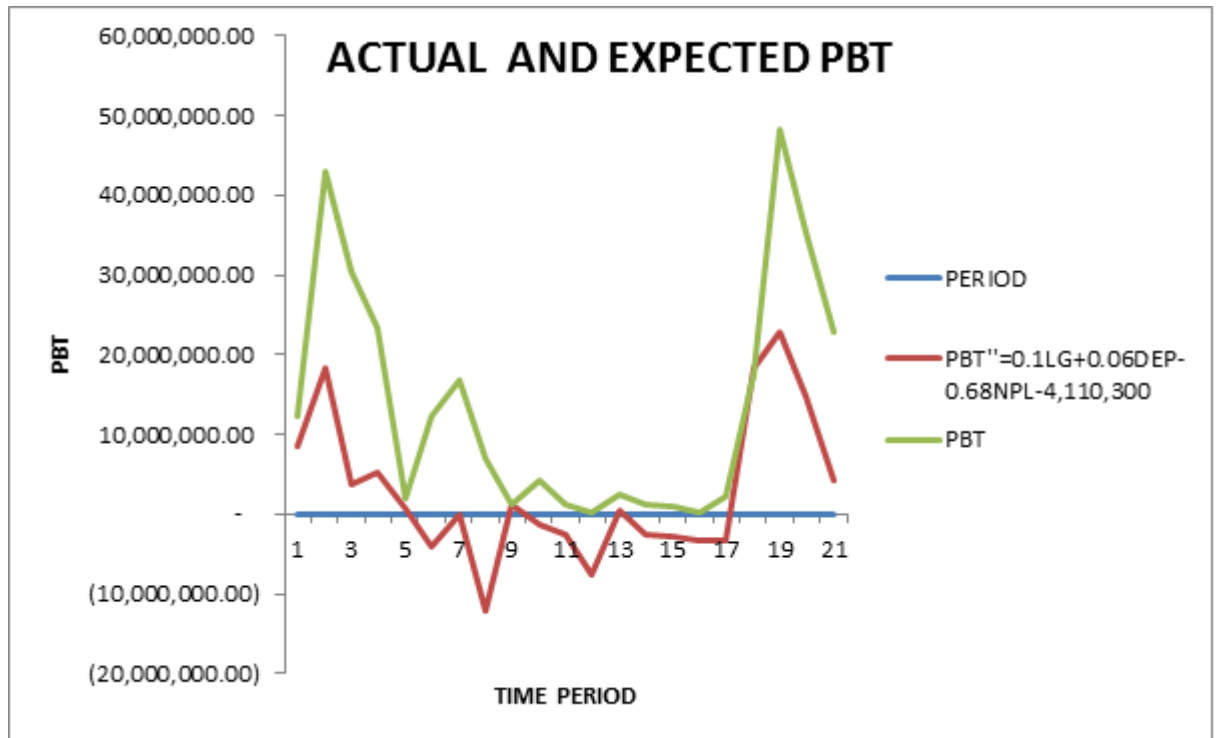
Scenario analysis of PBT.

Figure 4.1: PBT AGAINST TIME PERIOD

From the Figure 4.1, a graph of actual PBT was plotted against the expected PBT that was determined from the model. It was observed that the trend of the expected and the actual were similar; however there was a lag between the two scenarios as can be seen. This could be attributed to the insignificant parameters (leverage ratio and net loans to deposit ratio) that were discarded during the re-run regression process.
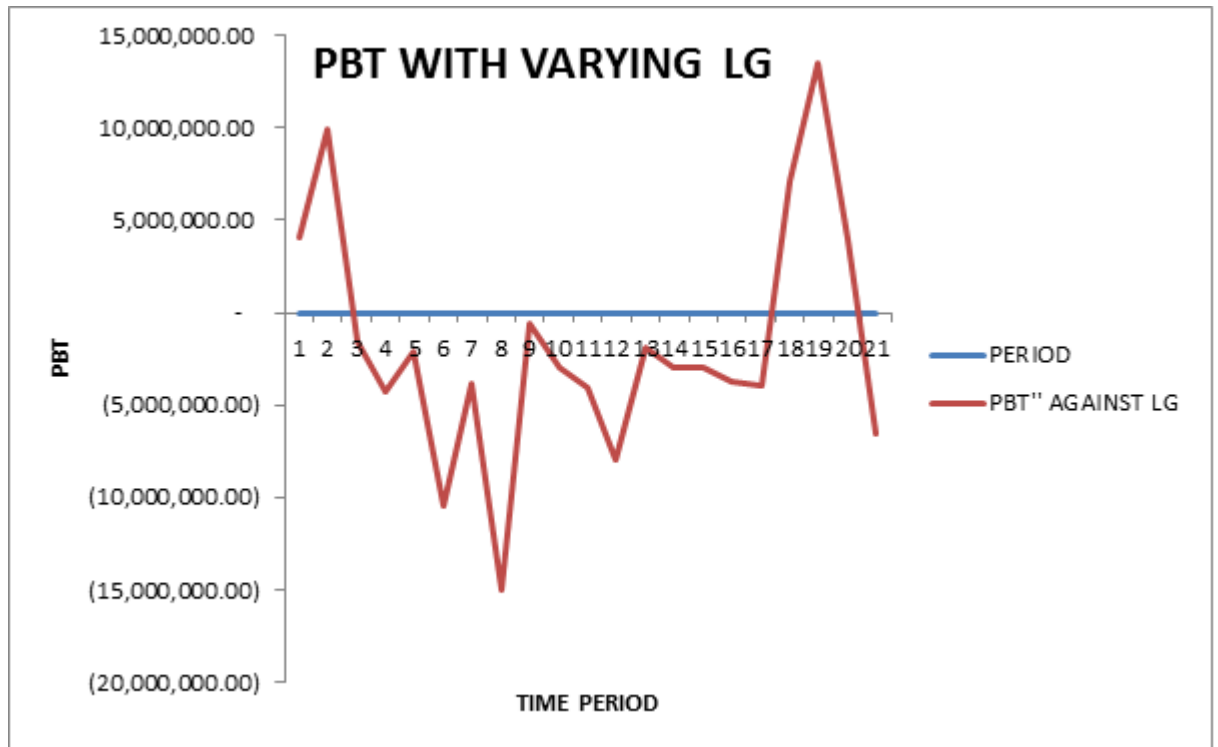
Figure 4.2: PBT WITH VARYING LG

Above is Figure 4.2, a graph of actual PBT plotted against time period. All other parameters were held constant whiles LG was varied. So that between period three (3) and seventeen(17), PBT recorded negative values ie loss while LG was increasing.
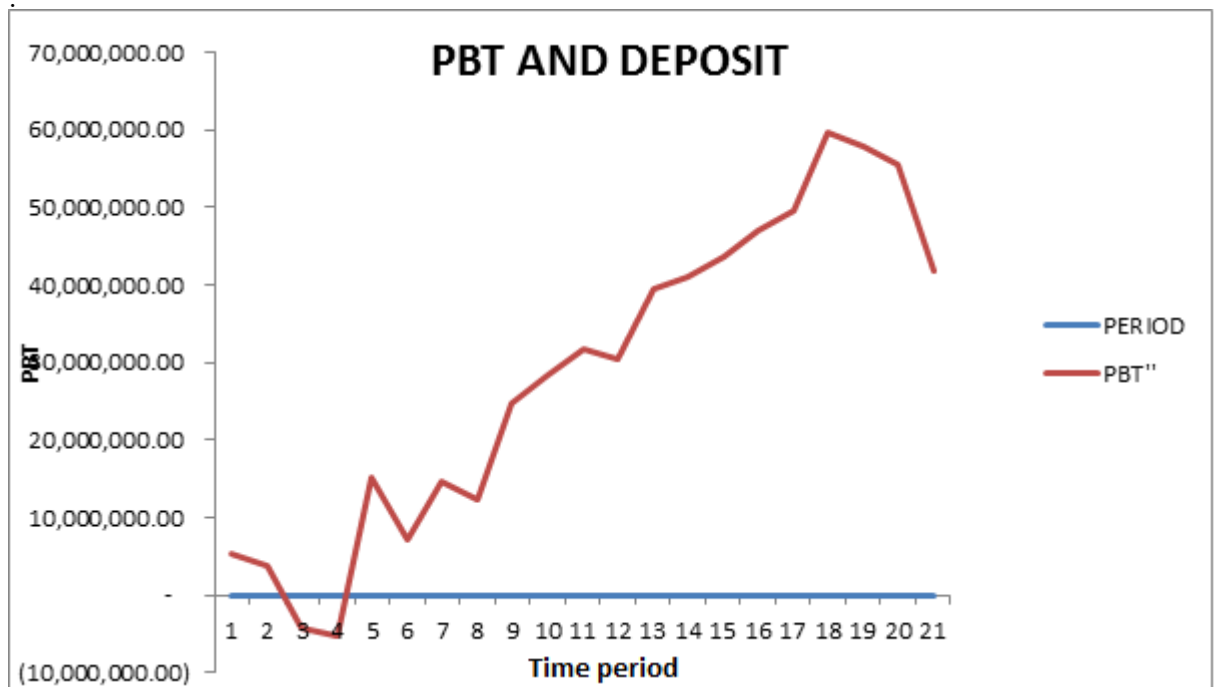
Figure 4.3: PBT and Deposit.

From Figure 4.3, as deposit level increases, Profit (i.e. PBT) increases. In this case, deposits were varied while all other parameters were held constant.
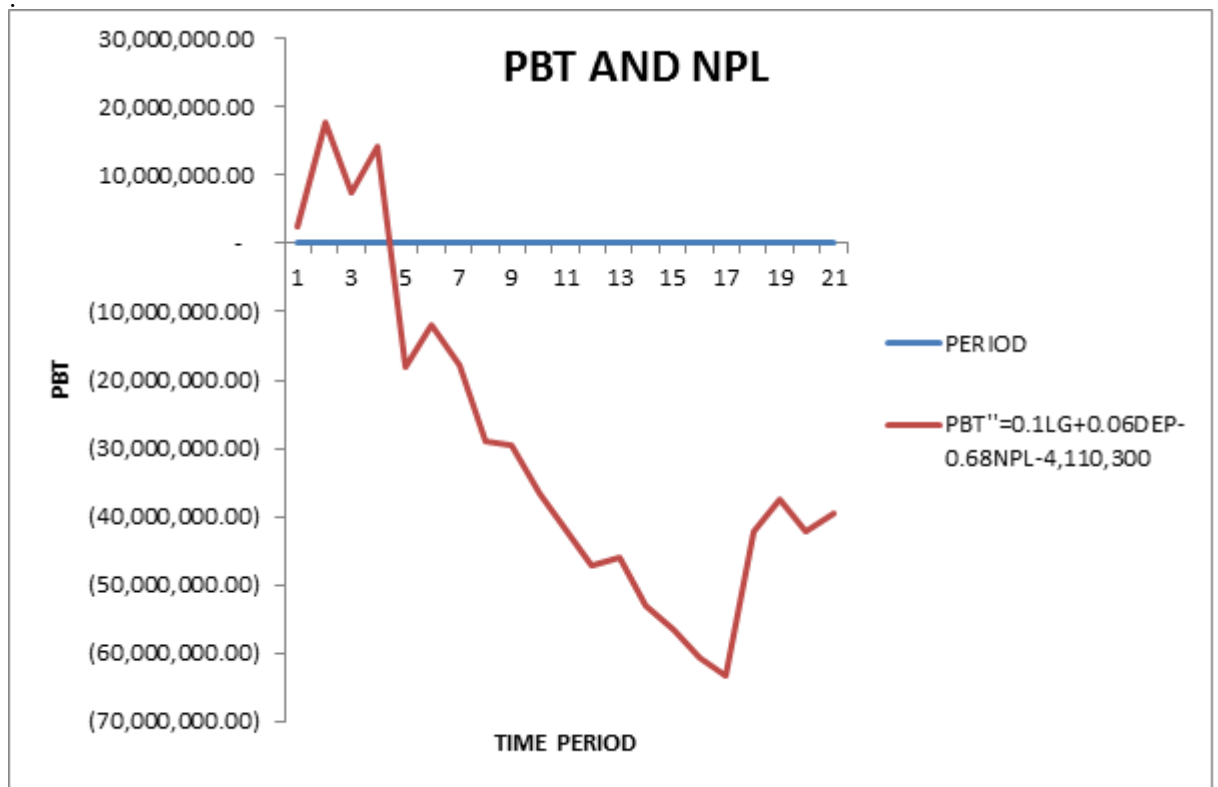
Figure 4.4: PBT and NPL

From Figure 4.4, as NPL increases, PBT declines. All other parameters were held constant.

4.6 Capital provisioning for Liquidity-at-Risk

Table 4.7: VaR for Assets and Liabilities for Average Bank in Ghana @95% and 99% CI

AVERAGE BANK	GHS '000	VaR@95%CI	VaR@99%CI
ASSETS			
Cash & Bank Balances	46,077,854	(4,253,500)	(2,905,428)
Govt Securities	53,045,684	(4,896,709)	(3,344,783)
Due from other Liabilities	20,392,820	(1,534,442)	(968,267)
Loans & Advances(Net)	157,549,406	(35,255,647)	(32,239,902)
Other Assets	11,417,282	(2,554,904)	(2,336,360)
PPE	6,762,273	(1,513,229)	(1,383,788)
TOTAL ASSETS	295,245,319	(50,008,431)	(43,178,529)
LIABILITIES			
Deposits	215,563,773	(15,307,903)	(11,131,765)
Due to other Banks & Fin. Inst.	10,857,448	(816,960)	(515,520)
Borrowings	21,031,276	(1,168,536)	(625,348)
Other Liabilities	18,694,688	(1,291,381)	(926,795)
TOTAL LIABILITIES	266,147,185	(18,584,780)	(13,199,428)
Net Liquidity Gap	29,098,134	(31,423,650)	(29,979,100)

.

From Table 4.5, It could be observed that VaR for 1 per cent confidence level gives an estimated loss of GHS 29,979,100 which is higher than 10% of total deposit (ie GHS 21,556,377) which is required by Bank of Ghana as a regulatory liquidity risk capital. This means that banks in Ghana are under reserving for liquidity risk capital. The situation gets worse when a confidence level of 5 per cent is used for the assessment. This gives an estimated loss of GHS 31,423,650 for an average Ghanaian bank.

Refer to Table 5.1 for the process involved in the estimation of results.

Chapter 5

Summary, Conclusion and Recommendations

5.1 Introduction

Under this section, the implication of the results of the study are analyzed and put into proper theoretical perspective through discussions and subsequently draw inferences in relation to the study's main objectives and hypothesis.

5.2 Conclusion

The purpose of the study was to establish the effect of Liquidity Risk on the performance of the banking system− specifically, the strength of the relationship between Liquidity Risk and performance of the banking system in Ghana.

- The analysis showed that a linear relation exists between Liquidity Risk and Performance of the Ghanaian Banking System of the form:

$$PBT = 0.15 \ LG + 0.06 \ DEP - 0.31 \ NPL - 373,460. \qquad (5.1)$$

  This means that PBT is inversely related to NPL but has direct relation with Liquidity Gap and Deposits.

- 62.85% of the total variation in the two hundred and sixty (260) observed values of profit was explained by the overall panel regression model. As a result the Liquidity Risk factors are highly related to performance and gave evidence that the model will predict accurately. This goes to support the argument that performance of the banking system is dependent on Liquidity Risk factors.

- Minimum and maximum deposits level was GHS 1.03 million and GHS 3,221.00 million respectively. This indicates that deposit mobilization has been on the rise and could boost the liquidity position of the financial system.

- NPL portfolio grew from GHS 5, 614 to GHS 71.17 million during the study period. The growth in NPL meant that the quality of the industry's loan portfolio is on the decline. This could have adverse effects on the liquidity position.

- The industry's Profit Before Tax (PBT) grew from a loss of GHS 47.88 million to GHS 311.22 million, averaging GHS 21.90 million over the period.

5.3   Recommendations

1. Profit making by the banks is largely dependent on mobilized deposits and the creation of liquidity to the public through loans granted. However, the fear that depositors may rush in to withdraw in times of financial crisis may result in a bank run. This may affect a bank's ability to make profit. There is the need for banks to take a look at Deposit Insurance as a means of precaution against liquidity risk associated with large scale withdrawal in times of financial crisis.

2. Impairment in the quality of loans granted may affect the profit of the banks (since Profit and NPL are adversely related from the study). There should be effective and efficient loan assessments prior to disbursement. Continuous monitoring mechanism should also be in place after the disbursement to enhance the quality of the loan portfolio and the level of Profit.

References

Abdullah (1994). Profitability of Islamic Banks in the GCC Region.

Acharya, Shin & Yorulmazer (2009). Crisis Resolution and Bank Liquidity.

Ali (2004). "Islamic modes of finance and associated liquidity risks",Conference on Monetary Sector in Iran: Structure, Performance and Challenging Issues,Tehran, p. 20.

Anin (2000). Banking in Ghana.

Anbar, A., & Alper, D. (2011). Bank specific and macroeconomic determinants of commercial bank profitability: empirical evidence from Turkey. *Business and Economics Research Journal*, 2(2), 139-152.

Arif, A., & Anees, A. (2012). Liquidity risk and performance of banking system. Journal of Financial Regulation and Compliance, 20(2), 182-195.

Ariffin, A. F., & Tafri, F. H. The Impact of Financial Risks on Islamic Banks Profitability.

Arlot, S. &Celisse, A. (2010).A Survey of Cross-Validation Procedures for Model Selection

Athanasoglou, P., Delis, M., & Staikouras, C. (2006). Determinants of bank profitability in the South Eastern European region.

Bagheri, H. (2007). The analysis of the effective factors on the profitability of

Commercial Banks.

Bank of Ghana Annual Reports (2005, 2014).

Barth (2003). The Impact of Liquidity on performance:Empirical Study on Ethiopian Private Commercial Banks.

Basel Committee on Banking Supervision (2008). Principles for Sound Liquidity Risk Management.

Bashir (2000). The effective factors on the performance of Islamic banks.

Beck, Dermirgue-Kunt & Levine (1999). A New Database on Financial Development and Structure. World Bank Economic Review 14, 597-605.

Beakly and Cowan (2004). Maturity Mismatch and Financial Crisis: Evidence from Emerging Market Corporation, *"Journal of Development"*.

Bessis, J. (2006). Risk Management in Banking.

Berger, A. N. (1995). The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking*, 432-456.

Bernanke (2008). Liquidity Provision by the Federal Reserve Risk Transfer Mechanisms and Financial Stability Workshop, Basel, Switzerland.

Biddle (1997, 1999) Strategic Financial Management & Firms' Performance.

Birge, J. R., & Judice, P. (2013). Long-term bank balance sheet management:

Estimation and simulation of risk-factors. *Journal of Banking & Finance*, 37(12), 4711-4720.

Bank for International Settlement (2008). Funding of Liquidity Risk: Definition and Measurement. BIS Working Papers No 316.

Boot, Greenbaum & Thakor (1993). Security design, *Journal of Finance* 48: 1349-1378.

BPP Publishing (2005). Financial Management.

Bouwman, C. H. (2013). Liquidity: How banks create it and how it should be regulated.

Bourke (1989). "Concentration and other Determinants of Bank Profitability in Europe". *Journal of Banking and Finance*, pp 65-80.

Bryant (1980). 'A model of reserves, bank runs, and deposit insurance', *Journal of Banking and Finance* 4: 335-344.

Central Bank of Barbados (2008). Liquidity Risk Management Guideline, Bank Supervision Department, Central Bank of Barbados, Bridgetown.

Chen (2010). Bank Liquidity Risk and Performance. Journal of Financial Regulation, 20(2).

Chirwa, E. W. (2003). Determinants of commercial banks' profitability in Malawi: a cointegration approach. *Applied Financial Economics*, 13(8), 565-571.

Chollete, L., Naes, R., & Skjeltorp, J. (2007). What Captures Liquidity Risk?. *A Comparison of Trade and Order Based Liquidity Factors* (No. 2007/03).

Demirguc-Kunt (1998). Opening to Foreign Banks: Issues of Stability, Efficiency and Growth.

Diamond & Rajan (2000, 2001). Banks, short-term debt and financial crises: theory, policy implications and applications.

Diamond & Dybvig (1983). Journal of Political Economy 85, 191 206.

Dell'Ariccia, Detragiache & Rajan (2009): 'The real effects of banking crises',*Journal of Financial Intermediation* 17: 89-112.

Drehmann & Nikolau (2009). Funding Liquidity, Market Liquidity and TED Spread.

Duffie, D., & Pan, J. (1997). An overview of value at risk. *The Journal of derivatives*, 4(3), 7-49.

Falconer (2001). The Financial Health Of The Banking Industry. https://www.ukessays.com/di review/the-financial-health-of-the-banking-industry.php?cref=1.

Ferias & Richet (2008). Microeconomics of Banking, 2nd Edition.

Ghana Review International (1999).

Goddard, J., Molyneux, P., & Wilson, J. O. (2004). The profitability of european banks: a cross-sectional and dynamic panel analysis. *The Manchester*

School,72(3), 363-381.

Goodhart, C. (2011). The Basel committee on banking supervision: *A history of the early years 1974-1997.* Cambridge University Press.

Gorton & Winton (2000). Liquidity provision, Bank capital, and the Macroeconomy, University of Minnesota working paper.

Greenbaum & Thakor (1995). Managing Banking Liquidity Risk in the Current Economic Conditions: A Conceptual Framework.

Helmen, G., Simonson, D., & Coleman, A. (1994). Bank Management: Text and Cases. America: John Wiley & Sons, Inc, 4.

Holmstrom & Tirole (1998). Public and private supply of liquidity, *Journal of Political Economy* 106:1-40.

Ismal (2010). Money, Islamic Banks and the Real Economy. Singapore: Cengage Learning.

Jenkison (2008). Liquidity Risk and Performance in the Banking Sector.

Jorion, P. (2002). How informative are value-at-risk disclosures?. *The Accounting Review*, 77(4), 911-931.

Kashyap, Rajan & Stein (2002). Banks as Liquidity Providers: An explanation for the Co-Existence of Lending and Deposit-Taking.

Koch & Macdonald (2006). Bank Management.

Kosmidou, K., & Zopounidis, C. (2008). Measurement of bank performance in Greece. *South Eastern Europe Journal of Economics*, 6(1),79-95.

Kosmidou, K., Tanna, S., & Pasiouras, F. (2005). Determinants of profitability of domestic UK commercial banks: panel evidence from the period 1995-2002. In Money Macro and Finance (MMF) Research Group Conference (Vol. 45).

Kumar (2008). Liquidity Risk and the Banking System.

Longworth (2010). "Bank of Canada Liquidity Facilities: Past, Present, and Future".

Molyneux, P. & Thornton, J. (2004). Determinants of European bank profitability: A note. Journal of banking & Finance, 16(6), 1173-1178.

Muranaga & Ohsaw (2002). Measurement of liquidity risk in the context of market risk calculation, working paper, Institute for Monetary and Economic Studies, Bank of Japan,Tokyo.

O'Byrne (1996). Financial Performance Measures and Value Creation: the State of the Art.

Peterson & Peterson (1999). Company Performance and Measures of Value Added.

Pettway & Sinkey (1980). 'Establishing On-Site Bank Examination Priorities: An Early Warning System Using Accounting and Market Information', *Journal of Finance*, 35(1).

Rose & Hudgins (2005). Bank Management and Financial Services, Seventh Edition II. Financial Statements and Financial Firm.

Saunders & Cornet (2007). Financial Markets and Institutions: An Introduction to the Risk Management Approach.

Sharma (2004). Islamic Banking in Indonesia: New Perspectives on Monetary and Financial Issues.

Shen, C. H., Chen, Y. K., Kao, L. F., & Yeh, C. Y. (2009, June). Bank liquidity risk and performance. In *17th Conference on the Theories and Practices of Securities and Financial Markets, Hsi-Tze Bay, Kaohsiung, Taiwan.*

Sinkey (2002). Commercial Bank Financial Management.

Sohaimi (2013). Liquidity Risk and Performance of Banking System in Malaysia.

Tabari, N. A., Ahmadi, M., & Emami, M. (2013). The Effect of Liquidity Risk on the Performance of Commercial Banks. *International Research Journal of Applied and Basic Sciences*, 4(6), 1624-1631.

Thakor (2005). Do Loan Commitments Cause Over lending?

Van Horne (2002). Financial Management and Policy.

Zhu (2001). Bank runs, Welfare and Policy Implications. Working paper No. 107 Bank for International Settlements, Basel.

Appendix

Table 5.1: Computation of Weighted Average Period of the Liabilities

Liabilities	0 - 3 months GH₵' Bn	3 - 6 months GH₵' Bn	6 -12 months GH₵' Bn	12 - 24 months GH₵' Bn	TOTAL GH₵' Bn	W$_{AV}$ Months	RATE USED	STANDARD DEVIATION
Deposits	78.254	22.023	46.743	68.543	215.564	8.68	I yr deposit	0.0284273
Other Banks	9.959	0.654	0.243	0.001	10.857	1.85	3 months inter bank	0.0407390
Borrowing	9.588	3.712	4.351	3.380	21.031	6.23	Borrowing	0.0378985
Other Liabilities	1.417	1.777	3.400	12.099	18.695	13.83	2 yrs Borrowing	0.0286167
Total Liab.	99.212	28.167	54.737	84.023	266.147			

Table 5.2: Computation of Weighted Average Period for the Assets

Assets	0 - 3 months GH¢' Bn	3 - 6 months GH¢' Bn	6 - 12 months GH¢' Bn	12 - 24 months GH¢' Bn	TOTAL GH¢' Bn	W_Av Months	RATE USED	STANDARD DEVIATION
Cash & Banks	26.680	0.050	0.040	19.308	46.077	8.42	1 Yr Tbill rate	0.04292978
Govt. Securities	15.398	5.357	14.270	18.021	53.046	9.42	1 yr Tbill rate	0.04292978
Balances Due from Banks	14.278	0.563	0.452	5.100	20.393	5.88	6 Mths Inter bank Av. lending	0.040739034
Loans	46.663	21.601	20.643	68.642	157.549	10.08	1 yr Av. Lending rate	0.028087664
Other Assets	2.076	0.152	1.539	7.651	11.417	13.61	2 yrs Av. lending rate	0.028087664
PPE	0.888	0.537	0.413	4.924	6.762	14.21	2 yrs Av. lending	0.028087664
TOTAL Assets	105.982	28.260	37.357	123.646	295.245			

Table 5.3: Computation of VaR

Assets	GH¢' Bn (P_0)	Average return	Standard Deviation	Min.Ret@ α = 5% (CI = 95%)	Portfolio Value GH¢' Bn P_0 [1+Min.Ret]	VaR GH¢' Bn
Cash & Banks	46.077	0.1629243	0.04292978	0.0923111	50.331	(4.254)
Securities	53.046	0.1629243	0.04292978	0.0923111	57.942	(4.897)
From Banks	20.393	0.1422539	0.04073903	0.0752442	21.927	(1.534)
Loans	157.549	0.2699752	0.02808766	0.2237751	192.805	(35.256)
Other Assets	11.417	0.2699752	0.02808766	0.2237751	13.972	(2.554)
PPE	6.762	0.2699752	0.02808766	0.2237751	8.276	(1.513)
TOTAL Assets	295.245				345.254	(50.008)

Table 5.4: Computation of VaR

Liabilities	GHc' Bn (P₀)	Average return	Standard Deviation	Min.Ret@ α = 5% (CI = 95%)	Portfolio Value GHc' Bn P₀ [1+Min.Ret]	VaR GHc' Bn
Deposits	215.564	0.11777222	0.02842738	0.07101333	230.872	(15.308)
Due to Other banks	10.857	0.14225395	0.04073903	0.07524420	11.674	(0.817)
Borrowings	21.031	0.11789933	0.03789852	0.05556180	220.199	(1.169)
Other Liab.	18.695	0.11614777	0.06907745	0.06907744	19.986	(1.291)
Total Liab.	266.147			284.732		(18.585)
Net Liquidity Gap						(31.424)

Table 5.5: VaR Computations for Average Ghanaian Bank at $\alpha = 1\%$

AVERAGE BANK							
ASSETS	GHS '000	Ave Return	STD	CI@99%	Min. Ret @99%CI	Val. of Portfolio	VaR
Cash & Bank Balances	46,077,854	0.162924367	0.04292978	0.99	0.063054766	48,983,283	(2,905,428)
Govt Securities	53,045,684	0.162924367	0.04292978	0.99	0.063054766	56,390,467	(3,344,783)
Due from other Liabilities	20,392,820	0.142253956	0.040739034	0.99	0.047480789	21,361,087	(968,267)
Loans & Advances(Net)	157,549,406	0.269975278	0.028087664	0.99	0.204633600	189,789,308	(32,239,902)
Other Assets	11,417,282	0.269975278	0.028087664	0.99	0.204633600	13,753,642	(2,336,360)
PPE	6,762,273	0.269975278	0.028087664	0.99	0.204633600	8,146,061	(1,383,788)
TOTAL ASSETS	295,245,319					338,423,848	(43,178,529)
Liabilities							
Deposits	215,563,773	0.117772222	0.028427382	0.99	0.051640241	226,695,539	(11,131,765)
Due to other Banks & Fin. Inst.	10,857,448	0.142253956	0.040739034	0.99	0.047480789	11,372,968	(515,520)
Borrowings	21,031,276	0.117899333	0.037898524	0.99	0.029734182	21,656,624	(625,348)
Other Liabilities	18,694,688	0.116147778	0.028616728	0.99	0.049575313	19,621,483	(926,795)
TOTAL LIABILITIES	266,147,185					279,346,613	(13,199,428)
Net Liquidity Gap	29,098,134					59,077,234	(29,979,100)

Table 5.6: VaR Computations for Average Ghanaian Bank for $\alpha = 5\%$

AVERAGE BANK	GHS '000	Ave Return	STD	CI 95%	Min. Ret @95%CI	Val of Portfolio	VaR
ASSETS							
Cash & Bank Balances	46,077,854	0.162924367	0.04292978	0.95	0.092311163	50,331,355	(4,253,500)
Govt Securities	53,045,684	0.162924367	0.04292978	0.95	0.092311163	57,942,393	(4,896,709)
Due from other Liabilities	20,392,820	0.142253956	0.040739034	0.95	0.075244207	21,927,261	(1,534,442)
Loans & Advances(Net)	157,549,406	0.269975278	0.028087664	0.95	0.223775182	192,805,053	(35,255,647)
Other Assets	11,417,282	0.269975278	0.028087664	0.95	0.223775182	13,972,187	(2,554,904)
PPE	6,762,273	0.269975278	0.028087664	0.95	0.223775182	8,275,502	(1,513,229)
TOTAL ASSETS	295,245,319					345,253,750	(50,008,431)
Liabilities							
Deposits	215,563,773	0.117772222	0.028427382	0.95	0.071013339	230,871,677	(15,307,903)
Due to other Banks & Fin. Inst.	10,857,448	0.142253956	0.040739034	0.95	0.075244207	11,674,408	(816,960)
Borrowings	21,031,276	0.117899333	0.037898524	0.95	0.055561808	22,199,812	(1,168,536)
Other Liabilities	18,694,688	0.116147778	0.028616728	0.95	0.069077449	19,986,069	(1,291,381)
TOTAL LILIABILITIES	284,731,966					266,147,185	(18,584,780)
Net Liquidity Gap	60,521,784					29,098,134	(31,423,650)

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Table 5.7: Scenario Analysis 1

PBT	LG	DEPOSIT	NPL	PERIOD	PBT" AGAINST LG	PBT
12,250,400.00	100,000.00	150,339,800.00	1,258,600.00	1.00	4,064,240.00	12,250,400.00
43,055,100.00	200,000.00	392,995,000.00	14,013,000.00	2.00	9,960,560.00	43,055,100.00
30,483,500.00	300,000.00	330,664,500.00	25,509,800.00	3.00	-1,587,094.00	30,483,500.00
23,380,400.00	400,000.00	426,573,300.00	37,944,400.00	4.00	-4,278,094.00	23,380,400.00
2,007,290.00	500,000.00	57,594,660.00	2,198,950.00	5.00	-2,099,906.40	2,007,290.00
12,285,300.00	600,000.00	160,370,400.00	23,615,200.00	6.00	-10,486,412.00	12,285,300.00
16,867,000.00	700,000.00	157,992,300.00	13,693,400.00	7.00	-3,872,274.00	16,867,000.00
7,082,900.00	800,000.00	44,670,300.00	20,053,300.00	8.00	-14,986,326.00	7,082,900.00
1,122,290.00	900,000.00	107,859,300.00	4,487,200.00	9.00	-600,038.00	1,122,290.00
4,143,500.00	1,000,000.00	54,268,700.00	3,248,200.00	10.00	-2,962,954.00	4,143,500.00
1,122,290.00	1,100,000.00	25,573,570.00	2,294,410.00	11.00	-4,026,084.60	1,122,290.00
227,300.00	1,200,000.00	13,068,200.00	7,009,300.00	12.00	-7,972,532.00	227,300.00
2,520,500.00	1,300,000.00	50,395,000.00	1,375,000.00	13.00	-1,891,600.00	2,520,500.00
1,135,580.00	1,400,000.00	25,751,660.00	807,030.00	14.00	-2,973,980.80	1,135,580.00
1,004,150.00	1,500,000.00	25,307,550.00	838,540.00	15.00	-3,012,054.20	1,004,150.00
145,790.00	1,600,000.00	11,220,600.00	664,020.00	16.00	-3,728,597.60	145,790.00
2,259,510.00	1,700,000.00	17,289,130.00	1,513,610.00	17.00	-3,932,207.00	2,259,510.00
17,629,000.00	1,800,000.00	256,845,900.00	6,352,000.00	18.00	7,161,094.00	17,629,000.00
48,233,700.00	1,900,000.00	417,868,100.00	11,198,000.00	19.00	13,537,146.00	48,233,700.00
35,435,200.00	2,000,000.00	371,846,900.00	21,176,900.00	20.00	4,000,222.00	35,435,200.00
22,903,700.00	2,100,000.00	473,839,200.00	45,671,100.00	21.00	-6,526,296.00	22,903,700.00

Table 5.8: Scenario Analysis 2

PBT	LG	DEPOSIT	NPL	PERIOD	PBT''=0.1LG+0.06DEP-0.68NPL-4,110,300	PBT
12,250,400.00	43,687,800.00	150,339,800.00	10,000,000.00	1.00	2,478,868.00	12,250,400.00
43,055,100.00	84,940,100.00	392,995,000.00	15,000,000.00	2.00	17,763,410.00	43,055,100.00
30,483,500.00	52,381,600.00	330,664,500.00	20,000,000.00	3.00	7,367,730.00	30,483,500.00
23,380,400.00	95,973,900.00	426,573,300.00	25,000,000.00	4.00	14,081,488.00	23,380,400.00
2,007,290.00	28,277,050.00	57,594,660.00	30,000,000.00	5.00	-18,226,915.40	2,007,290.00
12,285,300.00	63,907,700.00	160,370,400.00	35,000,000.00	6.00	-11,897,306.00	12,285,300.00
16,867,000.00	39,680,300.00	157,992,300.00	40,000,000.00	7.00	-17,862,732.00	16,867,000.00
7,082,900.00	30,290,000.00	44,670,300.00	45,000,000.00	8.00	-29,001,082.00	7,082,900.00
1,122,290.00	19,703,300.00	107,859,300.00	50,000,000.00	9.00	-29,668,412.00	1,122,290.00
4,143,500.00	16,603,800.00	54,268,700.00	55,000,000.00	10.00	-36,593,798.00	4,143,500.00
1,122,290.00	14,682,510.00	25,573,570.00	60,000,000.00	11.00	-41,907,634.80	1,122,290.00
227,300.00	4,403,400.00	13,068,200.00	65,000,000.00	12.00	-47,085,868.00	227,300.00
2,520,500.00	25,986,200.00	50,395,000.00	70,000,000.00	13.00	-46,087,980.00	2,520,500.00
1,135,580.00	6,698,340.00	25,751,660.00	75,000,000.00	14.00	-52,895,366.40	1,135,580.00
1,004,150.00	4,071,620.00	25,307,550.00	80,000,000.00	15.00	-56,584,685.00	1,004,150.00
145,790.00	4,688,490.00	11,220,600.00	85,000,000.00	16.00	-60,768,215.00	145,790.00
2,259,510.00	8,420,130.00	17,289,130.00	90,000,000.00	17.00	-63,430,939.20	2,259,510.00
17,629,000.00	112,321,700.00	256,845,900.00	95,000,000.00	18.00	-42,067,376.00	17,629,000.00
48,233,700.00	95,613,500.00	417,868,100.00	100,000,000.00	19.00	-37,476,864.00	48,233,700.00
35,435,200.00	111,094,500.00	371,846,900.00	105,000,000.00	20.00	-42,090,036.00	35,435,200.00
22,903,700.00	110,422,700.00	473,839,200.00	110,000,000.00	21.00	-39,437,678.00	22,903,700.00

Table 5.9: Scenario Analysis 3

PBT	LG	DEPOSIT	NPL	PERIOD	PBT"	PBT
12,250,400.00	43,687,800.00	100,000,000.00	1,258,600.00	1.00	5,402,632.00	12,250,400.00
43,055,100.00	84,940,100.00	150,000,000.00	14,013,000.00	2.00	3,854,870.00	43,055,100.00
30,483,500.00	52,381,600.00	200,000,000.00	25,509,800.00	3.00	-4,218,804.00	30,483,500.00
23,380,400.00	95,973,900.00	250,000,000.00	37,944,400.00	4.00	-5,315,102.00	23,380,400.00
2,007,290.00	28,277,050.00	300,000,000.00	2,198,950.00	5.00	15,222,119.00	2,007,290.00
12,285,300.00	63,907,700.00	350,000,000.00	23,615,200.00	6.00	7,222,134.00	12,285,300.00
16,867,000.00	39,680,300.00	400,000,000.00	13,693,400.00	7.00	14,546,218.00	16,867,000.00
7,082,900.00	30,290,000.00	450,000,000.00	20,053,300.00	8.00	12,282,456.00	7,082,900.00
1,122,290.00	19,703,300.00	500,000,000.00	4,487,200.00	9.00	24,808,734.00	1,122,290.00
4,143,500.00	16,603,800.00	550,000,000.00	3,248,200.00	10.00	28,341,304.00	4,143,500.00
1,122,290.00	14,682,510.00	600,000,000.00	2,294,410.00	11.00	31,797,752.20	1,122,290.00
227,300.00	4,403,400.00	650,000,000.00	7,009,300.00	12.00	30,563,716.00	227,300.00
2,520,500.00	25,986,200.00	700,000,000.00	1,375,000.00	13.00	39,553,320.00	2,520,500.00
1,135,580.00	6,698,340.00	750,000,000.00	807,030.00	14.00	41,010,753.60	1,135,580.00
1,004,150.00	4,071,620.00	800,000,000.00	838,540.00	15.00	43,726,654.80	1,004,150.00
145,790.00	4,688,490.00	850,000,000.00	664,020.00	16.00	46,907,015.40	145,790.00
2,259,510.00	8,420,130.00	900,000,000.00	1,513,610.00	17.00	49,702,458.20	2,259,510.00
17,629,000.00	112,321,700.00	950,000,000.00	6,352,000.00	18.00	59,802,510.00	17,629,000.00
48,233,700.00	95,613,500.00	1,000,000,000.00	11,198,000.00	19.00	57,836,410.00	48,233,700.00
35,435,200.00	111,094,500.00	1,050,000,000.00	21,176,900.00	20.00	55,598,858.00	35,435,200.00
22,903,700.00	110,422,700.00	1,100,000,000.00	45,671,100.00	21.00	41,875,622.00	22,903,700.00

Table 5.10: Scenario Analysis 4

PBT	LG	DEPOSIT	NPL	PERIOD	PBT''$=0.1$LG$+0.06$DEP-0.68NPL$-4{,}110{,}300$	PBT
12,250,400.00	43,687,800.00	150,339,800.00	1,258,600.00	1.00	8,423,020.00	12,250,400.00
43,055,100.00	84,940,100.00	392,995,000.00	14,013,000.00	2.00	18,434,570.00	43,055,100.00
30,483,500.00	52,381,600.00	330,664,500.00	25,509,800.00	3.00	3,621,066.00	30,483,500.00
23,380,400.00	95,973,900.00	426,573,300.00	37,944,400.00	4.00	5,279,296.00	23,380,400.00
2,007,290.00	28,277,050.00	57,594,660.00	2,198,950.00	5.00	677,798.60	2,007,290.00
12,285,300.00	63,907,700.00	160,370,400.00	23,615,200.00	6.00	-4,155,642.00	12,285,300.00
16,867,000.00	39,680,300.00	157,992,300.00	13,693,400.00	7.00	25,756.00	16,867,000.00
7,082,900.00	30,290,000.00	44,670,300.00	20,053,300.00	8.00	-12,037,326.00	7,082,900.00
1,122,290.00	19,703,300.00	107,859,300.00	4,487,200.00	9.00	1,280,292.00	1,122,290.00
4,143,500.00	16,603,800.00	54,268,700.00	3,248,200.00	10.00	-1,402,574.00	4,143,500.00
1,122,290.00	14,682,510.00	25,573,570.00	2,294,410.00	11.00	-2,667,833.60	1,122,290.00
227,300.00	4,403,400.00	13,068,200.00	7,009,300.00	12.00	-7,652,192.00	227,300.00
2,520,500.00	25,986,200.00	50,395,000.00	1,375,000.00	13.00	577,020.00	2,520,500.00
1,135,580.00	6,698,340.00	25,751,660.00	807,030.00	14.00	-2,444,146.80	1,135,580.00
1,004,150.00	4,071,620.00	25,307,550.00	838,540.00	15.00	-2,754,892.20	1,004,150.00
145,790.00	4,688,490.00	11,220,600.00	664,020.00	16.00	-3,419,748.60	145,790.00
2,259,510.00	8,420,130.00	17,289,130.00	1,513,610.00	17.00	-3,260,194.00	2,259,510.00
17,629,000.00	112,321,700.00	256,845,900.00	6,352,000.00	18.00	18,213,264.00	17,629,000.00
48,233,700.00	95,613,500.00	417,868,100.00	11,198,000.00	19.00	22,908,496.00	48,233,700.00
35,435,200.00	111,094,500.00	371,846,900.00	21,176,900.00	20.00	14,909,672.00	35,435,200.00
22,903,700.00	110,422,700.00	473,839,200.00	45,671,100.00	21.00	4,305,974.00	22,903,700.00