THE IMPACT OF MACROECONOMIC AND BANK-SPECIFIC FACTORS ON THE LIQUIDITY OF THE DOMESTIC COMMERCIAL BANKS IN MALAYSIA

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DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university,
or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

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DEDICATION

This dissertation is dedicated to our supervisor, Mr. William Choo Keng Soon for all his advices and guidance to assist us in completing this thesis.

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et al.	and others
BC	Bank's Capital
BIS	Bank for International Settlement
BLUE	Best Linear Unbiased Estimator
BOPR	Bank's Overnight Policy Rate
BS	Bank's Size
CLRM	Classical Linear Regression Model
CPI	Consumer Price Index
DSU	Deficit Spending Unit
FC	Financial Crisis
GDP	Gross Domestic Products
GLS	Generalized Least Square
KYC	Know your customer
NPL	Non-performing loan
Pooled OLS	Pooled Ordinary Least Square
Ramey RESET Test	Regression Equation Specification Error test
ROE	Return on Equity
SSU	Surplus Spending Unit
VIF	Variance Inflation Factor

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PREFACE

Many past evidences showed that the decrease in liquidity in banks during a financial crisis is the driving force behind the failure of the banking system. Bank's liquidity is explained as the ability of banks in fulfilling their obligations. These include meeting all their depositors' withdrawals. The foundation idea of this paper is to find out the determinants of bank's liquidity. Furthermore, few researches have been done in domestic commercial banks in Malaysia.

Bank's liquidity is measured using the ratio of liquid asset divided by total asset. The higher the ratio, the higher is the bank's liquidity. There are two major factors that will potentially affect the bank's liquidity. These factors are the macroeconomic factors and bank-specific factors.

The macroeconomic factors used are gross domestic product, inflation rate, and financial crisis are. For the bank-specific factors, bank's size, bank's capital, bank's overnight policy rate, bank's profitability, and bank's non-performing loans are used to explain the bank's liquidity.

This thesis includes the background of domestic commercial bank's liquidity, research objective, empirical result, policy implication, and future recommendation.

ABSTRACT

The purpose of this study is to examine the effect of macroeconomic factors and bank-specific factors on the domestic commercial bank's liquidity. The regression model used is Pooled Ordinary Least Square and include eights domestic commercial banks in Malaysia which are Affin Bank, Alliance Bank, AmBank, CIMB Bank, Hong Leong Bank, Maybank, Public Bank and RHB Bank from the year 2005 until 2011. The result shows that bank's size, bank's capital, bank's non-performing loan, bank's overnight policy rate, inflation rate, bank's profitability and gross domestic are significantly in examine the bank's liquidity. While financial crisis is not significant in explaining the bank's liquidity.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

Commercial banks play an important role in the economic development in a country. They are the financial intermediaries that provide an array of services to the consumers. These services can be as diverse as time deposit services, loan services, processing transactions sevices and credit creation services (Dodoo, 2007). Apart from these services, one of the purposes of a commercial bank is to channel funds from the surplus spending unit (SSU) to the deficit spending unit (DSU). In this process banks earn profit from the interests and fees charged. However in the midst of channeling fund process, banks are exposed to the risk that depositors might withdraw large amount of fund which will cause the banks to face a liquidity shock. Basel committee for Banking Supervision explained that liquidity are essential for banks' daily routine operations to meet their short term obligations (Basel Committee on Banking Supervision, 2000).

Thus the aim of this research is to examine how the liquidity of domestic commercial banks is affected by macroeconomic factors as well as bank-specific factors. In this chapter, it will cover the background of study, problem statement, objectives, research questions, hypothesis of the study, significance of study, chapter layout and end with a brief conclusion.

1.1 Research Background

Many past evidences acknowledged that the decrease in liquidity in banks during a financial crisis is the driving force behind the failure of the banking system. Quoting findings from Moore (2009), on average, liquidity of the banks might decrease by 7 percentage points during a crisis. Furthermore, financial crisis usually results in bank panic (Carlson, 2004). During the event, panic depositors will withdraw large amount of deposits from the banks which causes banks to be illiquid. In 2009, Cao explained that illiquidity happens when banks could not sell off their assets or convert them into cash without incurring a loss due to the decrease in value of the assets. Banks that do not hold enough liquid assets to meet these sudden large withdrawals are forced to sell off their investments and assets at fire-sales prices. Archarya, Hyun, and Yorulmazer (2009) pointed out that fire-sales pricing that happens during financial crisis is because of the lost of initial value of the assets. Moreover, the banking sector that has restricted liquidity will restrain the development of economy because an illiquid financial system can reduce the credit in a country. When banks in a country turn illiquid, it will disrupt the economic growth as more organizations start to close down which then leads to more problems including an increase in unemployment rate and decreases in both consumption levels and the aggregate demand (Fisher, 1933; Bernake, 1983).

Table 1.1: Number of Domestic Banks in Malaysia

Year	1980	1990	1997	1999	2001	2003	2005	2010
No. of domestic Banks	21	22	22	21	10	10	10	8

Over the past two decades, the two most noticeable financial crises are the Asian financial crisis in year 1997 and Subprime crisis in year 2008. These two crises have significant effects on the banking industry. The table above shows that before Asian financial crisis 1997 happened, Malaysia has 22 domestic

commercial banks operating as financial intermediaries. In the aftermath of the crisis, the number of domestic commercial banks in Malaysia started to drop. On 29 July 1999, Bank Negara Malaysia has imposed the restructuring plan of merger and acquisitions for its 54 domestic deposit taking financial institutions to be consolidated into six institutions (Ahmad, Arrif, and Skully, 2007). Consequently, today Malaysia is left with 8 domestic commercial banks.

Although the Subprime crisis started out in United State, the impact could be felt by other countries, it has caused recession in countries such as the European Union, Japan, Singapore and Malaysia. In order to cushion the effect, Malaysia took a post-crisis measure by re-positioning itself. Throughout this process, Malaysia restructured the banking and financial system along with improved governance structure, risk management framework, infrastructure and practices (Nambiar, 2009; Bank for International Settlements, 2010a).

Thus when Basel III was implemented in 2010 to overcome the shortfall of Basel II on liquidity matters, one of the new regulatory requirements is to maintain high quality of liquid assets.

> "Basel III proposals have 2 main objectives that are strengthen global capital and liquidity regulations with goal of promoting a more resilient banking sector and improve banking sector ability to absorb shocks arising from financial and economic stress." (Bank for International Settlement [BIS], 2010b).

Basel report 2010 clearly outlines in paragraph 32, that with this new regulation, banks are not only required to hold adequate level of high quality liquid assets but should in accordance with their liquidity requirements in every currency as well. If bank's liquidity requirements are denominated in a few currencies, the bank should hold assets denominated in those currencies. The main purpose of this

asset holdings regulation is to meet the liquidity coverage ratio. Liquidity coverage ratio objectives are to ensure that a bank maintains a sufficient level of unencumbered, high-quality liquid assets. These must be able to turn into cash to fulfill its liquidity requirements for a 30 calendar day time period under a severe state of liquidity stress specified by supervisors. It is a minimum requirement for the bank to survive 30 Days of the stress scenario with the liquid assets. (BIS, 2010b).

Nevertheless, banks can choose their optimal liquidity needs based on their own leverage target. Some banks would not prefer to hold an inefficient level of liquid assets. Larger banks will tend to use the deposits as a source of investment to maximize their profits. This is because these banks have better ability in raising funds whenever their investments turn sour. In addition, banks that are "too big to fail' usually have more deposits, thus they are willing to risk more funds in high risk investments to generate more profit.

The implementation of Basel III has highlighted the importance of holding liquid assets, thus banks are now more aware of their liquidity status, especially their on hand liquid assets. Basel III stated that liquid assets should possess characteristic such as, easily convertible in large sum into cash promptly, have deep secondary markets, have low counterparty credit risks and do not have any encumbrances that restrict its sales. In the event of an economy downturn, banks with more liquid assets have better survival chances than banks with less liquid assets. This encourages the banks to hold more liquid asset to curb the economy shock. In addition, holding more liquid assets can improve the financial position of a bank because high liquid assets such as the government securities, are more valuable and incur less cost when traded.

Nonetheless, there are challenges behind this liquid asset holdings requirement. Demirgüç-Kunt, Laeven and Levine (2003) pointed out in the study, banks that hold high level of liquid assets are more likely to have lower net interest margins.

It is based on the fact that bank's liquidity has a negative relationship with interest margins when banks operate in a competitive deposit market. Aikaeli (2006) mentioned that when banks hold more liquidity than the required level of reserves requirement, they will offer lower interest rate loans to attract consumers thus resulting in lower interest income.

1.2 Problem Statement

Summarizing Park (2009) paper, the East Asian banking sector has been affected by the 2008 European debt crisis as well. One of the instances used is Malaysia. This happened because most of the banking sectors have reserve currencies dominated in US Dollar and Euro and investments in US and Europe countries. When the current crisis occurred, many foreign investors and lenders sold off the assets and refused to renew the loans. Consequently, East Asian's financial institutions suffered from shortage of liquidity. Hence, many East Asian's banks were unable to rollover the external financing which resulted in insolvency.

In order to resolve this problem, East Asia's banks have to liquidate their banks assets on hands to compensate for the liquidity loss. Unfortunately, the banks could not liquidate immediately their long maturities assets which are normally in the form of loans to consumers. Therefore, this maturity mismatch of assets and liabilities caused the banks to suffer from liquidity crisis and the whole financial institution to become insolvent (Park, 2009).

Nowadays, domestic commercial banks focus not only on bank's profitability but take into account bank's liquidity as well. The rise of liquidity awareness among banks faces some issues: how much liquid assets banks should hold during the

financial crisis? How might bank liquidity be affected by macroeconomic factors and bank-specific factors?

This research sets up a theoretical framework of domestic commercial banks' liquidity to determine which variables should be included in the models. In this circumstance, variations in macroeconomic factors and bank-specific factors are taken into account.

Hence, this study is to investigate the ways to retain adequate liquidity levels based on macroeconomic factors and bank-specific factors for the period from year 2005 to year 2011. It analyzes the relationship between the liquidity of domestic commercial banks and four macroeconomic factors which are the inflation rate, gross domestic product growth rate, financial crisis and bank's overnight policy rate as well as the four bank-specific variables which include bank's capital, bank's size, bank's non-performing loans, and bank's profitability. All domestic commercial banks in Malaysia: Affin Bank, Alliance Bank, AmBank, CIMB Bank, Hong Leong Bank, Maybank, Public Bank and RHB Bank have been included in the study.

1.3 Research Objectives

There is a general objective and a few specific objectives in this study.

1.3.1 General Objective

To investigate the impact of macroeconomic and bank-specific factors on bank's liquid asset holdings in Malaysia for the period 2005-2011 for eight domestic banks.

1.3.2 Specific Objectives

1. To investigate whether there is a relationship between the gross domestic product growth rates and the liquid asset holdings of the bank.

2. To investigate whether there is a relationship between the inflation rate and the liquid asset holdings of the bank.

3. To investigate the effect on the bank's liquid asset holdings during a financial crisis.

4. To investigate whether there is a relationship between the bank's overnight policy rate and the liquid asset holdings of the bank.

5. To investigate whether there is a relationship between the bank's capital and the liquid asset holdings of the bank.

6. To investigate whether there is a relationship between the bank's non-performing loans and the liquid asset holdings of the bank.

7. To investigate whether there is a relationship between the bank's profitability and the liquid asset holdings of the bank.

8. To investigate whether there is a relationship between the bank's size and the liquid asset holdings of the bank.

1.4 Research Questions

1. Is there any relationship between the gross domestic product growth rates and the liquid asset holdings of the bank?
2. Is there any relationship between the inflation rate and the liquid asset holdings of the bank?
3. Is there any effect on the bank's liquid asset holdings during a financial crisis?
4. Is there any relationship between the bank's overnight policy rate and the liquid asset holdings of the bank?
5. Is there any relationship between the bank's capital and the liquid asset holdings of the bank?
6. Is there any relationship between the bank's non-performing loans and the liquid asset holdings of the bank?
7. Is there any relationship between the bank's profitability and the liquid asset holdings of the bank?
8. Is there any relationship between the bank's size and the liquid asset holdings of the bank?

1.5 Hypotheses of the study

Macroeconomic Factors:

Gross domestic product

H0: There is no relationship between the gross domestic product growth rates and the liquid asset holdings of the bank.

H1: There is a relationship between the gross domestic product growth rates and the liquid asset holdings of the bank.

Inflation rate

H0: There is no relationship between the inflation rate and the liquid asset holdings of the bank.

H1: There is a relationship between the inflation rate and the liquid asset holdings of the bank.

Financial crisis

H0: There is no effect on the bank's liquid asset holdings during a financial crisis.

H1: There is an effect on the bank's liquid asset holdings during a financial crisis.

Bank's overnight policy rate

H0: There is no relationship between the bank's overnight policy rate and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's overnight policy rate and the liquid asset holdings of the bank.

Bank-specific Factors:

Bank's capital

H0: There is no relationship between the bank's capital and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's capital and the liquid asset holdings of the bank.

Non-performing loans

H0: There is no relationship between the bank's non-performing loans and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's non-performing loans and the liquid asset holdings of the bank.

Bank's profitability

H0: There is no relationship between the bank's profitability and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's profitability and the liquid asset holdings of the bank.

Bank's size

H0: There is no relationship between the bank's size and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's size and the liquid asset holdings of the bank.

1.6 Significance of Study

Although there are studies on the liquid asset holdings of banks but only a handful of researches are done on banks in Malaysia. Hence, this research which provides empirical results on the liquid asset holdings of Malaysia's domestic commercial banks, will be the stepping stone for future research. Furthermore, this study helps in the understanding of the role of liquid asset holdings in a bank. This result intends to assist the central bank to perform its monitoring function. These empirical analyses show the liquid asset holdings of banks, thus enabling the central bank to set a benchmark on the bank's liquid asset holdings. It is to ensure the domestic banks fulfill the requirements to prevent bank panic as well as maintain the soundness and stability of financial system in Malaysia.

Another significance of this study is it deepens the bank's understanding of variables that will have significant effects on the bank's liquid asset holdings. The interpretations of the results provide practical information that will improve the effectiveness of bank managers' decisions making in overcoming the liquidity crisis and determining the bank's future plan in asset liability management. Moreover, our studies conduct researches on few financial ratios. These ratios especially ratios on the bank's non-performing loans, equity and profitably are instrumental in evaluating the bank's performance (Quey, J. Y., 1996). In the long run, by evaluating these performances indicators, banks can gain more competitive advantage in the industry.

In the macroeconomic environment, liquidity serves as a cushion against unexpected crisis. If banks are unaware of their own liquid asset holdings, they might face difficulties in meeting their short-term obligations when struck by crisis. Accordingly, banks might become illiquid and disrupt the liquidity in the whole financial system within a country.

1.7 Chapter Layout

The organization of this paper will be as follow:

Chapter 1 gives a brief introduction on the study, starting with the problem statements and research objectives. It is then followed by the hypotheses, significance of the study, chapter layout and conclusion at the end of this chapter.

Chapter 2 provides a literature review on the liquidity of the commercial banks. These reviews arouse the researchers' curiosity on what macroeconomic factors and bank-specific factors can affect the liquid asset holdings of the Malaysia domestic commercial banks.

Chapter 3 presents the data and methodology used in this study. This chapter begins with the data collection methods and ends with analysis of the collected data.

Chapter 4 presents the findings and analysis of our results. The findings include which macroeconomic factors and bank-specific factors that have significant relationships with the liquid asset holdings of the bank. These will be answer for our previous research questions.

Chapter 5 is the last chapter which presents the implications and limitations of the study. This chapter ends by providing few suggestions for the future research.

1.8 Conclusion

Liquid asset holdings are important to the banking sector especially during the financial crisis; a bank with good liquid assets management can minimize the negative effects inflicted by a financial crisis. The aim of this study is to examine the effects of macroeconomic and bank-specific factor on the liquid asset holdings of eight domestic commercial banks in Malaysia. It highlights the importance of liquid asset holdings for banks and how liquid asset shortage occurs in financial institutions. The detailed review of previous findings will be presented in the following chapter.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, the review of prior literature by the previous researchers will be presented. Vast bodies of literatures have been done to investigate the determinants of liquidity of commercial banks. These researches give further insight and additional information about this research topic. This chapter will be the summary of the reviews from the journals and working papers that have been referred. In addition, the subsequent parts of this chapter will discuss the relevant theoretical models, conceptual frameworks, hypothesis, and proposed theoretical framework for the study.

2.1 Review of the Literature

Dependent Variable

2.1.1 Bank's Liquid Asset Holdings

There is an extensive body of literature exists on bank's liquidity and the earlier literature were done by Baltensperger (1980) and Santomero (1984). These studies investigate bank's liquid asset holdings through liquidity management. In the early studies, the liquidity cushion from holding liquid assets reflects the opportunity cost of earnings by issuing loans. Based on the prior studies, the subsequent studies shed light on the determinants of bank's liquid asset holdings. These empirical papers were carried out by G. Alger and I. Alger (1999) in Mexico, Bunda and

Desquilbet (2008), Agenor, Aizenman, & Hoffmaister (2004), Aspachs, Nier, & Tiesset (2005) in United Kingdom, Moore (2009) in Latin America and Carribean, Archarya et al (2009), Fadare (2011) in Nigeria and Qin and Pastory (2012) in Tanzania. Despite their similar objectives, their findings vary from each other due to different liquidity measurements used in the studies. Sharma (2004) stated that liquidity can be measured by stock approach, flow approach or the mix approach. Among these approaches, stock approaches are most widely used and practiced (Crosse and Hempel, 1980; Yeager and Seitz, 1989; Hempel, Simonson and Coleman, 1994). In a recent research study, bank's liquid asset holdings in Slovakia and Czech Republic were tested using the stock approach (Vodova 2011a; Vodova 2011b). In order to identify the impacts on the bank's liquid asset holdings, the determinants were separated into two groups, the macroeconomic factors and bank-specific factors. This gives further insight to the previous studies.

Independent Variables

Macroeconomic Factors:

2.1.2 Gross Domestic Product (GDP)

The impacts of GDP on bank's liquid asset holdings have been highlighted by many previous researchers in their study. GDP is taken to measure of the economy cycle. High GDP indicates that the country is experiencing economic expansion while low GDP means the country is undergoing recession.

Vodova (2011b) found that GDP is positively correlated with the bank's liquid asset holdings in the commercial banks in Slovakia.

On the contrary, Calomiris and Wilson (1998) study, bank's liquid asset holdings tends to increase during recession and then decrease when the economy starts to recover. During the economic expansion, demand for loans will increase as borrowers and investors are more confident in the economy and have more favourable investment opportunities. Therefore, banks that grant more loans when the economy starts to recover will suffer a decline in bank's liquid asset holdings (Bunda and Desquilbet, 2008; Maynard and Moore, 2005).

Summarizing G. Alger and I. Alger (1999) journal, they pointed out that economic recession can affect the stability of the interbank market which will later affect the bank's decision on the holding of liquid assets. Based on their study, banks have conservative liquid asset holdings behavior during the recession. Their results postulated that the interbank market is at a higher risk of collapsing in the economic recession because of the higher default risk of borrowing banks. Thus banks will hold more liquid assets during the recession as the stability of the interbank markets is reduced (Kharroubi and Vidon, 2009). These results are supported in Aspachs et al. (2005) study where they explained that banks will hold more liquid assets during recession to buffer the liquidity shocks but less liquid assets when economy starts to recover.

In general, gross domestic product is used to indicate the economy cycle in a country. Despite unemployment rate was used as a proxy variable for gross domestic product, Hackethal, Rauch, Steffan, & Tyrell (2010) found that their findings are still consistent with the previous studies. In the study, Hackethal et al. (2010) justifies that default risk of the borrower tends to increase during a high unemployment period.

2.1.3 Inflation Rate

The empirical studies by most of the previous researchers on the relationship between the bank's liquid asset holdings and inflation are negative (Bunda and Desquilbet, 2008; Vodova, 2011a; Vodova, 2011b). Based on the empirical results of Vodova (2011a), he found that inflation rate is negatively correlated with the bank's liquid asset holdings in Czech Republic but no relationship in Slovakia. Vodova(2011a) pointed out that inflation will deteriorate the overall economy condition thus causing the bank's liquid asset holdings to deteriorate as well. This is due to the decrease in nominal value of the bank's loan from the period it was lent till the period it was collected back. Bunda and Desquilbet (2008) noted that the bank's liquid asset holdings behavior can be affected by inflation because banks are customer-oriented, and the banks will increase their long term lending in order to satisfy their customers. Since loans are part of the bank's assets, bank's liquid asset holdings will be greatly reduced. This result is consistent with Ubegbunan's (1999) study which indicates that during period of high inflation, the real value of bank's earnings will be reduced significantly.

2.1.4 Financial Crisis

The effect on the bank's liquid asset holdings during a financial crisis is well documented in the prior researches. Bunda and Desquilbet (2008) tested out the impact on bank's liquid asset holdings in 36 emerging countries during a financial crisis. Empirical results from Bunda and Desquilbet (2008) revealed that financial crisis has a positive relationship

with the bank's liquid asset holdings. In the aftermath of the financial crisis, the growth of the business sector is sustained, causing the demand of loans to decrease. The drop in demand for loans results in banks holding more liquid assets, thus leading to higher bank's liquid asset holdings (Moore, 2009).

On the contrary, research on commercial banks in both Slovakia and Czech Republic found that financial crisis is negatively correlated with bank's liquid asset holdings (Vodova, 2011a; Vodova, 2011b). In addition, Vodova (2011a), Vodova (2011b) stated that bank's liquid asset holdings and financial crisis have bidirectional causal effects. Financial crisis can cause poor bank's liquid asset holdings or they can be caused by poor bank's liquid asset holdings as well. This statement is supported in Tirole (2002) study where Tirole (2002) stated that financial crisis may result from excessive lending that eventually causes the banks to suffer poor bank liquid asset holdings. Quoting findings from Vodova (2011a) and Vodova (2011b), financial crisis can impair borrower's capacity and cause the banks to suffer losses. Thus financial crisis can cause the bank's liquid asset holdings to drop. The second factor that can contribute to this cause is shown in Moore (2009) study where he stated that during the financial crisis, depositors might require more cash, thus leading to more withdrawals.

2.1.5 Bank's Overnight Policy Rate

Carlettie, Hartmann and Spagnolo (2003) stated that the increase of reserves and deposits will increase along with interbank rate and loans demand. So this will directly reduce the liquid asset holding of banks. It is the nature of business for banks to transform retail deposits into business

loans to gain profit. However, banks will have to forego the profits if banks decide to hold them as reserves instead (Moore, 2009). Thus most banks will tend to issue loans rather than holding them as reserves. In Moore's (2009) study, money market rate is used to quantify the interbank rate.

Freixas, Martin and Skeie (2009) claimed that at a higher interbank rate, banks will hold optimal liquid assets at the equilibrium to satisfy their depositors' liquidity needs, ceteris paribus.

Interbank rate is postulated as insignificant to bank's liquid asset holdings in the study done on commercial banks in Czech Republic and Slovakia (Vodova, 2011a; Vodova, 2011b).

Bank-specific Factors:

2.1.6 Bank's Capital

Bank capital serves as cushion to absorb the unexpected losses and a source of fund to deal with liquidity risks. G. Alger and I. Alger (1999) concluded that the bank with more capital will tend to hold more liquid assets. The rationale behind this is because larger capital will lead to a greater loss for the investor (Bunda and Desquilbet, 2008). Therefore more liquid assets will be hold as precaution measure. This is in accordance with Vodova (2011a) pointed out Czech Republic's banks in his research, liquid asset holdings will increase when the capital is higher.

However Gonzalez-Eiras (2003) claimed that there is negative relationship between liquid asset holdings and capital where the liquid asset holdings of a bank will decrease when the capital of the bank increase. Vodova (2011b) found a different result in Slovakia, the banks with lower capital have higher liquid asset holdings, which means bank liquid asset holdings has a negative relationship with bank's capital. Vodova (2011b) justified that banks with lower capital are more concern on liquidity management, therefore more liquid assets will be held.

2.1.7 Non-performing Loans (NPL)

Non-performing loans are measured by the share of non-performing loans in term of total loans. Festic and Repina (2009) stated that non-performing loan is loan that its principal and interest are due or not paid for consecutive six months after the first day of default. The NPL ratio and credit expansion are said to have a relationship with each other. The meltdown of the economy can cause the NPL to increase and vice versa. Thus, the NPL ratio will affect the bank liquid asset holdings (Festic and Repina, 2009).

Quoting findings from Vodova (2011a), NPL ratio is one of the determinants that affect banks liquid asset holdings. Based on his findings on Czech Republic's commercial banks from the period year 2001 until year 2009, NPL ratio and bank liquid asset holdings are positively correlated which contradicts Vodova's former expectation. This proves that banks remain prudent in their liquidity risk management to offset the high credit risk.

The most recent study was conducted by Iqbal (2012) on Islamic and Conventional banks. In his study, NPL ratio was used as the determinant for liquidity risk management and liquid assets ratio as the dependent variable in the model. The empirical results show that NPL ratio has a negative relationship with bank's liquid asset holdings. Quoting from Iqbal (2012), NPL ratio reflects the excessive lending by banks that could lead to liquid asset shortage. High NPL ratio is a sign that large portions of loans will turn into bad debts and thus reducing bank's liquid asset holdings. For both conventional and Islamic banks in Iqbal's study, the NPL ratio and the bank liquid asset holdings portray the same relationship.

Vodova (2011b) has done the same research on banks in Slovakia, however, the NPL ratio shows no relationship with bank liquid asset holdings.

2.1.8 Bank's Profitability

Chiaramonte, Casu, & Bottiglia (2012) found that return on equity is significant and has a positive relationship with the bank's liquid asset holdings. Chiaramonte et al (2012) clarified that poor liquid asset holdings will lower bank's performance as profit-oriented banks are perceived to be safer than other banks. Thus banks with better performances tend to hold more liquid assets. In brief, ROE has a positive relationship with commercial bank's performance.

Vodova (2011b) claimed that ROE has a negative relationship with bank's liquid asset holdings in the case of commercial banks in Slovakia during the period from year 2001 until year 2010. This result is consistent with

usual finance theory, stating that high bank's liquid asset holdings reflect poor bank's performance. Hanif, Tariq, Tahir & Momeneen (2012) pointed out that return on Equity (ROE) is used to measure the profitability of a bank and generally ROE will tell us about a bank's performance. On top of that, it provides information to the investors and shareholders on return earned from their investments and usually investors will tend to choose to invest in the bank that has high ROE. Most banks are profit-oriented (Leightner and Lovell, 1998; Mallick, 2005). Since most banks with more profits tend to involve more in interest rate-based businesses such as supplying more loans. In brief, liquid asset holdings of a bank will decrease when its ROE increase (Hackethal et al, 2010). Moreover, Iqbal (2012) state banks with lower ROE mean that the banks are undergoing expansion in the market. Thus, ROE and liquid asset holdings have a negative relationship in Conventional banks and Islamic banks in Pakistan. This result is in line with the researchers' expected result.

However in Vodova (2011a) stated that there is no correlation in commercial banks in Czech Republic.

2.1.9 Bank's Size

Iqbal (2012) concluded that the effect of bank's size on bank's liquid asset holdings is not only applicable to conventional but to Islamic banks as well. In Iqbal (2012) results, the size of banks is proved to have positive influence on the bank's liquidity risk due to less liquid asset holdings.

Summarising the previous researches studies on the determinants of bank's liquid asset holdings, bank's size is generally a significant determinant.

Referring to a research done by Vodova (2011b), the size of a bank is negatively related with the liquid asset holdings of the banks in Slovakia. The reason is because the larger banks rely more on the liabilities to solve the liquid asset holdings problem. Similar result was found by Hackethal et al (2010) in banks in Germany. G. Alger and I. Alger (1999) supported the result and explained that larger banks will have less liquid asset holdings due to more deposits they hold. Furthermore, larger banks have more diversified depositors population and better access to external funding.

However Bunda and Desquilbet (2008) found a contradicting result when conducting a research on 1107 commercial banks in 36 emerging economies spanning from year 1995 to 2000 to test the determinants of bank's liquid asset holdings. Bunda and Desquilbet (2008) concluded that bank's size will not have any influence on bank's liquid asset holdings which is consistent with Vodova (2011 a) study.

2.2 Review of Relevant Theoretical Model

2.2.1 Model 2.2.1

$$L_{it} = \alpha + \beta' X_{it} + \delta_i + \varepsilon_{it}$$

The research was done by Vodova (2011a) to determine the liquid asset holdings of Czech Republic commercial banks, by using the panel data regression analysis. The analysis uses the bank-specific data and macroeconomic data from the period 2001 to 2010. Vodova (2011b) also used the same method in his research to examine the liquid asset holdings of Slovakia's commercial banks from the period from 2001 to 2009. The model include δ to represent the fixed effects in bank, X to represent the

vector of explanatory variables for the bank to examine the dependent variable *Lit* which is measured by liquidity ratio (Liquid assets to total assets)

Vodova (2011a; 2011b) used four bank-specific factors namely the capital on total assets of banks, non-performing loans on total volume of loans, return on equity and logarithm of total assets of bank. While macroeconomic factors that are used, are the financial crisis as dummy variable, gross domestic product, inflation rate, interest rate on interbank transactions, interest rate on loans, difference between interest rate on loans, monetary policy interest rate and unemployment rate.

2.2.2 Model 2.2.2

$$(y)_{n,t} = \propto_n \sum_{l=1}^{L} \beta_1 (y)_{n,t-1} \sum_{l=1}^{L} \beta_2 (Macro)_{n,t-1} \sum_{l=1}^{L} \beta_3 (Performance)_{n,t-1} + \sum_{l=1}^{L} \beta_4 (Characteristics)_{n,t-1} + \sum_{l=1}^{L} \beta_5 \, (Size)_{n,t-1} + d_t + \varepsilon_{n,t-1}$$

Hackethal et al (2010) examined the determinants on bank's liquid asset holdings of 457 German savings banks from the period 1997 until 2006 using the multivariate dynamic panel model. The research used three different dependent variables to represent bank's liquid asset holdings. One of the variables is the liquid assets to total assets ratio. The influential factors are divided into four categories which are macroeconomic variable, bank's performance, bank's characteristics and bank's size. Unemployment rate, savings quota, interest rate and yield curve spread are used to represent macroeconomic variables. The earnings before interests and tax and the return on equity are used to measure bank's performance. Meanwhile, the loans volume to the total volume of outstanding loans and

provision income as well as interest income is used to explain bank's characteristics. Bank's size used in the study is the total number of bank's customers, both the loans and customers' deposits.

2.2.3 Model 2.2.3

$$Y_1 = \propto + \beta_1 SIZE + \beta_2 NPL + \beta_3 ROE + \beta_4 CAR + \beta_5 ROA + \varepsilon$$

The above equation is developed by Iqbal (2012). This research examines the liquidity risk bore by the conventional and Islamic banks of Pakistan between the period 2007 of 2010. The dependent variable is quantified by the ratio of liquid assets on the total assets of banks. The factors used to determine liquid asset holdings is the size of the bank, non-performing loans ratio, return on equity, capital adequacy ratio and return on assets. All those ratios are obtained based on the historical data from the period 2007 until 2010.

2.2.4 Model 2.2.4

$$Liq_{\text{it}} = c + c * NUK + \beta_{11} SR_{it} + \beta_{12(} NUK * SR) + \beta_{21} r_{it} + \beta_{22}(NUK * r_{it}) + \beta_{31} Y_{it} + \beta_{32}(NUK * Y) + \eta_i + \varepsilon_{it}$$

Aspachs et al. (2005) investigated the macroeconomics factors effects on liquid asset holdings by banks in United Kingdom from the year 1985 to 2003. In addition, they take into account the support by central bank as

Lender of last resort (LOLR) into their test. The equation developed by of Aspachs et al (2005) show as above

The dependent variable Liq represents Liquidity which is quantified by the ratio of either liquid assets to total assets or liquid assets to total deposit. The independent variables include SR which represents the support from the LOLR, r which represents the short-term interest rate, and Y which represents real GDP growth. While NUK is a dummy variable to capture the effect of foreign owned banks. Aspachs et al (2005) use fixed effect model (FEM) to regress the panel data.

2.2.5 Model 2.2.5

$$Liquidity\ ratio = \alpha_0 + \alpha_1 total\ asstes + \alpha_2 equity\ to\ asset\ ratio + \alpha_3 presences\ of\ prudential\ regulation(dummy) + \alpha_4 lending\ interest\ rate + \alpha_5\ public\ expenditures/GDP + \alpha_6 rate\ of\ inflation + \alpha_7 rate\ of\ growth + \alpha_8 realisation\ of\ a\ financial\ crisis(dummy) + \sum_k \beta_k\ type\ of\ the\ exchanges\ rate\ regime(dummy)$$

The study by Bunda and Desquilbet (2008) investigated the determinants of bank liquid asset holdings in 36 emerging countries spanning from year 1995 to 2000, emphasizing on the effect of exchange rates regime. Bunda and Desquilbet (2008) used bank's specific factors, market's factors and macroeconomic factors to explain the bank's liquid asset holdings. In order to show the relationship between the bank's liquid asset holdings and the bank-specific factors and macroeconomic factors, Bunda and Desquilbet (2008) developed the above equation.

The total assets and equity to assets ratio are classified as the bank-specific factors, Presences of prudential regulation, lending interest rate and the

exchanges rate classified as the macroeconomic factors. Lastly the public expenditure/GDP, rate of inflation, rate of growth and the financial crisis are grouped as macroeconomics factor. Bunda and Desquilbet (2008) performed two way random effect models on their panel data.

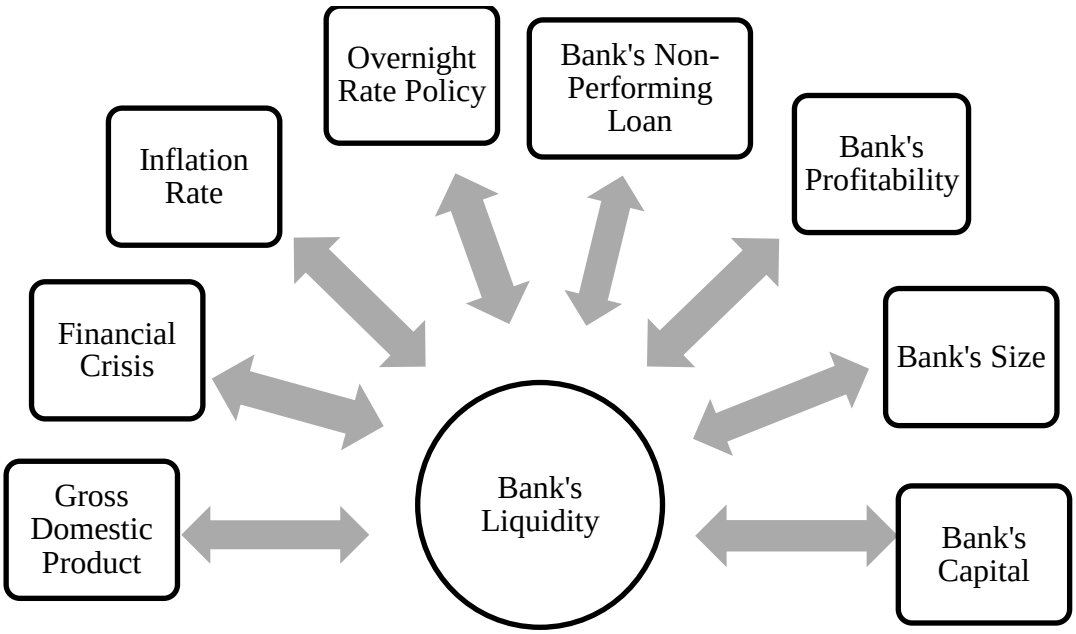
2.2.6 Model 2.2.6

$$LA_{it} = \propto_i + \beta_1 DEPO_{it} + \beta_2 TDEPO_{it} + \beta_3 K_{it} + \beta_4 SIZE_{it} + \beta_5 FC + \varepsilon_{it}$$

G. Alger and I. Alger (1999) developed the above equation. This research is to examine the effects of demand deposits, refinancing cost, capital and size as determinants of liquid assets. G. Alger and I. Alger (1999) used banks as the panel variable and year as time variable in a set of panel data totalling 442 observations. The data for this study is taken from period of January 1997 to February 1998 with DEPO representing the demand deposit, TDEPO representing time deposit, K representing capital, SIZE representing the bank's size, while the FC represent the refinancing cost.

2.3 Proposed Theoretical/Conceptual Framework

Diagram 2.1 Conceptual Framework



Dependent Variable:

2.3.1 Bank's Liquid Asset Holdings

There are several ways to measure bank's liquidity (Moore, 2007). In this study, bank's liquidity is quantified by the ratio of liquid assets in terms of total assets. The higher the ratio, the higher the bank's capability to overcome the shortage of liquidity (Vodova, 2011a; Vodova, 2011b).

Quoting from Komárková, Geršl, & Komárek (2011), banks categorize their assets based on their liquidity. Bank of Canada (2011) explained that

liquid assets can assist banks to deal with liquidity shock and meet their obligations in the event of financial turmoil. Thus, liquid assets are chosen to measure the buffer in absorbing liquidity shock (KDID; Vodova, 2011a; Vodova, 2011b).

The total assets are used to reflect bank's size by dividing liquid assets with total assets. It will standardize the liquid asset holding by banks with different bank's size. Given the same amount of liquid assets, the bigger banks will have lower coefficient of total assets (Bunda and Desquilbet, 2008). Thus, it indicates that bigger banks need more liquid asset holdings buffer than the medium and small banks given that the market liquidity is the same among all banks.

Independent Variable:

Macroeconomic factors:

2.3.2 Gross Domestic Products (GDP)

Based on the previous researches, GDP is used to represent the economic cycle (Vodova, 2011b). High GDP reflects economic growth while low GDP reflects economic downturn. This variable is taken into account in this model to capture the impact of the fluctuations in economic cycle on bank's liquid asset holdings. In this study, gross domestic product growth rate is used. This result indicates the bank's liquid asset holdings behavior in the different stages of economic cycle as well.

2.3.3 Inflation Rate

Inflation rate is included in the model to investigate the degree of correlation between the inflation rate and bank's liquid asset holdings. Inflation rate acts as an incentive for banks to hold liquid assets as inflation rate can affect the nominal value of customer loans (Bunda and Desquilbet, 2008; Vodova, 2011a). Thus, inflation rates can influence bank's liquid asset holdings behavior. For this research purpose, consumer price index is used as a proxy variable to represent the changes in the inflation rate in Malaysia.

2.3.4 Financial Crisis

Financial crisis is included in the model with an intention to investigate the effect of bank's liquid asset holdings during financial crisis. Additionally, behavior of the bank's liquidity buffer during a financial crisis period can be examined. Financial crisis is used as a dummy variable in this model where one will be allocated in financial crisis period and zero for the other time period.

2.3.5 Bank's Overnight Policy Rate

Overnight policy rate is the interbank transactions interest rate used in Malaysia. It is a rate where banks borrow and lend promptly to another

bank overnight to meet their daily liquidity needs. This rate measures the opportunity cost that banks suffer by holding liquid assets instead of lending to another bank.

Bank-specific Factors:

2.3.6 Bank's Capital

Bank's capital is quantify as bank's capital over bank's total assets (Vodova, 2011a; Vodova, 2011b). This ratio represents the capital adequacy where it is used to cushion liquidity shocks during a financial crisis (Iqbal, 2012). Hence, it is important to take into account this variable in order to measure the strength of the bank's capital in determining the bank's liquid asset holdings.

2.3.7 Non-performing Loans

In this study, non-performing loans over total volume of loans is used to measure the bank's non-performing loans (Vodova, 2011a; Vodova, 2011b). Non-performing loans are included in the model to investigate its relationship with bank's non-performing loans and bank's liquid asset holdings. Furthermore, this study will shed light on how bank's non-performing loan can deteriorate the bank's liquid assets.

2.3.8 Bank's Profitability

Bank's profitability is the return on equity of bank. This is quantified by the share of net profits in terms of the bank's own capital (Vodova, 2011a; Vodova, 2011b). Net profits reflect the source of liquid asset holdings of a bank (Aspachs et al., 2005). Banks with different net profits have different liquidity buffer. Thus, this variable is important to gather information on the correlation between bank's liquid asset holdings and bank's profitability

2.3.9 Bank's Size

Bank's size is quantified using the logarithm of total assets of bank (Bunda and Dequilbet, 2008; Aspach et al., 2005; Vodova, 2011a; Vodova, 2011b). Ahmad, Arrif & Skully (2009), the logarithm is used to capture the bank's size effect because different bank's sizes among the commercial banks will influence the liquid asset holdings decisions.

2.4 Hypotheses Development

Macroeconomic Factors:

2.4.1 Gross Domestic Product

H0: There is no relationship between the gross domestic product growth rates and the liquid asset holdings of the bank.

H1: There is a relationship between the gross domestic product growth rates and the liquid asset holdings of the bank.

2.4.2 Inflation Rate

H0: There is no relationship between the inflation rate and the liquid asset holdings of the bank.

H1: There is a relationship between the inflation rate and the liquid asset holdings of the bank.

2.4.3 Financial Crisis

H0: There is no effect on the bank's liquid asset holdings during a financial crisis.

H1: There is an effect on the bank's liquid asset holdings during a financial crisis.

2.4.4 Bank's Overnight Policy Rate

H0: There is no relationship between the bank's overnight policy rate and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's overnight policy rate and the liquid asset holdings of the bank.

Bank's specific factors:

2.4.5 Bank's Capital

H0: There is no relationship between the bank's capital and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's capital and the liquid asset holdings of the bank.

2.4.6 Non-performing Loans

H0: There is no relationship between the bank's non-performing loans and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's non-performing loans and the liquid asset holdings of the bank.

2.4.7 Bank's Profitability

H0: There is no relationship between the bank's profitability and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's profitability and the liquid asset holdings of the bank.

2.4.8 Bank's Size

H0: There is no relationship between the bank's size and the liquid asset holdings of the bank.

H1: There is a relationship between the bank's size and the liquid asset holdings of the bank.

2.5 Conclusion

This chapter is intended to review other prior researches that are relevant to this research topic. Reviews of these researches are to justify the relationship between the variables used in this study which are the dependent variable (liquid asset) and independent variables (gross domestic product, inflation rate, financial crisis, bank's overnight policy rate, bank's capital, non-performing loans, bank's profitability, and bank's size). These reviews can be used as a reference and

guidance throughout the study undertaken to investigate the determinants of bank's liquid asset holdings in Malaysia. In the next chapter, details on the variables, data and methodology used in this study will be further discussed.

CHAPTER 3: METHODOLOGY

3.0 Introduction

In this chapter, the research methodology such as the framework for this research, descriptions of data, data collection methods, data analyses techniques and the treatment of econometric problems will be explained in details.

This study evaluates the independent variables in this model. These include gross domestic product, inflation rate, financial crisis and bank's overnight policy rate as the macroeconomic factors, and bank's capital, non-performing loans, bank's profitability, and bank's size as the bank-specific factors.

This study tested on eight domestic banks, Affin Bank, Alliance Bank, AmBank, CIMB Bank, Hong Leong Bank, Maybank, Public Bank and RHB Bank from the time period of 2005 to year 2011.

3.1 Research Design

The main objective of the study is to examine the macroeconomic factors and bank-specific factors on the bank's liquid asset holdings. Hence, quantitative

research and explanatory research design have been chosen to be carried out to provide the empirical results to explain the bank's liquid asset holdings. Hopkins (2008) stated that quantitative research is used to quantifying the relationship between the variables. This research design best suit the study since empirical results needs to be provided for the independent variables. The independent variables used to explain our dependent variable which is the bank's liquid asset holdings, are the gross domestic product, inflation rate, financial crisis, bank's capital, bank's non-performing loans, bank's profitability, bank's size and bank's overnight policy rate.

3.2 Data Collection Method

In this study, secondary data was used to carry out the empirical test. There are two subsets of data that are collected. First is the macroeconomic factors' data and second is the bank-specific factors data.

The data for the bank-specific factors are collected from the annual report from the 8 domestic banks while the data for the macroeconomic factors are obtained from data stream.

Table 3.1 Data Sources

Type of data	**Data Source**
Macroeconomic factors	
Gross domestic product	Department of Statistics Malaysia
Inflation rate	Oxford Economics
Financial crisis	
Bank's overnight policy rate	Central Bank of Malaysia
Bank's specific factors	
Bank's capital	Bank's annual reports
Non-performing loans	Bank's annual reports
Bank's profitability	Bank's annual reports
Bank's size	Bank's annual reports

3.2.1 Gross Domestic Product

Gross domestic product can contribute to liquid assets. Higher gross domestic product reflects that the government is supplying large amount of securities. Hence, it is possible that the government interfere in the banking activities. In an instance, in the process of capital market development, banks help to finance the government on its expenditure (Bunda and Desquilbet, 2008). In this study, the time series data on Gross domestic product for 7 years, spanning from 2005 until 2011, is obtained from the Department of Statistic Malaysia.

3.2.2 Inflation Rate

Inflation rate is a motivator for banks to hold liquid assets as inflation will cause the nominal value of assets to decrease. However, if banks emphasis on customers relation, they will increase their long term lending. (Bunda and Desquilbet, 2008). Time series data on Inflation rate for 7 years, spanning from 2005 until 2011, is obtained from the Oxford Economics.

3.2.3 Financial Crisis

The financial crisis is said to have effect on liquid asset holdings. Financial crisis maybe occur because of banks holding insufficient liquid assets, which can lead to lending boom. On top of that, banks will tend to reduce lending during the financial crisis thus there will be a decrease in the demand of loans, thus financial crisis should reflect high liquid asset holdings in banks (Bunda and Desquilbet, 2008). The variable will be allocated with a 1 during financial crisis period, 0 if otherwise.

3.2.4 Bank's Overnight Policy Rate

Interbank rate or money market rate is known as bank's overnight policy rate in Malaysia. It is a rate set by the Bank Negara Malaysia for daily

liquidity operations. The increase of the overnight policy rate will reduce bank's liquid asset holdings. This is because banks will lend their liquid fund to other banks when the rate is high. Consequently, the bank's liquid asset holdings will drop when the rate is high. Time series data on bank's overnight policy rate for 7 years, spanning from 2005 until 2011, is obtained from the bank's annual reports.

3.2.5 Bank's Capital

Bank's capital is the minimum capital adequacy that is required in banks and is claimed by Bunda and Desquilbet (2008) that it is correlated with bank's liquid asset holdings. Banks with higher capital hold less liquid assets to balance with liquid liabilities. In addition, banks might not gain more profit by lending more due to the information asymmetries in the credit market. Therefore, the higher the bank's capital, the higher the liquid assets (Bunda and Desquilbet, 2008). Time series data on Bank's capital for 7 years, spanning from 2005 until 2011, is obtained from the Bank's annual reports.

3.2.6 Non-performing Loans

Non-performing loan is quantified by using non-performing loan to total volume of loan. Bank's assets are mostly made up of loan. Therefore, when these loans become non-performing, they will reduce the bank's profitability. Banks need to hold liquid assets to buffer against the losses. Hence, liquid assets will reduce when there are more non-performing loans

(Iqbal, 2012). Time series data on non-performing loans for 7 years, spanning from 2005 until 2011, is obtained from the Bank's annual reports.

3.2.7 Bank's Profitability

Bank's profitability is used to quantify the performance of the bank. Higher profit might not lead to higher liquid assets due to the interest based business that bank involved. When facing diseconomies of scale, more profit-oriented banks prefer reserving more liquid assets for safety purpose. Time series data on bank's profitability for 7 years, spanning from 2005 until 2011, is obtained from the bank's annual reports.

3.2.8 Bank's Size

If banks perceived themselves as "too big to fail", they will hold less liquid assets. This is because larger banks have better political networking and support than smaller banks (Bunda and Desquilbet, 2008). Time series data on bank's size for 7 years, spanning from 2005 until 2011, is obtained from the bank's annual reports.

3.3 Sampling Design

3.3.1 Target Population

In this study, secondary data was used to carry out the empirical test. Hence, the data collected from eight domestic commercial banks in Malaysia are stated as below:

1) Affin Bank
2) Alliance Bank
3) AmBank
4) CIMB Bank
5) Hong Leong Bank
6) Maybank
7) Public Bank
8) RHB Bank

3.4 Data Analysis

3.4.1 Pooled OLS Model

In this study, pooled OLS model is used to analyze the data collected. The purpose of using pooled OLS model is to examine the macroeconomic factors and bank-specific factors on the domestic commercial bank's liquid asset holdings regardless of the time effect. In this study, the intercepts are assumed to be constant across the domestic commercial banks, slopes are assumed to be constant across domestic commercial banks and time is invariant. The equation is shown as below:

$Y_{it} = \propto_1 + \beta_{1+}\beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \varepsilon_{it}$……model 1.1

Table 3.2 : Symbols and Measurements

Symbol	Definition	Measurement
Y_{it}	Bank's Liquid asset holdings	Liquid asset / Total assets
$\propto_1$	Intercept	-
β_1	Gross domestic product	Gross domestic product growth rate
β_2	Inflation rate	Consumer price index
β_3	Financial crisis	"1" applied in year 2007 and 2008
β_4	Bank's overnight policy rate	Bank's overnight policy rate
β_5	Bank's capital	Total capital / Total asset
β_6	Non-performing loans	Non-performing loans / Total loans
β_7	Bank's profitability	Net income / Total equity
β_8	Bank's size	Logarithm of total asset
εit	Error term	-

3.4.2 Diagnostic Tests

The diagnostic tests such as Ramsey RESET test, Jarque-Bera test, VIF, Breusch-Pagan / Cook-Weisberg test, and Wooldridge test, are performed

to reform the model to fulfill the Classical Linear Regression Model (CLRM) assumptions. The Classical Linear Regression Model (CLRM) assumptions are as below:

1. There is no relationship between independent variables (No multicollinearity)
2. The error term is constant across the number of observations (Homoscedasticity)
3. There is no relationship among the error term at the period *t* and the error term at period before *t* (No autocorrelation problem)
4. There is no relationship between error term and independent variables. (homoscedasticity and no autocorrelation problem).
5. The error term is normally distributed.

Once CLRM assumptions are fulfilled, Best Linear Unbiased Estimator (BLUE) results will be obtained. When BLUE result is achieved, the variance of errors will be achieved at optimal level and its estimators are efficient. Furthermore, the results of the p-values will be accurate and reliable as they are not overestimated or underestimated.

3.4.2.1 Model Specification

Model specification of the model will be incorrect if the important independent variables are omitted or irrelevant independent variables are included determining the dependent variable, or the functional form of the model is incorrect. Ramsey RESET is performed to test the model specification error. The P-value obtained is used to examine the model specification problem. If the p-value is more than 10% significant level, it implies that the model is correctly specified.

Ramsey RESET Test Statistic

H_0 : Model specification is correct

H_1 : Model specification is not correct

Decision Rule: Reject the Ho if p-value is less than the significant level. Otherwise, do not reject the Ho.

Decision: Do not reject Ho since the p-value is more than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 is correctly specified.

3.4.2.2 Normality of the Error Term

The Classical Linear Regression Model (CLRM) assumes that the error term is normally distributed with zero mean of error because positive error will offset the negative error. The normality of error term can be examined through an informal way which is by using the graph to detect the shape of the residual and a formal way which is by using the Jarque-Bera test statistics. The Jarque-Bera test statistics require the value of skewness and kurtosis of the model in order to calculate the test statistics value.

Jarque-Bera Test Statistics

H_0 : The error term are normally distributed

H_1 : The error term are not normally distributed

Decision Rule: Reject H_0 if the Jarque-Beratest-statistics value more than and less than the critical value. Otherwise, do not reject the H_0

Critical Value: $X^2 \propto, 2$

Jarque-Bera Test statistic Value: $\frac{n}{6}$(Skewness^2+ $\frac{1}{4}$ (kurtosis – 3)^2

Decision: Reject the H_0 since the Jarque-Bera test- statistical value is more than the critical value.

Conclusion: There is sufficient evidence to conclude that the error term are normally distributed.

3.4.2.3 Multicollinearity

Multicollinearity occurs when there is relationship between the independent variables. Firstly, the correlations between the independent variable are examined and the highest correlations between the two independent variables are chosen later. An auxiliary estimated regression model between the two independent variables that have the highest correlation are constructed to obtain the R-squared. Next, Variance Inflation Factor (VIF) are calculated to test seriousness of the multicollinearity problem between the independent variables. If the VIF is

equal to 1, this implies that there is no multicollinearity problem in the model. However, if VIF obtained is less than 10, it implies that the multicollinearity problem is not a very serious problem. Hence, there is no need to solve the multicollinearity problem.

$$VIF = \frac{1}{1 - R^2_{x_1,x_2}}$$

3.4.2.4 Heteroscedasticity

Heteroscedasticity occurs when the variance of error term is not constant across the number of observations. Breusch-Pagan / Cook-Weisberg test is used to test for heteroscedasticity problem, and p-value is obtained to detect the heteroscedasticity problem. If the obtained p-value more than 10% significant level, it implies that the model does not has heteroscedasticity problem.

H_0 : There is no heteroscedasticity problem

H_1 : There is heteroscedasticity problem

Decision Rule: Reject the Ho if p-value is less than significant level. Otherwise, do not reject the Ho.

Decision: Do not reject Ho since the p-value is more than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 does not consist of hetetoscedasticity problem.

3.4.2.5 Autocorrelation

Autocorrelation problem will occur when error term at the period *t* is correlated with the error term at period before *t*. Autocorrelation is most likely to happen in time series data due to the importance of the sequence of time period. Autocorrelation test is carried out by using Wooldridge test. It is derived for panel model to examine the presence of relationship between current error term of the model and the error term in the past (Drukker, 2003). The p-value obtained is to examine whether or not the autocorrelation problem occurs in the model. If the obtained p-value is more than 10% significant level, it implies that there is no autocorrelation problem in the model.

Wooldridge Test Statistic

H_0 : There is no autocorrelation problem

H_1 : There is autocorrelation problem

Decision Rule: Reject the Ho if p-value is less than significant level. Otherwise, do not reject the Ho.

Decision: Do Not Reject Ho since the p-value is more than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 consist autocorrelation problem.

3.5 Conclusion

In this chapter, the progress of this research is explained which includes the data collection methods, research framework, variable specification, and data analysis. Next chapter 4 will spell out in details regarding the hypothesis testing and diagnostic tests that have been carried out for the data that had been collected. These tests are carried out by using Stata 10.0

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In chapter 3, the research methodology of the study is discussed thoroughly. Tests were carried out to validate the hypothesis as well as to ensure the reliability of the data. Thus, in this chapter, the interpretations and analysis of the findings will be presented in an organized manner were the inferential analysis of the data will be presented first then follow by a conclusion.

4.1 Scale of Measurement

In order to ensure that our results are precise and reliable, a few econometric treatments have been performed on the model. The first test that has been performed is the test on the model specification then followed by the normality of error term, multicollinearity, heteroscedasticity, and autocorrelation.

4.1.1 Ramsey RESET Test

The test on the model specification has been performed first in consideration of its importance compared to other diagnostic checking tests. Ramsey RESET test is to examine the functional form of the model.

It is use to determine whether model 1.1 is correctly specified. Model misspecification can occur due to including irrelevant variables, omitting important variables, or wrongly estimate the functional form.

Table 4.1 Result of Ramsey Reset Test

	P-value	**Decision Rule**
Ramsey RESET Test	0.5588	Do Not Reject Ho

Ho: The model is correctly specified.

H1: The model is not correctly specified.

Decision Rule: Reject the Ho if p-value is less than significant level. Otherwise, do not reject the Ho.

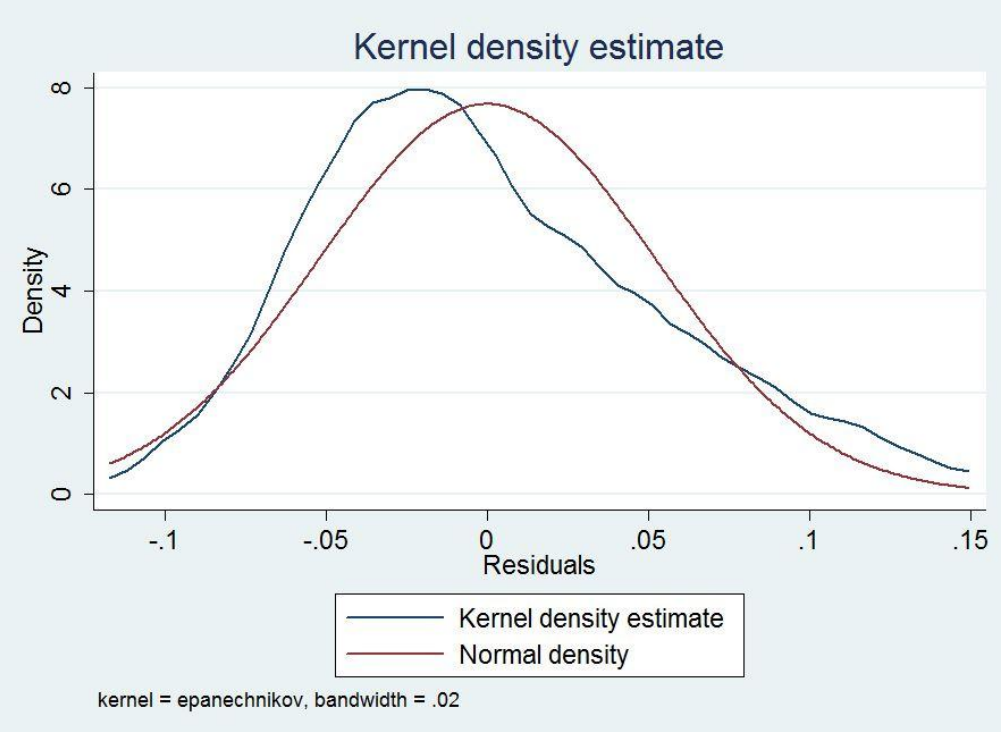
Decision: Do not reject Ho since the p-value is 0.5588 which is more than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 is correctly specified.

4.1.2 Normality of Error Term

Next, an informal test to check the distribution of the error term has been performed by drawing a graph using Kernel density estimation. The result is shown as below and it is clearly shown (blue curve) that the error term is normally distributed.

Diagram 4.2 Distribution of Error Term



On top of that, a hypothesis testing on the normality of error term has been carried out by using Jarque-Bera Test. The details of the tests are as follow.

Ho: The error term is normally distributed.

H1: The error term is not normally distributed.

Significant Level: $X^2_{0.05, 2} = 5.991$

Decision Rule: Reject the Ho if Jarque-Bera test statistics is more than or less than the significant level. Otherwise, do not reject the null hypothesis.

Table 4.3 Value of Skewness and Kurtosis

Skewness	0.6060973

Kurtosis	2.807944

Jarque-Bera test statistics = $\frac{n}{6}$ [skewness^2 + $\frac{1}{4}$ (Kurtosis – 3)^2]

= $\frac{56}{6}$ [0.6060973^2 + $\frac{1}{4}$ (2.807944 – 3)^2]

= 9.33333[0.367354 + $\frac{1}{4}$ (-0.192056)^2]

= 3.5147

Decision: Do not reject Ho since the Jarque-Bera test statistics is 3.5147 which is more than -5.991 and less than 5.991.

Conclusion: There is sufficient evidence to conclude that the error term of the model 1.1 is normally distributed.

4.1.3 Multicollinearity

Multicollinearity test was carried out to examine the presence of relationship between the independent variables. Correlation matrix test was performed on the model 1.1 in order to test the strength of the relationship presents between the independent variables. Table 4.3 shows the result of the strength of the correlation between two independent variables for all the independent variables.

Table 4.4 Correlation Among the Independent Variables

	BC	**BS**	**NPL**	**GDP**	**BOPR**	**CPI**	**FC**	**ROE**
BC	1.0000	-	-	-	-	-	-	-
BS	-0.2034	1.0000	-	-	-	-	-	-
NPL	0.0555	-0.5296	1.0000	-	-	-	-	-
GDP	0.2096	0.2120	-0.5631	1.0000	-	-	-	-
BOPR	-0.2175	-0.0822	0.3514	-0.2404	1.0000	-	-	-
CPI	-0.0785	-0.0547	0.1515	0.0255	0.6523	1.0000	-	-
FC	-0.1945	-0.0261	-0.1024	0.0490	0.4922	0.4111	1.0000	-
ROE	-0.2273	0.3719	-0.4514	0.3146	-0.0690	0.1077	-0.0025	1.0000

High correlation between two variables implies that they might have relationship with each other and may cause the model to suffer from multicollinearity problem. As shown in the table 4.3, it is found that the bank's overnight policy rate (BOPR) and the consumer price index (proxy variable for the inflation rate) have the highest correlation among all the other independent variables. Thus the correlation between these two variables has the highest possibilities to cause the model to suffer from multicollinearity problem.

Hence, an auxiliary estimated regression model has been constructed by assigning the bank's overnight policy rate as the dependent variable and consumer price index as the independent variable to obtain the R-square and calculate the variance inflation factor (VIF).

Table 4.5 Indications of VIF Value

VIF value	**Indications**
VIF = ∞ (Undefined)	Perfect multicollinearity problem.

VIF ≥ 10	Serious multicollinearity problem.
1<VIF<10	No serious multicollinearity problem.

VIF is an indicator of the seriousness of multicollinearity problem in a model.

Table 4.6 Result of Auxiliary Estimated Regression Model

Dependent variable	**Independent Variable**	**R-square**
Bank's overnight policy rate	Consumer Price index	0.4255

$y = c + 0.2193\ CPI$

$VIF = 1/\ 1\text{-}R^2_{BOPR,\ CPI}$

$= 1/\ 1- 0.4255$

$= 1.7406$

Based on the VIF calculation above, the VIF value is 1.7406 which implies that there is no serious multicollinearity problem in the model. Therefore, there is sufficient evidence to conclude that the model 1.1 does not contain any serious multicollinearity problem.

4.1.4 Heteroscedasticity Test

After testing for multicollinearity problem, Breusch-Pagan / Cook-Weisberg test has been performed on model 1.1. It is a heteroscedasticity test where it tests for constant variance of error term.

Table 4.7 Result of Breusch-Pagan / Cook-Weisberg Test

	P-value	Decision Rule
Breusch-Pagan test	0.6621	Do Not Reject Ho

Ho: There is not heteroscedasticity problem.

H1: There is heteroscedasticity problem.

Decision Rule: Reject the Ho if p-value is less than significant level. Otherwise, do not reject the Ho.

Decision: Do not reject Ho since the p-value is 0.6621 which is more than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 does not consist hetetoscedasticity problem.

4.1.5Autocorrelation Test

Lastly, autocorrelation test is carried out by using Wooldridge test. It is derived for panel data to examine the presence of relationship between current error term of the model 1.1 and the error term in the past (Drukker, 2003).

Table 4.8 Result of Wooldridge Test

	P-value	Decision Rule

Wooldridge test	0.0009	Reject Ho

Ho: There is not autocorrelation problem.

H1: There is autocorrelation problem.

Decision Rule: Reject the Ho if p-value is less than significant level. Otherwise, do not reject the Ho.

Decision: Reject Ho since the p-value is 0.0009 which is less than the significant level 0.01 (1%).

Conclusion: There is sufficient evidence to conclude that the model 1.1 consist autocorrelation problem.

Since model 1.1 consists of autocorrelation problem, generalized least square method is used to solve the autocorrelation problem. The present of autocorrelation problem will only cause the estimator of model 1.1 to become inefficient. However, Model 1.1 will still remain unbiased and consistent. This autocorrelation problem can be solved using the generalized least square. (Liu, 2008; Heyes, 2001). Generalized least square method will incorporate the autocorrelation problem error structure for error term. After regressing using generalized least square method, model 1.1 will become unbiased, efficient and consistent (BLUE). Thus, the variance of errors of Model 1.1 is achieved at optimal level and its estimators are efficient. Furthermore, the results of the p-values are accurate and reliable as they are not overestimated or underestimated.

4.2 Inferential Analysis

Table 4.9 Result of the Pooled Ordinary Least Square After Regressed by Generalized Least Square

Independent Variable	**Coefficient Value**	**Sign**	**P-Value**
Gross Domestic Products (GDP)	-3.04e-07	-ve	0.000*
Inflation rate (CPI)	-0.0181024	-ve	0.007 *
Financial crisis (FC)	0.018005	Insignificant	0.355
Bank's Overnight Policy Rate (BOPR)	0.065137	+ve	0.005 *
Bank's capital (BC)	1.399859	+ve	0.014 **
Non-Performing Loans (NPL)	-1.949124	-ve	0.000*
Return On Equity (ROE)	0.2875147	+ve	0.010 **
Bank's Size (BS)	-0.1092975	-ve	0.000*

*significant at 1%(strong effect)

**significant at 5%(effect)

***significant at 10%(weak effect)

y = c –3.24e-13 GDP – 0.014924 CPI + 0.0201719 FC + 0.068939 BOPR + 1.405507 BC – 2.039819 NPL + 0.1020149 ROE – 0.103575 BS ……Model 1.1

Pooled ordinary least square is used to estimate the gathered data. The bank's annual reports are gathered from their respective official websites, then the bank-specific data are extracted from their respective annual reports for 7 years, spanning from 2005 until 2011. The macroeconomic data are obtained from the DataStream. A dummy variable is included for

financial crisis to capture the effect of the financial crisis on bank's liquid asset holdings.

Based on the empirical results, it is found that gross domestic product, Inflation rate, bank's overnight policy rate, non-performing loans, and bank's size are significant at 1% which implies that they have strong effects on bank's liquid asset holdings.

While return on equity, and bank's capital are only significant at 5% which implies that they have effects on bank's liquid asset holdings.

However, it is found that financial crisis is not significant in explaining the domestic bank's liquid asset holdings.

Macroeconomic factors:

4.2.1 Gross Domestic Products (GDP)

Gross domestic product, as predicted, is found significant and negatively correlated with the bank's liquid asset holdings which are consistent with the previous researchers study. The negatively relationship indicates that the banks hold less liquid assets when the economy is growing. Both G. Alger and I. Alger (1999) and Kharroubi and Vidon (2009) studies claimed that banks will tend to hold more liquid asset during recession since there are more exposures to default risks in the interbank market. Summarizing Calomiris and Wilson (1998) and Aspachs et al. (2005) researches, bank's liquid asset holdings and GDP have negative relationship as well.

Calomiris and Wilson (1998) and Aspachs et al. (2005) elucidated that banks hold more liquid assets to buffer liquidity shocks. Their studies are further supported in Maynard and Moore (2005), Bunda and Desquilbet (2008) and Hackethal et al (2010) studies. In brief, these two factors explain the negative relationship between gross domestic product and bank's liquid asset holdings.

4.2.2 Inflation Rate

The results show that CPI which is used to measure the inflation is significant and negatively correlated with the bank's liquid asset holdings. This is consistent with findings from Vodova(2011a) where he suggested that inflation rate has a negative relationship with bank's liquid asset holdings in Czech Republic because inflation can cause bank's liquid asset holdings to decline. Furthermore, Bunda and Desquilbet (2008) findings supported our results, they explained that bank's liquid asset holdings can be greatly affected by the inflation. On top of that, the results are in agreement with Ubegbunan (1999) study as well where he claimed that the real value of bank's earning decrease during inflation. Thus, inflation rate will have negative relationship with bank's liquid asset holdings.

4.2.3 Financial Crisis

Based on the results, the financial crisis is insignificant. Referring to Goh, Lim & Tan (2012) research, the Global financial crisis (2007-2008) did not cause the banking sector to go into banking crisis. Goh et.al. (2012) further

explained that the banking sector in Malaysia has grew stronger since Asian financial crisis 1997. In addition, the country macroeconomic fundamental experienced the same effect as well in the aftermath of the crisis. Both of these factors best explain the insignificance of financial crisis in this research. Moreover, to further support this result, Bank Negara (Central Bank) governor, Tan Sri Dr Zeti Akhtar Aziz, had said "Liquidity remains ample in the domestic financial system," in explaining the strong banking liquidity despite of the crisis ("Malaysia Financial System", 2008).

4.2.4 Bank's Overnight Policy Rate

Based on the result, bank's overnight policy rate is significant and has negative relationship with bank's liquid asset holdings. The results are in line with Freixas, Martin and Skeie (2009) study where they explained that at high interbank rate, banks will hold their liquid assets at optimal level. Banks have to satisfy both depositors' liquidity needs as well as their own liquidity needs without incurring high interest expenses.

Bank-specific factors

4.2.5 Bank's Capital

The results of the tests show that there is a positive relationship between the bank's capital and bank's liquid asset holdings. This finding is in line with Vodova (2011a) and G. Alger and I. Alger (1999) finding where both

researchers found that bank's capital is positively correlated with bank's liquid asset holdings. Vodova (2011a) and G. Alger and I. Alger (1999) justified that the bank's liquid asset holdings is to build investors confidence towards the bank. On top of that, the liquid assets act as a buffer to protect shareholders from suffering losses.

4.2.6 Non-performing Loans

The results show that the non-performing loans (NPL) are significant in explaining Malaysia local commercial bank's liquid asset holdings. NPL has a negative relationship with the bank's liquid asset holdings. This result indicates that the excessive lending increase the possibilities that the loan will turn into non-performing loans which can deteriorate the bank's liquid asset holdings. These results are in line with results obtained by Iqbal (2012) which implies that the NPL ratio is negatively correlated with bank's liquid asset holdings. Iqbal (2012) explained that high NPL ratio means that large portion of total loans will turn into bad debts and thus reducing the bank's liquid asset holdings. Summarizing Brandt, Li, & Roberts' (2005) paper, he claimed that a bank with the highest liquid asset holdings has lower NPL ratio compare to other commercial banks. In conclusion, NPL ratio has an inverse relationship with the bank's liquid asset holdings.

4.2.7 Bank's Profitability

Referring to the results, return on equity is significant and has a positive relationship with the bank's liquid asset holdings. This finding is consistent with Chiaramonte et al (2012) who stated that during crisis period, bank's performance and the bank's liquid asset holdings has positive relationship. Chiaramonte et al (2012) further clarified that poor liquid asset holdings will lower bank's performance as profit-oriented banks are perceived to be safer than other banks. Thus banks with better performances tend to hold more liquid assets. In brief, ROE has a positive relationship with Malaysia local commercial bank's performance.

4.2.8 Bank's Size

The bank's size is found to be negatively correlated with bank's liquid asset holdings, which denotes that larger banks will have less liquid asset holdings. Similar finding was found by previous researchers. In year 1999, G. Alger and I. Alger did a similar research on Mexican banks and found that bank's size is negatively correlated with bank's liquid asset holdings. The reason being that larger banks have larger amount of depositors. The deposits from the depositors can be a source of liquidity and increase the bank's liquid asset holdings despite being the liabilities of the bank. Furthermore, Vodova (2011b) pointed out that larger banks favour using liabilities to meet the liquidity needs as well. The results are supported by Hackethal et al. (2010) study which is done a year ago based on similar determinants. In conclusion, the relationship between the bank's size and the bank's liquid asset holdings is negative.

4.3 Conclusion

In conclusion, it is found that financial crisis and return on equity are the independent variables which are insignificant in explaining the bank's liquid asset holdings. However, the gross domestic product, inflation rate, non-performing loans and bank's size are significant and negatively correlated with the bank's liquid asset holdings. Meanwhile, the bank's capitals and bank's overnight policy rate are significant but have positive relationship with the bank's liquid asset holdings. All the findings are consistent with the previous researchers. Next chapter will proceed with the limitations of the study and recommendations for future researchers.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

Chapter 5 wraps up the study by presenting the implication and limitation of the study in the first and second section of the chapter followed by recommendation for future researchers and lastly ends with a conclusion that summarize the research.

5.1 Summary of Statistical Analyses

Table 5.1 Result of Diagnostic Checking

Diagnostic Checking	Test Statistical	Decision	Result
1. Model specification	Ramsey Reset Test	Do Not Reject Ho	Passed
2. Normality of Error Term	Jarque-Bera Test	Do Not Reject Ho	Passed
3. Multicollinearity	Variance Inflation Factor	Do Not Reject Ho	Passed
4. Heteroscedasticity	Breusch-Pagan / Cook-Weisberg test	Do Not Reject Ho	Passed
5. Autocorrelation	Wooldridge test	Reject Ho	Passed (after being treated with GLS)

5.2 Discussion on Major Findings

Macroeconomic Factors:

5.2.1 Gross Domestic Products (GDP)

The results show that gross domestic product is significant and has a negative relationship with the liquid asset holdings of bank. This could be attributable to two reasons. Firstly, it might be due to a less stable interbank market during recession that affects bank's behaviour on holding liquid assets. This justification is documented in G. Alger and I. Alger (1999) and Kharroubi and Vidon (2009). Secondly, it might be due to the conservative behaviour in holding liquid asset during the economy recession. On top of that, banks will lend more loans when the economy starts to recover. The latter explains why bank's liquid assets drop when the economy recovers.

5.2.2 Inflation Rate

In the results, inflation rate is significant and shows a negative relationship with bank's liquid asset holdings. One of the bank's main activities is lending out loans. However lending out loans during inflation is bad for the bank's liquid asset holdings. The reason is because the nominal value of the loans will decrease during inflation. This result is consistent with Bunda and Desquilbet (2008), Vodova (2011a), and Vodova (2011b)

results as well. In addition, the real value of bank's earnings will decrease during inflation thus reducing the liquid assets of the banks.

5.2.3 Financial Crisis

The results show that the event of a financial crisis is insignificant to the domestic bank's liquid asset holdings. Goh, Lim & Tan(2012) explained that banks in Malaysia did not fall into a banking crisis during the Global financial crisis (2007-2008) because the banks have grew stronger since the Asian financial crisis in 1997. In addition, Malaysia's macroeconomy grew stronger as well in the aftermath of the crisis. These two factors contribute to the insignificance of the occurrence of a financial crisis to the domestic commercial bank's liquid asset holdings.

5.2.4 Bank's Overnight Policy Rate

Based on the result, bank's overnight policy rate is significant and inversely related to bank's liquid asset holdings. Bank's overnight policy rate is positively correlated with bank liquid asset holdings because when the interbank rate is high, banks will hold liquid assets at optimal level. Banks will have to incur higher interest expenses to borrow at a higher interbank rate. Therefore, banks opt to hold liquid assets at optimal level to meet their own liquidity needs.

Bank-specific Factors

5.2.5 Bank's Capital

Bank's capitals represent the net worth of the banks. Hence, banks with higher capital will be more likely to hold more liquid assets as a precaution measure. In addition, banks with higher capital indicate that they have higher stakes from the shareholders. Therefore, banks will be more concern about their liquidity management, as they want to avoid investors bearing the losses in the event of a liquidity problem.

5.2.6 Non-performing Loans

The empirical results in the study show that non-performing loans ratio has a negative relationship with bank's liquid asset holdings. Non-performing loans are loans that are in default or soon to be in default. When this happens, banks will suffer losses as banks have to write it off as bad debt. Since losses will deteriorate the bank's liquid asset holdings, higher NPL ratio will eventually cause the banks to be less liquid. This explanation in documented in Iqbal (2012) study on Islamic and conventional banks

5.2.7 Bank's Profitability

In this research, bank's liquid asset holdings has a positive relationship with return on equity. Lower bank's performance can lower bank's liquid asset holdings. When banks gain higher profits, banks can reserve more liquid assets and generally banks with higher liquid asset holdings are perceived to be safer. Banks that gain higher profits will gain comparative advantages over banks during a financial crisis as they will have more liquid assets to buffer the liquidity shocks.

5.2.8 Bank's Size

Bank's assets are used to represent the size of a bank. Through this study, it is found that banks that are larger in size can gather fund through customer deposits more easily (G.Alger and I. Alger., 1999). Apart from that, the larger banks also have better credit ratings compare to smaller banks. When larger banks require liquid asset holdings, liabilities such as deposits or borrowings can be a source of funds for the bank (Hackethal et al. 2010; Vodova, 2011b). Therefore the larger banks will hold less liquid assets, and use the available fund to invest in a more profitable investment.

5.3 Implications of Study

5.3.1 Macroeconomic Factors:

Based on this study, it is found that three out of four macroeconomic factors have significant effects on bank's liquid asset holdings. In order to deal with these effects, banks can develop a more advanced system that can forecast inflation rates and gross domestic product (GDP) based on

past data more accurately. This system will assist banks in the decision making when adjusting the interest rates on loans.

During recession, the default risk of borrowers will increase due to the drop in the employment rate. Thus, banks should remain conservative in liquid asset holdings during recession and keep in mind that the liquid assets should only be kept at an optimal level. This is to reduce the opportunity cost that has to be forgone while holding these liquid assets.

As shown in the study, inflation will reduce the nominal value of the loans which leads to the decrease in the nominal value of bank's total assets. Thus, extra measures should be taken during inflation. Bank should adjust the interest rate on loans during inflation. Thus the effect of the deterioration of the bank liquid asset value will be reduced.

Bank Negara Malaysia plays a vital role in regulating the liquid asset holdings in the banks through the interbank market. The bank's overnight policy rate which is used to quantify the interbank rate should be monitored closely by Bank Negara Malaysia in order to regulate the bank's liquid asset holdings. When the liquid asset holdings levels among the banks are low, interbank rate should be increased so that banks would opt to hold more liquid assets than borrowing from banks through the interbank market.

In addition, banks at all times should remain prudent in all their activities to buffer shocks in the event of a financial crisis occur. The risk management department should be on its toes to detect any noncompliance activities by the banks, especially with regards to the liquid asset holdings of bank and report to Bank Negara Malaysia.

Bank-specific factors

5.3.2 Bank's Capital

The shareholders can play a role in supervising banks' involvement in risky activities and their risk management. On the other hand, government should encourage banks to go beyond Basel and hold 10% of total capital. Consequently, banks will be hindered from being too involved in risky investments as they have to hold larger amount of capital. Alternately, banks can issue more shares to increase number of shareholders. These shareholders stakes will contribute to the bank's capital thus reducing the liquidity risks. All these are to ensure that the banks can achieve the minimum liquid asset holdings target and at the same time improve domestic commercial bank's liquid asset holdings. In conclusion, the domestic commercial banks will be subjected to less liquidity risks.

5.3.3 Non-performing Loans

Through the hypothesis testing, non-performing loans can reduce banks liquid asset holdings. In order to reduce non-performing loans, fraud management should be taken seriously. Financial sales agent should perform Know Your Customer(KYC) as a prudent approach before approving loans. On top of that, banks should at all times follow the risk assessment guidelines and issue loans to prime borrowers only. Furthermore, banks should have periodic monitoring on borrowers' capability to repay the loans and maintain the credit risk of the loans at

minimal level. Banks should develop a model that can interpret the complexity of every situation and provide the most suitable treatments to substitute the current practice where all judgments and decisions are solely made by loan officer. Apart from that, banks should have proper collateral management. Collateral for each loan should be managed accordingly and have periodic review on its value and its condition.

5.3.4 Bank's Profitability

The results show that higher profitability leads to higher bank's liquid asset holdings. Thus, it is advisable for banks to increase their profitability in order to increase their liquid asset holdings. The major portion of bank's profits is by charging interest and services fees on their assets especially loans. Hence, banks must ensure the quality of their income-generating assets by taking prudent measurement and enhance their risk management. In addition, banks should offer differentiated product to attract more customers in order to increase their profits. The products should be designed to attract different types of customers and satisfy their needs.

5.3.5 Bank's Size

Larger banks can gather fund with less difficulty as they can gather from the deposits from depositors. Consequently, these banks will not hold too much liquid assets on hands. In order to resolve this issue, the government can reduce the interest rates of deposits to discourage people from depositing in the bank. Subsequently, banks have to hold enough liquid

assets to buffer shocks. On top of that, this can prevent banks from being too dependent on their liabilities to generate needed fund.

On top of that, Bank Negara Malaysia should take an extra step in ensuring the quality of the liquid assets that domestic commercial banks hold. Banks should be advised to hold large amount of high quality assets.

Moreover, government can tighten requirements on borrowing loan to reduce the amount of loans that banks will issue. Consequently, banks will have more liquid assets on hand instead of issuing it out as loans.

5.4 Limitations of Study

This study suffers from several limitations. There a numbers of researchers did studies on banking field. Nonetheless only a handful of these studies are on the liquidity of bank and fewer use liquid assets as the dependent variable. Thus, this confined the researchers from performing an inclusive literature reviews.

Secondly, mergers and acquisitions between banks are common and in fact it is still an ongoing occurrence. This causes the process of data retrieval to become complicated. Furthermore, for the past decades, several local banks in Malaysia have undergone a series of merger and acquisitions. To date, only 8 local banks are outstanding and annual reports for some of these local banks prior to year 2005 are not available. Consequently, the numbers of observation are limited.

Secondary research requires critical judgment on the reliability and validity of the information, hence it is time consuming. Unlike primary data, where researchers have control over its origin, thorough examination is required for secondary data as its origin might be dubious but primary data will consume much longer time. Since the time frame given to complete this study on the determinants of bank's liquid asset holdings is only a year, secondary data is a better option to be used to carry out this study.

Often, secondary data might not be in the form that is needed, therefore the researchers have to use similar data to meet the research requirements. Moreover, some valuables secondary data such as articles and journals only provide an abstract of the studies and charge a fee for the full version. Thus, due to the lack of resources, only bank's data from bank's annual reports and complimentary journals are able to retrieve to explain the hypothesis testing.

Moreover, every country is distinct with its own political background, regulations and culture. Since this research is based on domestic banks in Malaysia, thus the findings and discussions are only meaningful for Malaysian domestic banks and government. Researchers from other countries can use this research as a referral but the findings and implications might not be applicable in other countries.

In addition, although this research is based on the liquid asset holdings of domestic banks in Malaysia, there are a few ratios to measure bank's liquid asset holdings but only bank's behaviour of holding liquid asset is being examined. Thus, liquid asset ratio is used in this study to define bank's liquid asset holdings. Thus, these findings only explain bank's liquidity in terms of their liquid asset holdings and not others.

5.5 Recommendations for Future Research

More researchers are encouraged to conduct researches on the liquid asset holdings of commercial banks in Malaysia so that policy makers in Malaysia can have more referrals before setting up new policies. On top of that, it also benefits the financial institutions as these researches provide in-depth study and inclusive results.

This research only covered domestic commercial banks in Malaysia. Thus, the results are only meaningful to be used in Malaysia or countries with similar characteristic. Therefore, the future researcher should widen their field of studies by including commercial banks in several countries with different characteristics so that the results are more inclusive and suitable to be used by more countries.

Furthermore, the future researchers that are interested to study about the liquid asset holdings of banks can attempt to include other liquidity ratios as the dependent variables. These ratios include liquid asset to deposit and short term financing ratio, loans to total assets ratio, loan to deposit and short term financing ratio. Including different liquidity ratio can help the future researchers to provide more comprehensive explanations and conclusions on the liquidity of bank. It also allows the users of the information to look at the liquidity of bank from other perspectives.

In addition, future researchers should extend the period of the research, so that they can have a larger sample size. Larger sample size also implies higher degrees of freedom which mean they can get more precise results. In addition, a longer research period also allows them to do a more comprehensive literature reviews on the topic of their research. This will increase the reliability of their study as well.

5.6 Conclusion

Banks should remain liquid always to prevent falling into a liquidity crisis and cause distress to the overall economy. Thus this study attempts to identify the determinants of liquid asset holdings of domestic commercial banks in Malaysia. This research also provides summary of previous studies on similar topics. Panel data set is used, spanning 8 Malaysia domestic banks over 7 years and estimated using pooled OLS. After carrying out the hypothesis testing, the following conclusion has been formed.

It is found that bank's capital, bank's size, non-performing loans ratio, gross domestic product, inflation rate, bank's overnight policy rate and return on equity have significant effects on bank's liquid asset holdings. However, the event of a financial crisis is proven to be insignificant in this research. This concludes that the occurrence of a financial crisis will not affect the domestic commercial bank's liquid asset holdings.

Summary of the hypothesis findings, discussions of the study, and its implications are included in this last chapter. Despite the best efforts, this research still suffers from a few limitations. However, these limitations do not have a large effect on the results and some of them can be overcome.

In brief, this research has reached its objective in finding the determinants of the liquid asset holdings of domestic commercial banks in Malaysia and can be used as a referral point for the future researchers who are interested to study this topic.

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APPENDICES

Appendix 1.1 Result for Ramsey Reset Test

```
Ramsey RESET test using powers of the fitted values of y
       Ho:  model has no omitted variables
                  F(3, 44) =      0.70
                  Prob > F =      0.5588
```

Appendix 1.2 Result for Skewness and Kurtosis

Residuals

Percentiles		Smallest		
1%	-.097736	-.097736		
5%	-.0754945	-.0759855		
10%	-.0635105	-.0754945	Obs	56
25%	-.0356145	-.0682357	Sum of Wgt.	56
50%	-.0094158		Mean	8.24e-11
		Largest	Std. Dev.	.0519468
75%	.0297877	.0945493		
90%	.0798442	.1010401	Variance	.0026985
95%	.1010401	.1227344	Skewness	.6060973
99%	.1297172	.1297172	Kurtosis	2.807944

Appendix 1.3 Result for Correlation Among Independent Variables

	bc	bs	npl	gdp	bopr	cpi	fc	roe
bc	1.0000							
bs	-0.2034	1.0000						
npl	0.0555	-0.5296	1.0000					
gdp	0.2096	0.2120	-0.5631	1.0000				
bopr	-0.2175	-0.0822	0.3514	-0.2404	1.0000			
cpi	-0.0785	-0.0547	0.1515	0.0255	0.6523	1.0000		
fc	-0.1945	-0.0261	-0.1024	0.0490	0.4922	0.4111	1.0000	
roe	-0.2273	0.3719	-0.4514	0.3146	-0.0690	0.1077	-0.0025	1.0000

Appendix 1.4 Result for Breusch-Pagan / Cook-weisberg Test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of y

         chi2(1)      =     0.19
         Prob > chi2  =   0.6621
```

Appendix 1.5 Result for Wooldridge Test

```
wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,       7) =     29.770
           Prob > F =      0.0009
```

Appendix 1.6 Result for Generalized Least Squares

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        homoskedastic
Correlation:   no autocorrelation

Estimated covariances      =         1          Number of obs      =        56
Estimated autocorrelations =         0          Number of groups   =         8
Estimated coefficients     =         9          Time periods       =         7
                                                Wald chi2(8)       =     60.88
                                                Prob > chi2        =    0.0000
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp	-3.04e-07	8.28e-08	-3.67	0.000	-4.66e-07	-1.41e-07
cpi	-.0181024	.0067149	-2.70	0.007	-.0312633	-.0049414
fc	.018005	.0194529	0.93	0.355	-.0201219	.056132
bopr	.065137	.0230145	2.83	0.005	.0200295	.1102445
bc	1.399859	.5682551	2.46	0.014	.2860997	2.513619
npl	-1.949124	.3528851	-5.52	0.000	-2.640766	-1.257482
roe	.2875147	.1121907	2.56	0.010	.0676248	.5074045
bs	-.1092975	.0261705	-4.18	0.000	-.1605907	-.0580044
_cons	1.45659	.3053975	4.77	0.000	.8580222	2.055158

Liquid Asset

Appendix 1.7 RHB Bank Berhad's Liquid Asset

Year	Liquid Asset				
	Cash and short-term funds ”000	Securities purchased under resale agreements ”000	Deposits and placements with banks and other financial institutions ”000	Securities available-for-sale ”000	Total ”000
2005	12,539,401	2,219,491	1,981,441	1,726,819	18,467,152
2006	8,571,796	2,691,541	4,004,276	5,607,140	20,874,753
2007	15,309,821	567,836	2,964,499	6,871,139	25,713,295
2008	11,963,560	106,565	848,371	3,846,603	16,765,099
2009	12,790,568	1,594,210	1,937,762	5,367,804	21,690,344
2010	11,093,561	276,407	1,539,648	8,143,221	21,052,837
2011	12,344,141	142,291	2,200,238	6,339,146	21,025,816

Appendix 1.8 AmBank (M) Berhad's Liquid Asset

Year	Liquid Asset

	Cash and short-term funds ”000	Deposits and placements with banks and other financial institutions ”000	Securities available-for-sale ”000	Total ”000
2005	3,156,862	358,800	102,949	3,618,611
2006	7,303,343	1,121,150	331,513	8,756,006
2007	8,129,295	1,838,200	598,751	10,566,246
2008	7,411,342	1,977,093	119,413	9,507,848
2009	13,634,119	427,143	5,053,563	19,114,825
2010	7,447,516	1,902,368	7,405,684	16,755,568
2011	8,375,879	3,702,163	6,557,696	18,635,738

Appendix 1.9 Public Bank Berhad’s Liquid Asset

Year	Liquid Asset				
	Cash and short-term funds ”000	Securities purchased under resale agreements ”000	Deposits and placements with banks and other financial institutions ”000	Securities available-for-sale ”000	Total ”000
2005	17,170,338	4,022,128	8,736,868	3,563,556	33,492,890
2006	22,890,702	10,797,358	3,954,803	3,437,739	41,080,602
2007	32,606,147	12,006,597	3,069,166	3,648,862	51,330,772
2008	29,564,959	4,762,407	3,834,326	4,914,144	43,075,836
2009	31,868,626	-	3,115,967	10,458,159	45,442,752
2010	27,172,447	10,737	-	14,269,479	41,452,663
2011	10,508,349	8,435,611	-	14,287,941	33,231,901

Appendix 2.0 Malayan Banking Berhad’s Liquid Asset

Year	Liquid Asset				
	Cash and short-term	Securities purchased	Deposits and placements with	Securities available-	Total ”000

	funds ”000	under resale agreements ”000	banks and other financial institutions ”000	for-sale ”000	
2005	18,479,404	296,871	9,975,736	-	28,752,011
2006	27,542,452	1,503,957	3,010,830	23,143,904	55,201,143
2007	34,200,909	258,772	15,560,914	25,213,654	75,234,249
2008	24,069,617	-	8,795,492	28,620,398	61,485,507
2009	17,448,312	346,462	7,563,969	39,349,558	64,708,301
2010	19,403,616	371,237	7,098,198	37,446,841	64,319,892
2011	25,803,796	-	7,644,471	40,262,042	73,710,309

Appendix 2.1 Alliance Bank Malaysia Berhad’s Liquid Asset

Year	Liquid Asset			
	Cash and short-term funds ”000	Deposits and placements with banks and other financial institutions ”000	Securities available-for-sale ”000	Total ”000
2005	1,969,672	414,466	426,934	2,811,072
2006	2,296,635	1,051,469	401,707	3,749,811
2007	3,572,840	2,411,834	1,337,196	7,321,870
2008	4,627,759	512,835	2,640,121	7,780,715
2009	4,888,007	1,001,373	4,378,893	10,268,273
2010	3,182,455	983,000	3,266,979	7,432,434
2011	958,111	954,610	6,329,994	8,242,715

Appendix 2.2 CIMB Bank Berhad’s Liquid Asset

Year	Liquid Asset				
	Cash and short-term	Securities purchased under	Deposits and placements with	Securities available-	Total ”000

	funds ”000	resale agreements ”000	banks and other financial institutions ”000	for-sale ”000	
2005	8,905,326	3,845,873	1,329,368	4,149,205	18,229,772
2006	16,721,668	2,702,396	4,163,256	5,712,558	29,299,878
2007	23,490,309	4,308,971	4,965,022	5,832,506	38,596,808
2008	14,308,346	2,967,770	4,967,910	6,503,390	28,747,416
2009	17,699,691	2,857,456	11,934,278	6,524,708	39,016,133
2010	12,911,193	2,475,591	16,083,982	7,377,258	38,848,024
2011	20,783,513	3,957,059	10,848,583	9,045,681	44,634,836

Appendix 2.3 Affin Bank Berhad’s Liquid Asset

Year	Liquid Asset			
	Cash and short-term funds ”000	Deposits and placements with banks and other financial institutions ”000	Securities available-for-sale ”000	Total ”000
2005	3,217,018	140,000	2,687,122	6,044,140
2006	5,306,090	297,600	1,916,715	7,520,405
2007	4,740,586	901,271	3,242,879	8,884,736
2008	4,318,934	454,776	3,114,716	7,888,426
2009	4,176,945	623,271	4,239,770	9,039,986
2010	6,102,307	559,533	4,428,260	11,090,100
2011	5,527,439	1,098,988	5,214,533	11,840,960

Appendix 2.4 Hong Leong Bank Berhad’s Liquid Asset

Year	Liquid Asset				
	Cash and	Securities	Deposits and	Securities	Total ”000

	short-term funds ”000	purchased under resale agreements ”000	placements with banks and other financial institutions ”000	available-for-sale ”000	
2005	11,125,551	9,928,492	3,537,614	2,348,500	26,940,157
2006	12,294,079	4,496,814	1,844,812	5,645,608	24,281,313
2007	14,880,849	3,495,309	9,047,158	2,678,308	30,101,624
2008	20,392,853	972,742	2,137,640	5,004,554	28,507,789
2009	15,820,913	-	5,291,952	3,570,387	24,683,252
2010	13,928,247	-	7,004,664	3,859,367	24,792,278
2011	17,349,793	86	6,131,473	2,536,925	26,018,277

Bank’s Specific Data

Appendix 2.5 RHB Bank Berhad’s Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	74,154,469	4,089,011	269,802	37,090,808	1,971,138
2006	85,948,893	4,357,570	392,045	46,879,331	2,213,752
2007	85,063,579	4,185,437	645,393	47,470,523	1,671,707
2008	84,238,533	6,266,099	936,456	52,600,047	1,159,999
2009	94,045,473	7,180,044	1,079,716	59,116,696	1,234,994
2010	105,179,231	8,397,474	1,294,437	71,125,558	2,927,024
2011	120,507,417	9,642,596	1,422,249	80,369,613	2,727,004

Appendix 2.6 AmBank (M) Berhad’s Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	35,118,060	2,643,620	237,651	27,282,390	3,420,544
2006	56,241,373	3,257,639	229,719	40,736,551	3,949,292
2007	53,583,722	2,918,761	-460,206	37,095,578	2,641,630

2008	55,366,411	3,402,693	378,507	39,948,718	1,659,246
2009	70,772,211	3,857,312	505,785	46,899,886	1,364,156
2010	73,379,270	4,772,540	717,126	52,010,508	893,839
2011	80,910,528	4,956,841	1,520,169	55,336,273	2,122,976

Appendix 2.7 Public Bank Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	107,364,902	8,137,955	1,280,892	64,579,905	1,138,462
2006	134,267,022	8,970,327	1,789,435	75,891,397	1,264,751
2007	158,471,100	9,350,615	2,106,197	89,805,707	1,205,499
2008	166,698,854	9,391,829	2,272,736	93,174,291	859,820
2009	176,576,601	10,442,212	2,181,665	107,962,807	732,002
2010	186,409,862	12,302,751	2,931,561	125,062,183	1,401,321
2011	205,433,044	13,909,928	3,268,756	142,255,685	1,150,234

Appendix 2.8 Malayan Banking Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	175,434,713	15,179,279	3,809,643	115,481,632	5,742,146
2006	197,057,006	15,274,094	2,520,198	127,848,395	4,951,661
2007	227,447,240	17,453,838	3,051,461	136,223,498	4,358,315
2008	219,172,485	17,200,315	2,303,965	138,985,721	2,639,905

2009	238,277,142	22,510,444	-331,165	144,431,798	2,189,282
2010	248,392,266	25,256,824	3,552,685	151,469,585	1,797,200
2011	293,660,532	27,998,403	3,358,699	181,572,844	4,261,599

Appendix 2.9 Alliance Bank Malaysia Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	21,550,647	1,873,550	187,391	13,964,342	1,613,128
2006	21,687,615	1,892,996	-171,772	12,901,180	1,235,062
2007	24,337,863	1,995,610	111,544	13,019,480	734,872
2008	25,821,950	2,481,087	381,194	15,318,769	512,283
2009	28,486,604	2,655,715	237,078	16,277,911	305,121
2010	26,937,995	2,727,474	183,178	17,132,000	284,275
2011	29,380,878	3,002,677	321,410	17,718,442	592,458

Appendix 3.0 CIMB Bank Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	86,489,410	6,452,151	578,297	54,153,477	3,538,757
2006	127,779,828	10,297,767	955,435	72,965,410	4,731,990
2007	139,987,541	10,897,054	1,178,487	73,011,777	3,176,312
2008	147,069,901	11,853,224	1,678,036	84,922,177	2,201,984
2009	160,221,618	14,828,441	1,469,073	84,456,367	996,697
2010	170,823,022	15,741,124	1,912,556	90,816,549	3,988,148
2011	186,545,248	16,998,847	2,674,531	99,222,358	4,041,828

Appendix 3.1 Affin Bank Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	24,993,405	2,084,999	163,363	16,423,069	2,301,644
2006	26,167,063	2,226,003	159,024	15,746,648	1,987,329
2007	26,233,528	2,409,341	180,859	15,100,333	1,285,283
2008	27,730,474	2,580,142	299,936	17,054,062	604,032
2009	30,333,116	2,810,766	295,240	19,108,595	465,708

2010	35,453,667	3,112,800	346,705	22,419,251	818,522
2011	40,070,290	3,351,398	388,496	25,318,061	693,318

Appendix 3.2 Hong Leong Bank Berhad's Specific Data

Year	Total Asset ”000	Total Equity ”000	Net Income ”000	Total Loans ”000	Non-Performing Loan ”000
2005	57,675,075	4,400,868	1,105,795	25,578,044	1,192,091
2006	55,139,095	4,335,328	502,556	24,671,107	859,532
2007	66,161,398	4,493,683	547,031	27,965,985	589,593
2008	69,992,756	4,923,133	696,530	30,306,207	473,601
2009	70,732,513	5,319,288	659,678	30,938,086	447,092
2010	77,730,208	5,815,063	767,817	33,589,093	437,615
2011	87,650,089	6,567,126	807,493	38,548,822	600,800

Macroeconomic Data

Appendix 3.3 Gross Domestic Product

Classifications & Metadata

Name	GDP
DS Mnemonic	MYY99B..A
Start Date	1955
End Date	2011
Market	Malaysia
Source	International Financial Statistics (IMF)
Frequency	Annual
Unit	Malaysian Ringgit
Scale	Millions
Base Period	
Adjustment	Current prices,not seasonally adjusted
Key Indicator	No
Forecast	Historical Series
Status	Active
Dataset	International Sources
Conversion Method	Sum
Last Updated	Oct 25 2012
Expanded Name	Malaysia, National Accounts & Population, GROSS DOMESTIC PRODUCT (GDP), MYR
Ecowin Code	ifs:s54899b00zfa
Alias Names	DOM GRS National Income and Product Accounts NATL Ncl NIPA Ntl Percent PRD

Appendix 3.4 Consumer Price Index

Classifications & Metadata Close

Name	CPI (%YOY)
DS Mnemonic	MYXCPI.Y
Start Date	1981
End Date	2037
Market	Malaysia
Source	Oxford Economics
Frequency	Annual
Unit	Percentage
Scale	
Base Period	
Adjustment	Not seasonally adjusted
Key Indicator	No
Forecast	Forecast Series
Status	Active
Dataset	International Sources
Conversion Method	Average
Last Updated	Jan 21 2013
Expanded Name	Malaysia, CPI, Chg Y/Y
Ecowin Code	oxem:mys_cpi_py_a
Alias Names	Change Consumer Price Index Consumer Price Indices Cost of Living Inflation Percent Percent Change

Appendix 3.5 Bank's Overnight Policy Rate

Classifications & Metadata Close

Name	OVERNIGHT POLICY RATE
DS Mnemonic	MYPRATE
Market	Malaysia
Currency	
Start date	Apr 26 2004
Source	Central Bank of Malaysia
Expanded Name	Overnight Policy Rate
Datatypes	IR-0404 more