

DETERMINANTS OF BANKING FRAGILITY 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.

(4) The word count of this research report is 13,741 words.

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## LIST OF ABBREVIATIONS

AFTA	ASEAN Free Trade Area
ARCH	Autoregressive Conditional Heteroscedasticity
ASEAN	Association of Southeast Asian Nations
BNM	Bank Negara Malaysia
CLT	Central Limit Theorem
GDP	Growth Domestic Product
GLS	Generalized Least Squares
Hong Kong SAR	Hong Kong Special Administrative Region
KLSE	Kuala Lumpur Stock Exchange
LM TEST	Lagrange Multiplier Test
NAIM	Narrow Interest Margin
NIM	Net Interest Margin
OLS	Ordinary Least Squares
PIDM	Perbadanan Insurans Deposit Malaysia
VIF	Variance Inflation Factor

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## **PREFACE**

This researcher paper is submitted in partial fulfillment of the requirement for Bachelor of Business Administration (HONS) Banking and Finance. Our supervisor for this research is Ms. Tan Tze Lin. The final year project is made solely by the authors yet it is based on the research of the others and the resources are quoted as in references. There are a lot of researches and studies conclude on this topic but yet, there is none of it doing studies about the determinants of banking fragility in Malaysia. Thus, reserve, interest rate, and exchange rate were chosen as independent variables while financial crisis as dummy variable, in order to examine the relationship between the independent variables and dependent variable (liquidity). Writing this thesis has been difficult but during the process, we have learned some extra knowledge. We strongly felt that the knowledge we learned from this research will help us in our future career.

## **ABSTRACT**

The purpose of this research is to identify the factors significant to explain banks liquidity in Malaysia. This study has categorized the independent factors into macroeconomic factors. The macroeconomic factors include reserve, interest rate, exchange rate and financial crisis. This study obtained secondary data from Bank Negara Malaysia from the year 2002 to 2011. Some factors were expressed in value, while some were in percentage, index and the dummy variable was qualitative in form. This study concludes the results based on panel data, multiple regressions model by using monthly data. The empirical findings state that all the factors included are significant except interest rate. The factors with positive influence on bank liquidity are including reserve, exchange rate and financial crisis. On the other hand, factors to bring negative effect to bank liquidity are interest rate and turned out in insignificant results.



## **CHAPTER 1: RESEARCH OVERVIEW**

### **1.0 Introduction**

The research that has been conducted in this study consists of three independent variables which are interest rate, exchange rate, reserve and financial crisis as dummy variable. At the same time, liquidity will be the dependent variable in this research. Liquidity is a very important factor to a bank's because liquidity shows how fast an asset can be converted into cash. As more liquid asset are holding by a bank, there is less chance for a bank's to meet the problem of banking fragility. The reason that researchers want to study the determinants of banking fragility in Malaysia is due to the ASEAN Trade Free Area (AFTA) agreement. In general, the existence of AFTA agreement was mainly due to the unusual exchange rate instability and financial crisis that would affect the international trade. This is the reason the researchers include the exchange rate and financial crisis into the research. Besides that, most of the researchers prefer to study the macroeconomic factors instead of microeconomic factors that will affect the bank because macroeconomic factors consist of many uncertainties as compared to microeconomic factors. There is lack of evidence to show whether macroeconomic factors such as interest rate, exchange rate, and reserve will affect the liquidity of bank. Therefore, the aim of this paper is to study and examine the determinants of banking fragility in Malaysia by using liquidity as the dependent variable which including the global financial crisis in year 2008.

## 1.1 Research Background

Banking fragility refers to system arises in banks that are easily affected by the factors which caused the bank to slowly becoming fragile. In general, bank can be fragile within one country and also can be fragile across the region. The bank will become more competitive when banks are holding more liquid assets and which will help to reduce the banking fragility (Degryse, Elahi & Penas, 2012).

Meanwhile, liquidity refers to how fast an organization can convert its assets into cash to meet the short-term obligations (BIS, 2008). Banks that hold more illiquid assets will cause bank become fragile. Therefore, many banks are going to maintain adequate liquidity during global financial crisis in order to prevent banking system fragility (Vodova, 2013).

In 1980s, Malaysian banking sector have been starting to experience the problems. In 1982s, Petronas suffers huge losses in loans to Hong Kong SAR real estate developers. Fortunately, Bank Bumiputera helps Petronas to overcome this problem in Malaysia. After that, there are a number of deposits taking institution failed along with illegal banks running in Malaysia. In order to solve this problem, Bank Negara Malaysia (BNM) took over control of these banks and institutions which included five finance companies and some of the mid-sized bank. Before the occurring of financial crisis in 1997s, Malaysia's economy is standing strong which was growing at an average annual real growth rate of 8.5%. Nowadays, there is a steady growth in Malaysia banking sector (Hock, 2013).

## 1.2 Problem Statement

Due to the fast changing in economic, business environment and rapid technological advances, Malaysia needs to have a more modern and comprehensive financial system in order to respond to the changes in domestic and international condition. In order to set up a strong financial system, the Central Bank of Malaysia has developed a modern and complex financial system which can help to effectively distribute the resources for both productive and effective use of funds in the economy. It is also very important to maintain the stability in both financial intermediaries and financial market because these two components are the main components in the financial industry. Central Bank of Malaysia was required to preserve these two components well, so that the financial system will become sound and strong in Malaysia. In addition, the banking system in Malaysia consists of Bank Negara Malaysia (BNM), commercial banks, Islamic banks and investment banks and they are the first mobiliser of funds and are the main source of financing to support the whole economy in Malaysia. Besides that, banking system plays an important role to maintain the stability in financial system to promote sustainable growth of the Malaysia economy as Malaysia's banking system covers about 67% or RM1651.8 billion of the total assets (RM2475.9 billion) in the financial system at the end of 31 December 2007 (Institute Bank-Bank Malaysia, n.d.).

During 1997-1998, Malaysia faced an Asian financial crisis and it will have a bad impact on Malaysia's economy. During that period, the value of Ringgit Malaysia depreciate sharply from RM2.42/US\$ in April 1997 to about RM4.88/US\$ on January 1998 which meant that the value of Ringgit Malaysia depreciated about 50% which will bring many negative impacts to the economy (Ariff & Yanti, 1999). Besides that, financial crisis also caused major impact on the stock market because during that time Kuala Lumpur Stock Exchange (KLSE) in Malaysia was the third largest stock exchange after Tokyo and Hong Kong. The composite index decreased from 1077.3 points in June 1997 to 262.7 points on September 1997. In September 1st, 1998,

market capitalization in KLSE decreased by 76% or RM181.5 billion. Next, the stock prices in Malaysia became weak compared to other countries and this caused the property to fall steep in terms of value in the property market which led to the negative wealth effects. Due to the sharp decrease in stock price and in property value, many domestic companies were facing bankruptcy because companies may not have enough capital and cash to solve their financial problem. Therefore, non-performing loan will increase in financial sector and caused the borrowing and financing process to slow down. Consequently, liquidity in financial market will dry up and all financial institutions suffered with the liquidity problem (Yanti, 2002).

After the financial crisis in year 1997 and 1998, BNM has implemented the reformation plan by merging the banking institutions in Malaysia and under the supervision of BNM. During 2001-2004, there have been restructuring between commercial banks and finance companies to becoming 10 local banking institutions as many international institution were seen setting up their branches in Malaysia.

Therefore, BNM need to centralize the ability and capacity of local banking institutions to enable the banking institutions to improve in terms of quality of risk management systems, improving the operational efficiency and greater compliance with governance structure in order to strengthen the foundation of financial system stability. Another global financial crisis happened in year 2007-2008 which is due to the weaknesses in the United States financial industry which caused the global economy recession. Moreover, the negative shock affected the economy in Malaysia in the last quarter in year 2008 which caused the decreasing in export and outputs to foreign country and reduced the number of foreign investors to invest in Malaysia.

Consequently, the GDP growth in Malaysia was dropped. According to the bad experience in the Asian financial crisis, BNM had been regulating the financial sector in a proper way so that financial sector will not without bringing too many effects upon the stock market. Furthermore, the chance exposure to non-performing loan and

foreign loan had been kept to minimum level among Asian economies (World Bank, 2008).

In this study, the researchers will examine how the independent variables which are exchange rate, interest rate, reserve and financial crisis as dummy variable will affect the bank liquidity in Malaysia.

### **1.3 Research Objectives**

The objectives in this paper are as followed:

- The general objective is to identify identify the factors that will affect the liquidity of bank in Malaysia.
  
- The more specific objectives are:
  - i. To determine the relationship between reserve and liquidity
  - ii. To determine the relationship between interest rate and liquidity
  - iii. To determine the relationship between exchange rate and liquidity
  - iv. To determine the relationship between financial crisis and liquidity

### **1.4 Research Questions**

There are four research questions in this paper:

- Is there a significant relationship between reserve and liquidity?
- Is there a significant relationship between interest rate and liquidity?
- Is there a significant relationship between exchange rate and liquidity?
- Is there a significant relationship between financial crisis and liquidity?

## **1.5 Hypotheses of the Study (Quantitative research)**

The major hypothesis of this research is to estimate whether the economic variables as well as internal factors are highly significant in banking fragility. There are few variables are being used in this research such as interest rate, exchange rate and financial crisis. Besides, the researchers evaluated that the conditions of liquidity that would be significantly affecting the banking performance. Financial crisis were to be the dummy variable. This study was to follow a comprehensive literature that focused on economic variables as determinant to determine the banking fragility in the certain countries. According to Gonsel (2012), the variable of interest rate and exchange rate have been taken into her research model. The expected sign of those variables were good indicator which supported by theory.

### **First Hypothesis**

H<sub>0</sub>: There is no significant relationship between reserve and liquidity

H<sub>1</sub>: There is significant relationship between reserve and liquidity

### **Second Hypothesis**

H<sub>0</sub>: There is no significant relationship between interest rate and liquidity

H<sub>1</sub>: There is significant relationship between interest rate and liquidity

### **Third Hypothesis**

H<sub>0</sub>: There is no significant relationship between exchange rate and liquidity

H<sub>1</sub>: There is significant relationship between exchange rate and liquidity

### **Forth Hypothesis**

H<sub>0</sub>: There is no significant relationship between financial crisis and liquidity

H<sub>1</sub>: There is significant relationship between financial crisis and liquidity

## **1.6 Significance of the Study**

Most of the empirical studies like Fadare (2011), Degryse et al. (2012), Eichler & Sobanski (2012), and Diamond & Rajan (2001) had omitted the studies on the determinants of banking fragility in ASEAN countries, especially Malaysia. In this research, the researchers would like to examine on the relationship between liquidity of bank and interest rates, exchange rates, reserve, and financial crisis in a selected developing ASEAN country which is Malaysia.

This research is beneficial as it would analyze on the determinants of banking fragility in Malaysia after the ASEAN Free Trade Area (AFTA) agreement was signed and the tariff rates between AFTA members are loosening in recent years as Brunei, Indonesia, Philippines, Singapore, Thailand, and Malaysia had already agreed to enact zero tariff rates on imports by 2010, and it would also apply to the Cambodia, Myanmar, Laos, and Vietnam by 2015. The AFTA agreement would be making different impact on all of the financial institutions across the ASEAN countries since they would be linked together after 2015. It is important to study on the determinants of banking fragility in Malaysia before all the AFTA members enacted zero tariff rates on import in between the AFTA members.

## **1.7 Chapter Layout**

This researchers' report can be divided into 5 chapters. Chapter 1 will be an overview about the whole research paper which included an introduction about topic, background, problem statement, research objectives, research questions, hypotheses of this study and the significance of this study. Next, in chapter 2 will be explaining further the literature review on liquidity of bank's determinants that was affected by the external variables and the elaboration of the theoretical model. Chapter 3 will

describe the data and methodology used in testing the effects of external variables on bank liquidity in Malaysia. Chapter 4 will explain about the pattern of result related to the research questions and hypotheses through inferential analysis, empirical result and finding of research. The major findings, implication for policy, limitations of study and suggest the recommendation for future research will be concluded in the last chapter.

## **1.8 Conclusion**

The conclusion chapter covers the introduction, background of the topic, problem statement, research objectives, research question, hypotheses and the significance of the study. The objective of this paper is to determine the importance of external variables that will affect the bank liquidity in Malaysia. Moreover, researchers will further discuss the literature reviews and theoretical model in next chapter.



## **CHAPTER 2: LITERATURE REVIEW**

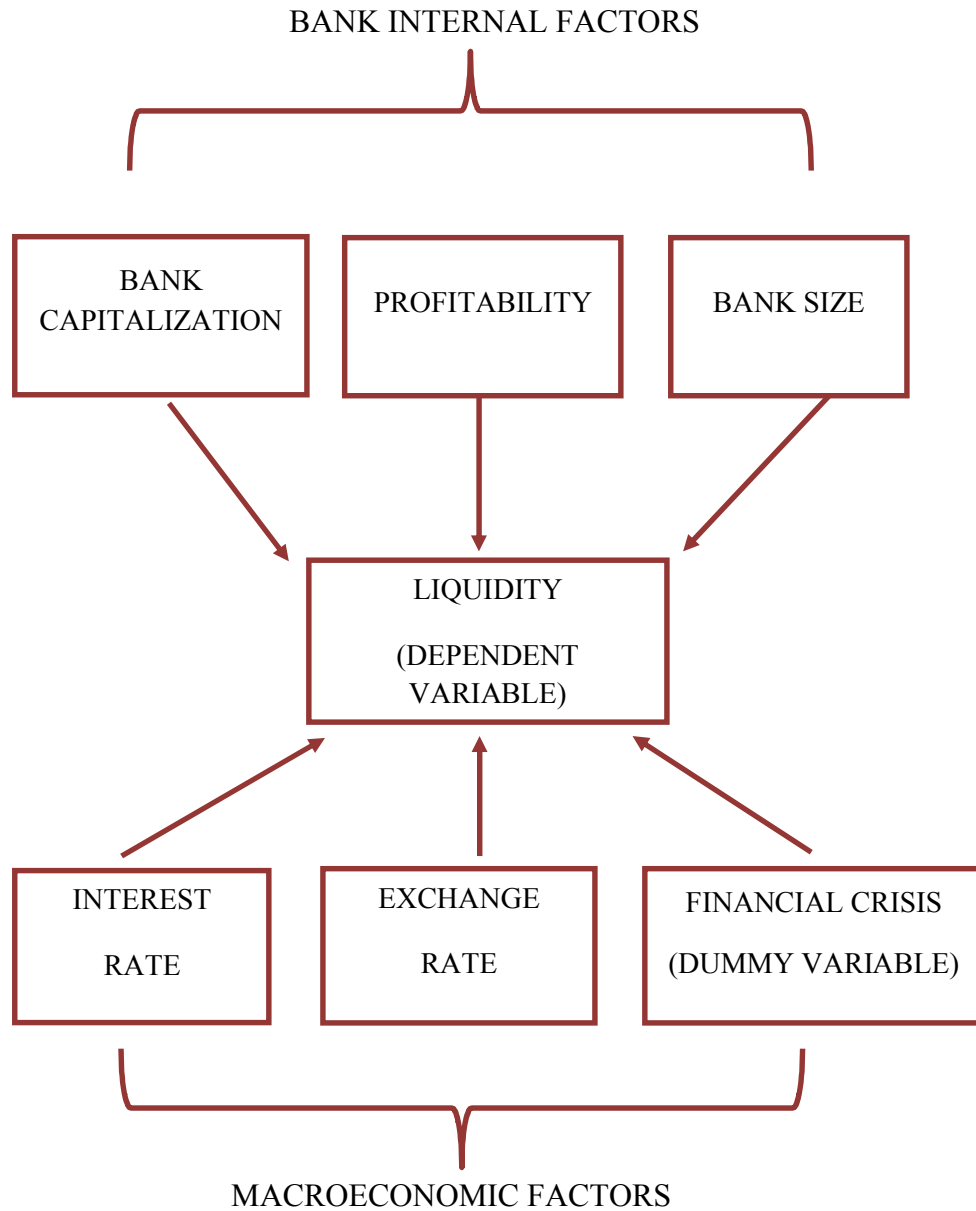
### **2.0 Introduction**

In the previous research, most of the studies were done by the researchers which investigated the banking fragility by using the profitability as determinants. In addition, the profitability can be influenced by two categories which are internal and external factors. The internal factors could be concentration, capitalization diversification, non-performing loans (NPL), return on asset of banks and so on. In these studies, the researchers would like to evaluate the factors that caused banking fragility by using the liquidity. Before the investment of the bank matures, the bank depositors would try to withdraw earlier, they could also expect that the bank will run out of liquidity. Besides, if the banks were failed to make estimation about the sufficient liquidity, and choose a wrong time to make a payment, it tends to lead to bank fragility (Ennis & Keister, 2010).

## 2.1 Conceptual Framework

Table 2.1.1: Conceptual Framework of Previous Research

### The Determinant of Banking Fragility



## **2.2 Review of the Literature**

### **2.2.1 Liquidity of bank (Liquidity)**

Normally, most banks would be shocked of their assets and liabilities. This will cause bank to face difficulty and caused fragility of the bank. Most of the previous literatures on banking fragility were being focused on bank stability. Degryse et al. (2013) described the regional banking fragility in Asia, Europe, Latin America and the United States. Those characteristics of a bank such as liquidity, diversification, and capitalization played an important role in banking system. The main defence against liquidity shocks is liquidity as any uncertainty of bank liquidity will enhance the stability of a bank.

However, Allen & Gale (2000) argued that a stable capitalized banking can help to minimize a banking failure. Banking characteristics played a main role in explaining the banking fragility, with a higher liquidity it will lessen the region banking fragility in all regions and with a higher capitalized it could reduce the banking fragility (Degryse et al., 2013). Liquidity has long been recognized as an important factor driving the prices of financial assets. According to Mitra & Abhilasha (2012), the term of liquidity were used as a financial sign for cash flow, ranges the overall existent financing that is available across the banking institution.

Besides that, 'Liquidity' is an amount of money that is available to banks for daily operations (Borio, 1997). Central bank is a monopoly supplier which supplies the liquidity as known as reserve. A reserve is deposit that a bank needs to keep a certain amount of money in the central bank to meet the requirement

of reserve that fulfils the central bank's requirement; it is an obligation for a bank to keep the reserve. Macroeconomic variables, liquidity relates with monetary conditions. One of the key indicators of liquidity in terms of price is interest rates (Longworth, 2007).

Liquidity buffer means the availability of liquidity. While under stress factors and over a period of time, the need for covering the extra liquidity may arises (Committee of European Banking Supervisors, 2009). However, if available liquidity is much more than the legal requirement, it would be costly for the financial intermediations as said by Delechat, Henao, Muthoora & Vtyurina (2010). It is because during a normal period, if banks were to hold a higher liquidity ratio would be costly for banks since it is federal with a lower return on assets without much offsetting benefit (Fazelina, 2012; as cited at Delechat et al., 2010).

Brendan & Raymond (2010) pointed out that risk for bank liquidity is universal and it would easily cause a bank to lose its liquidity as the depositors of the bank can withdraw their funds at any given time. Besides, if banks were unable to meet their short term obligation, it will lead a bank to facing financial problems or otherwise known as banking crisis. In short, it could impact the economy since banks have engaged in certain activities of the economy such as investment funds to a certain sector of the economy (Vries, 2003). It is because when a bank fails, it will lead shrinks to the flow, creation of liquidity and causes a liquidity shortage (Douglas & Raghuram, 2003).

Chen & Phuong (2014) studied those factors in order to determine the size of liquidity buffer in banks. They examined the effect of those factors that related with banks such as bank characteristics, loan-related operations of bank, fundamentals of macroeconomic, and regulations policies implemented by regulators. They found that the sizes of bank liquidity buffer are correlated with

bank loan-related operations and it would minimize the impact of policy that carried out by regulator in bank liquidity management. In the research, the study suggested all of the factors are statistically significant and have expected signs on the influences on the bank's liquidity buffer.

Bunda & Desquilbet (2008) evaluated the determinants of liquidity with a panel data. They assumed that the liquidity as dependent variable, and the other variables such as total asset, exchange rate, ratio of equity to asset, financial crisis, inflation and thus to determine. At their research, they found that ratio of equity to assets had a positive relationship while the exchange rate, financial crisis and interest rate have a negative relationship with liquidity.

### **2.2.2 Reserve Requirements (Reserve)**

Reserve requirements are the minimum amount of funds banks were required to deposit in central bank for the purpose to prevent bank runs. The goal of reserve requirement is very wide but there are two main aspects which are liquidity and solvency. According to Carlson (2013), the policymakers of United States promote liquidity of individual bank by implementing the reserve requirements to ensure the soundness of bank. The policy that implemented by central bank would be an impact on the individual bank liquidity especially during a financial crisis. When central bank increases the reserve requirements, banks that don't have sufficient liquidity to meet the reserve requirements would have to borrow from others. If the discount rate is higher than the federal funds rate, bank will prefer to borrow overnight loan from another bank instead of central bank to meet the short-term obligations. However, during financial crisis, even if the federal funds rate is critically low, but most probably the insufficient liquidity of bank would be unable to receive loan from other banks since most

banks will reduce on liquidity supply because they will have to hoard liquidity as liquidity has become more important or valuable in the event of financial crisis. Therefore, an increase in reserve requirement that set by the central bank will lead to an increase in the liquidity of individual banks especially during the financial crisis period.

Furthermore, Robitaille (2011) also pointed out that in order for central bank to help banks in managing their liquidity risks that may face by banks, central bank will increase the reserve requirements ratio so that banks will hold more liquid assets. When banks hold more liquid assets, the liquidity risk will be reduced and banking fragility will be reduced as well. This indicated that the reserve requirements are positively related to the liquidity of bank. Therefore, the purposeful requirement of central bank to increasing the reserve ratio is to avoid banking fragility due to illiquid and insolvency. Most of the time, a bank is illiquid because of the holding of too much of illiquid assets that are unable to convert into cash in short-term period without loss of the value. The profit gain from liquid assets are relatively lesser than the long-term assets, this is one of the reasons why banks would like to hold more long-term assets instead of liquid assets that will help them in meeting the short-term obligations.

In addition, the excess reserves can be categorized into two categories which are precautionary excess reserves and involuntary excess reserves. The precautionary excess reserves are the reserves that banks hold as cushions to cover risks while the involuntary excess reserves are the excess reserves that exceeding the precautionary levels. Nguyen & Boateng (2013) stressed that banks will have to inject more funds for the precautionary excess reserves in order to prevent from the illiquidity risk. In other words, it means when the reserves are high, the liquidity of bank will increase as well as the illiquidity risk will be reduced. The banking fragility will be less likely to happen when the illiquidity risk is not serious. When banks increase the precautionary excess

reserves, the involuntary excess reserves will be decreased and it leads to decrease in deposits that will cause a reduction in lending due to agency problems in replacing the shortage of deposit with other liabilities.

### **2.2.3 Interest Rate (INT)**

Interest rate is the one of important factors to be examined in any financial institutions or financial intermediary capacities. Besides, previous researchers found that interest rate is clearly linked with the banking sector efficiencies. Rising in operation costs will have a positive impact on interest rate whereby liquidity would be a negative impact. According to Liu (2008) interest rate is functioning as a tool that balances the supply and demand. Interest rate is differential in the commodity market and financial market. In the financial market, there are two types of interest rate which is real interest rate and nominal interest rate. It would have an insignificant relationship between interest rates and grow rate of money. In the short run, the liquidity effects the fluctuation of interest rate (Leeper & Gordon, 1991).

Besides that, monetary economists and policy makers said that liquidity effect is the changes in the money supply that can cause to change in short term nominal interest rates in the short run. Guirguis (1999) stated that if the real money supply increases, most of the economic agents will adjust their portfolio by buying more bonds and become more liquidated. This will lead the real bond prices become the highest bid and generate a liquidity effect by decreasing the nominal interest rates. Moreover, other researcher Friedman (1968) and Cogan (1972) indicated that the increase in money supply will decrease the nominal interest rates in the short run, inflation will increase caused by the increment in money supply and it will also dictate the liquidity effects in the long run. Their studies show that when using bank deposit assets, there would be a negative

relationship between monetary shocks and interest rate and it will then cause the liquidity effect.

According to Jankee (2003) described that in semi-open economic in Mauritius, interest rates can be determined by domestic factors as well as external factors. Besides, he also described that when an economic was becomes risks neutral and the bonds of domestic and foreign are perfect substitutes in fully open economies, internal and external interest rates are linked. They believed that determinant of interest rates can be explained by the change of money supply, real income, inflation, exchange rate and foreign interest rate. In his studies, he found that even the adjusted foreign interest rates and lagged interest rates have expected signs but they are not significant. He also found that there was a positive relationship between nominal interest rates and expected inflation. He concluded interest rates are more sensitive to domestic compared to external factors.

Furthermore, the interest rates are an important tool to financial managers because changes in interest rates can greatly influence the liquidity in bank's performance stated by Michis (2011). In addition, the liquidity preference theory for the determination of interest rates recommended that changes in equilibrium rates will cause changes in the supply and demand of money. When the money supply increases, it will lead to a reduction in interest rates and changes in interest rate will cause the liquidity effect. Finally, it may become illiquid in the bank's performance which causes the bank fragility. Cochrane (1989) indicated that the liquidity effect illustrated there had negative correlation between short run movement in money growth and interest rates.

According to Sibusiso, Yinusa & Francis (2011), they defined that interest rates classified as two categories which is net interest margin (NIM) and narrow interest margin (NAIM). They found that the effects on liquidity on the net



interest margin are indistinct, the effects of liquidity on the narrow interest rate margin are statistically significant while the bank liquidity is higher. Martinez & Mody (2004) also defined that there are positive relationship between interest rate margin and liquidity. In other words, bank liquidity will decrease the net interest margin but raise narrow interest margin (as cited at Sibusiso et al., 2011). In a meanwhile, Tesfaye (2012) found that interest rates are statistically significant and positively influenced on bank liquidity. However, they also defined that the interest rates are negatively affecting a financial performance. Besides that, Muhammad and Amir (2013)'s research that examined the bank's specific and macroeconomic variables will impact the liquidity of banks found that by using the model 2 (advances net of provisions to total assets), the interest rates are significant and had a positive impact with liquidity. However, according to Valla (2006) and Bunda & Desquilbet (2008), they found a negative relationship between interest rates and liquidity in their studies.

#### **2.2.4 Exchange Rate (EXR)**

Broadly speaking, liquidity refers to the ability of a financial institution to meet all legitimate demands for funds (Tesfaye, 2012). The volatility of exchange rate is a sort of international risk faced by exporting firms. This is because firms are required to consider the changes of the exchanged rate when there is a sharp increase in cost competition in terms of their strategies planning. Firms who are always exporting and characterized by heterogeneous productivity would have a chance to face a liquidity constraint; this liquidity constraint normally is affected by the changes of the exchange rates. At the same time, the profits of more productive firms may face a liquidity constraint as it is very sensitive to the exchange rate fluctuation. With the cost of external funds increases, the profits are less sensitive to exchange rate. Since appreciation in exchange rate significantly positively affects the liquidity, it would mean there is a positive

relationship between exchange rates and liquidity. This is due to the increase in exchange rates which tend to increase the liquidity of a firm (Guillou & Schiavo, 2011).

Chaney (2005) found that firms that are able to export depend on the sufficient liquidity because firms must pay the cost before they entered to the foreign market. For those firms are having insufficient liquidity, they are not going to export even when it is very profitable after good are were being exported. This is because of the difficulty to solve the amount of fixed costs needed when they are entering into the foreign markets. At the same time, appreciation of exchange rates will make the exporters lose their competitiveness abroad and they will tend to reduce their exports. Some of the firms will start to export when liquidity constraints for accessing foreign markets are relaxed due to increase in foreign prices since exports is positively affected by an appreciation of exchange rate. Firms who export to a new foreign market will generate some liquidity from its exports. This shows that appreciation of exchange rate will increase the liquidity when the firms are exporting to the new foreign market.

On the other hand, Rossi (2013) found that there was an unstable relationship between exchange rates and liquidity, but it is due to the liquidity forecast on the exchange rate movements. However, Tabak (2006) found that there was a significant relationship between exchange rates and stock price in the Brazilian economy. They found that the stock price was affected by the exchange rates when using the nonlinear granger causality test. However, Chan, Hameed & Kang (2012) found that liquidity of the individual stock is significantly affected by the stock price synchronicity. At the same time, higher return co-movement will improve the liquidity. This situation shows that when the exchange rates increases, stock price also increases. After the stock price increases, higher-return co-movement will arise and help to improve the liquidity. So the researchers can assume that there is a positive relationship between exchange

rates and liquidity because exchange rates are not directly affecting the liquidity in this situation. This is due to the lack of previous studies about the direct relationship between exchange rates and liquidity.

### **2.2.5 Financial Crisis (D01)**

For financial institutions who are scarce of liquidity which they had been fall into the financial distress during financial crisis, bankruptcy have become the resolution option of choice for them (Ayotte & Skeel Jr, 2013). When a large financial institution fails, the regulators will emphasize on bankruptcy repeatedly. Financial institutions defaults will bring two important consequences to economy. First, the financial institution who defaults will have severe effects spread over to other financial institutions and also the whole financial system. Second, if the financial institution is in trouble, the liquidity of a financial institution can evaporates immediately. The considerable value will also be lost even if there is just a minor delay in replacing the liquidity. The liquidity problems would have become the causing factors of the financial crisis and thereby causing the number of bankruptcy to increase. In this case, the relationship between the financial crisis and liquidity of banks are not just negatively related, but both variables also had bidirectional relationship.

According to Fadare (2011), he pointed out that the savings banks are significantly illiquidity relative to the benchmarks during financial crisis periods, thus the savings banks will be easily distressed. In addition, he also claimed that when the savings banks wrote off the non-performing loans, the surplus liquidity of the banking industry will erode rapidly and had to meet the unexpected bank runs. Bank runs can be defined as large cash withdrawals from many customers of the bank at the same time and none of a bank will have sufficient amount of reserves on hand to cover with all of the deposits being

withdrawn at once. This might happen when those depositors of the bank or citizens feel that it is insecure to deposit their money in that bank anymore. Besides that, bank runs may not only happen to a bank in a country, it may also happen to any other banks in the country because of the depositors had lost faith in any of the banks, they might feel that their deposits had been threatened. Although central bank will try to guarantee savings of depositors with deposit insurance system such as Federal Deposit Insurance Corporation in United States, but many of the depositors lack of information about it made this protection utterly meaningless in the event of bank runs and will lead to bank fragility.

Furthermore, financial crisis can cause a sound bank to have liquidity problem in a very short time frame (Grauwe, 2008). Although this kind of issue will not occur when depositors or citizens have faith in the banks, however faith can be destroyed or damaged rapidly due to insolvency problem happened to a bank. All of the banks' assets are illiquid, even a sound banks would make no difference, therefore they are unable to liquidate all of their assets immediately or in short time to solve any bank runs issue or financial crisis. And if they want to sell their assets immediately to cope with the crisis, the value of the assets will be reduced and it will be sold under-priced. Lastly, the financial crisis will lead the banks to face the illiquid problem again. Financial crisis is significant to the banking system due to liquidity of banks.

In addition, the credit risk is the possibility of loss that occur only when the borrower is considered fails to meet its contractual obligation that should have repay debt with agreed term. Joseph et al. (2012) had examined and found out that the credit risk and financial crisis are positively related in Malaysian financial system during Asian financial crisis in year 1997. During the financial crisis, the non-performing loans tend to increase rapidly as with the credit risks increases, and hence the liquidity of banks will be decreased. Thus, although the

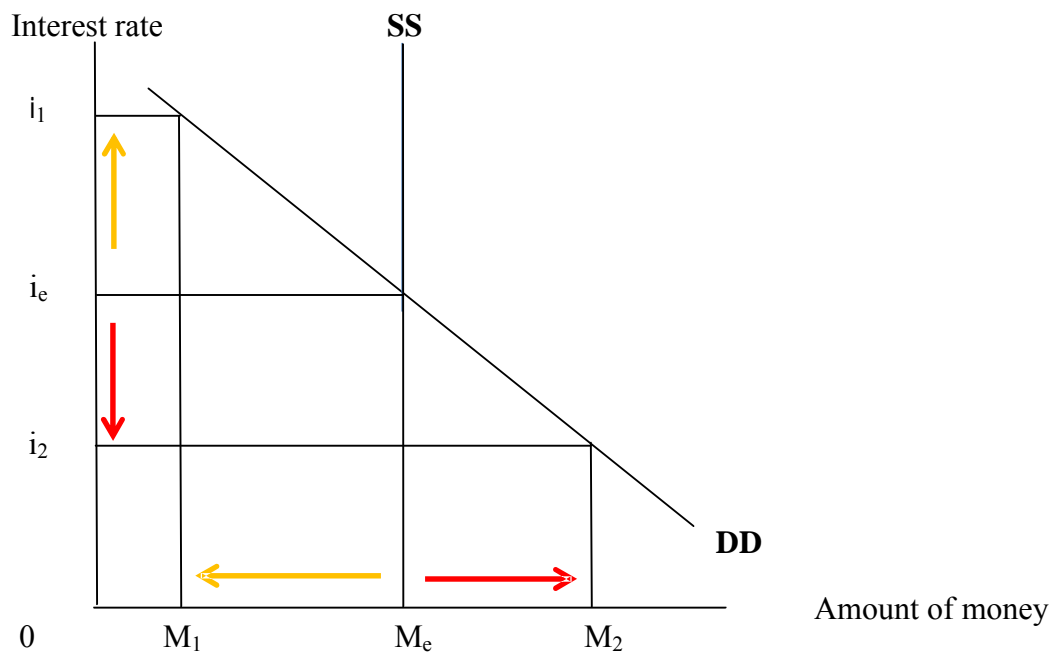
relationship between financial crisis and liquidity of bank is indirectly related, but somehow it shows that the liquidity of banks will decrease during the financial crisis period.

During the financial crisis period, those financial institutions which have more liquidity have found that they are less likely to be liquidity providers (Vossen & Van Ness, 2010). Liquidity providers will lend money to another party such as bank with lower liquidity or corporates with interest rates charged. Although those financial institutions with higher liquidity before financial crisis will be able to act as a liquidity provider, but most of them are not willing to be liquidity provider because they would need the liquidity to be their own cushion during financial crisis. The liquidity cushion will provide banks a competitive advantage in economic downturn. Therefore, liquidity of banks will be very important during financial crisis period. In this case, as it was discussed earlier that the independent variable which is the financial crisis will be able to affects the dependent variable too. However, it would not be efficient if a bank holds more excessive liquidity as the excessive liquidity was unable to provide any profits to banks. So, banks that hold more excessive liquidity will only have competitive advantage during financial crisis period.

## 2.3 Review of Relevant Theoretical Models

According to Keynes, J.M. (1936), a famous English Economist penned “General Theory of the Rate of Interest” introduced a theory “Keynes Liquidity Preferences Theory of Interest”. Keynes defined that the interest rate as a return for liquidity for a specified time, it was not the reward for waiting. In addition, he had described that demand and supply of money also can be a determination for interest rates. Below is the figure that shows the relationship between interest rates and money.

Figure 2.2.1: Relationship between interest rate and money

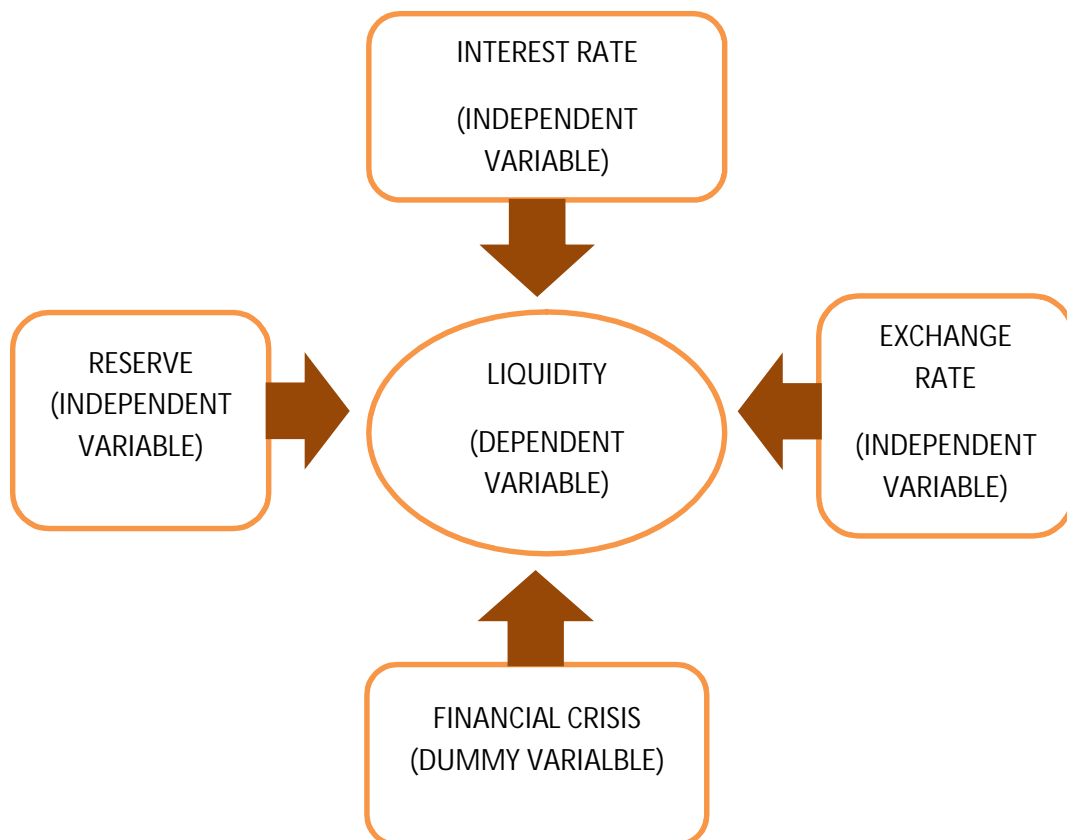


According to Keynes Liquidity Preferences Theory of Interest, the equilibrium of interest rate is determined by demand and supply of money. When the money demand and supply of money were fluctuated, it will lead a change in interest rate. From figure 2.2.1, it is known that when interest rate ( $i$ ) decreases, demand for money will increase, from  $i_e$  to  $i_2$  and from  $M_e$  to  $M_2$ . Whereas, when interest rate increases, the

demand will decrease from  $i_e$  to  $i_1$  and  $M_e$  to  $M_1$ . However, Keynes Liquidity Preferences Theory of Interest only interpreted the interest rate in short-run economic and it eliminated the interest rate in short-run economic. Besides, Keynes Liquidity Preferences Theory of Interest also pointed out that the interest rate was not a phenomenon of monetary cycle. The productivity of capital even in saving also is an important role to determinant of interest rate.

## 2.4 Proposed Theoretical Framework

Figure 2.3.1: The Determinants of Banking Fragility from year 2002 – 2011 in Malaysia



## **2.5 Hypotheses Development**

In this study, the researchers used four independent variables to examine the bank liquidity in Malaysia. In this research project, researchers will use the period from year 2002 to 2011. In addition, the four independent variables are interest rate, exchange rate, reserve requirements and financial crisis (dummy variable). Moreover, the hypotheses below are used to test the relationship between the independent variable and dependent variables.

### **2.5.1 Reserve Requirements (Reserve)**

According to Kolar, Zivkov & Momcilovic (2011), there are several fundamentals of banking aggregates will be affected by the changes in reserve requirements. The first banking aggregate is the level of loans, when there is an increase in reserve requirements, the loans will be decreased in contrary. That means there would be a negative relationship between the reserve requirements and the level of loans. While the reduction in the level of loans will lead to an increase in liquidity of bank because most of the maturities of loans are long-term, it is not a liquid asset that can convert into cash easily and quickly. Besides that, the second banking aggregate is the level of deposits. When there is an increase in reserve, the deposits will be increase as well. The larger amount of deposits a bank holding, the more liquidity the bank would maintain. So, the relationship between reserve and deposits are positive, and the relationship between deposits and liquidity of bank are positive.

Other than that, the last banking aggregate is the lending rates. An increase in reserve will leads to an increase in lending rates. When the lending rates are high, there will be lesser borrowers to borrow money from bank, and then the



level of loans will be decrease like what had discussed in the first banking aggregate. In short, the reserves are positively but indirectly related to the liquidity of bank through the fundamentals of banking aggregates.

H<sub>0</sub>: There is no significant relationship between reserve and the liquidity.

H<sub>1</sub>: There is a significant relationship between reserve and the liquidity.

The null hypotheses described that the reserve and liquidity of bank is not significantly related with each other while the alternative hypotheses described that the reserve and liquidity of bank is significantly related with each other.

### **2.5.2 Interest Rate (INT)**

Interest rate is the one of the importantly factor to examine a financial institution's capacity. Besides that, previous research found that interest rates are clearly linked with the banking sector efficiencies. Rising in operation costs will have a positive impact on interest rate whereby liquidity is negative impact. According to Liu (2008) interest rate is function as a tool to balances the supply and demand. Interest rate is differential in the commodity market and financial market. According to previous researchers which were Tesfaye (2012), Muhammad & Amir (2013) that argued that there have been positively influenced on bank liquidity. However, other researchers such as Valla (2006), Bunda & Desquilbet (2008), Friedman (1968), Cogan (1972) and Cochrane (1989) found that there have were negative relationships between interest rates and bank liquidity. Therefore, below are the hypotheses that formed to test the relationship between the bank liquidity and interest rates.

H<sub>0</sub>: There is no significant relationship between interest rate and liquidity.

H<sub>1</sub>: There is significant relationship between interest rate and liquidity.

The null hypotheses described that the interest rate and liquidity of bank is not significantly related with each other while the alternative hypotheses described that the interest rate and liquidity of bank is significantly related with each other.

### **2.5.3 Exchange Rate (EXR)**

Exchange rates can be described as the rate of one currency is going to exchange for another currency. It is very important because it showed the value of money can be exchanged in a country. When the exchange rate is high in a country, it can be exchanged for more money when trading with another country. According to the previous studies, Guillou & Schiavo (2011) and Chaney (2005) found that appreciation in exchange rate significant positively affect the liquidity. As a result, the higher the exchange rates, the higher the liquidity in a country. Besides that, the previous studies from Tabak (2006) and Chan, Hameed & Kang (2012) suggested that significant relationships existed between exchange rates and stock prices. The rising of exchange rates will tends to increase the stock prices at the same time will help to improve the liquidity. Since higher liquidity would not cause a bank's fragile. Therefore, hypotheses were formed between exchange rate and liquidity.

H<sub>0</sub>: There is no significant relationship between exchange rate and liquidity.

H<sub>1</sub>: There is significant relationship between exchange rate and liquidity.

The null hypotheses described that the exchange rate and liquidity of bank is not significantly related with each other while the alternative hypotheses described that the exchange rate and liquidity of bank is significantly related with each other.

### **2.5.4 Financial Crisis (D01)**

The recent global financial crisis which happened in year 2007 to 2008 had been spread over the entire world rapidly and affected the economy (Bagliano & Morana, 2014). With the economic recession, the banking industry had also been affected severely. The credit risk has become the concern of banking industry due to the slowdown of economic growth during the years, thus the number of bankruptcy had increased rapidly. Many banks' assets, especially the loans have become non-performing loans; huge reduction in the income of the banks will lead the banks to illiquid since the expenses of the banks will be higher than the incomes of the banks. Therefore with the occurrence of the financial crisis, the liquidity of bank will tends to decreases indirectly and lastly the banks illiquid will lead to the banking fragility. During financial crisis, most of the banks may hoard excessive liquidity (Acharya, Shin, & Yorulmazer, 2011). Holding large amount of excessive liquidity in hands will reduce the banks' performance because the excessive liquidity is unable to gain profits to banks.

H<sub>0</sub>: There is no significant relationship between financial crisis and the liquidity.

H<sub>1</sub>: There is a significant relationship between financial crisis and the liquidity.

The null hypotheses described that the financial crisis and liquidity of bank is not significantly related with each other while the alternative hypotheses described that the financial crisis and liquidity of bank is significantly related with each other.

## **2.6 Conclusion**

The objective of this chapter is to identify the factors that will affect the bank liquidity in Malaysia. In this research, the researchers found that previous researches are matching with the study. Besides that, the researchers have certified with the right guidance and also with much information to this research. More information will be conferred in more detail in the following chapters.

## **CHAPTER 3: METHODOLOGY**

### **3.0 Introduction**

In this chapter, this research is going to do about the methodology. Methodology is a set of practices. It acts as a method and principle for particular kinds of work especially for academic research. Methodology theory is important for research result which used to test the relationship of liquidity in banking system (dependent variable) with the exchange rates, interest rates and financial crisis (independent variable). By using the correct method, it can further enhance the relationship between dependent and independent variables and giving out more accurate result in the research. Meanwhile, secondary data was being collected in this research and time series data was using to run the research result. This research obtained all the data and elements that being used in this research from bank financial statement which searched from website, articles, and journals that done by other researcher, past thesis and databases obtained from UTAR library.

### **3.1 Research design**

Research design is the systematic planning that concerned with the research question in a research. The best research design is depends on how best of research questions which falls into problems statement, how to collect data, evaluation of data and analysing of the accuracy of the data, research purpose and research hypotheses. Besides, it can be categories into quantitative and qualitative research designs. In addition, quantitative method was applied in this research.

### **3.1.1 Quantitative method**

Quantitative research design is used the mathematical and statistical method to evaluate and analyse the data. However, qualitative method normally will not offer any accepted validation guidelines. When comes to validation, the researches have to use the mixed methods which are combination of the qualitative and quantitative research methods in order to avoid conceptual confusion (Venkatesh, Brown & Bala, 2013). Before analyze the quantitative data, this research need to examine the relationships between the variable whether the variable are correlated or how strong the correlated between them. So, this research are using the secondary data which are found on the Bank Negara Malaysia( BNM) which means that this secondary data is reliable because the data are the latest data and it is reliable.

### **3.1.2 Descriptive research**

The purpose of the descriptive research is comes out with how, what and why on the research question and the data analyzed in the research. It is normally used to explain the data, large scale phenomena and others. Most of the researcher will use the descriptive research as an explanatory research to come out with a table to describe the variables that using in their research. The table helps the future researchers able to understand the meaning of the variables.

As mention earlier, the objective of this research is to study the relationship between the liquidity of banks in Malaysia and the 4 independent variables.

$$LIQUIDITY_t = \beta_0 + \beta_1 RESERVE_t - \beta_2 INT_t + \beta_3 EXR_t - \beta_4 D_{FCT} + \varepsilon_t$$

Table 3.1: Description of dependent and independent variables

Variable	Description
LIQUIDITY = Liquidity (RM in millions)	Liquidity of bank
RESERVE = Reserve requirements (RM in millions)	Reserve of bank to total liquidity
INT = Interest rate (%)	Interest rate of bank to total liquidity
EXR = Exchange rate (Index)	Exchange rate of country to total liquidity of bank
D = Financial crisis	Dummy variable for financial crisis

D = Dummy Variable, 1 if there is financial crisis, 0 if otherwise.

$\varepsilon_t$ : Error term

### 3.2 Data Collection Methods

The data that were collected for this research is secondary data. On the other hand, the reason of this research used secondary data is because of the efficiency compared to primary data because of primary data will gathering new data will consume a lot of time and energy. In this study, secondary data were obtained from outside sources such as journals and articles and mostly obtained from database from UTAR Online Library. Moreover, the data that used in this research are obtained from Bank Negara Malaysia (BNM) and Thomson DataStream from UTAR library. The data obtained are started from year 2002 until year 2011, 10 years' data that were based on monthly basis.

### 3.3 Sampling design

The country that selected by this research is Malaysia. The reason that chosen Malaysia as research benchmark is due to the reason there are few researches investigating on the related topic of determinants of banking fragility in Malaysia. While, the data that used for this research is secondary data that obtained from the Bank Negara Malaysia (BNM) and Thomson DataStream from UTAR main library. This research was choose Malaysia liquidity data to estimate the model and examined the determinants of banking fragility. This data is time series data which is covered the sample period from 2002 to 2011. The dataset was included the financial crisis to act as the dummy variables that happened during the period of study and this research used the confident interval level at 99% (significant level at 0.01)<sup>1</sup>. In addition, the frequency of data in this research is monthly as monthly data will help the research to better capture the effect of independent variables. Liquidity data of Malaysia were used in order to better capture the more accurate data in this research.

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#### <sup>1</sup>Significant level

Significant level acts as a criterion to reject null hypothesis. If the p-value smaller than the significant level, the null hypothesis will be reject and vice versa. There could be few level of the significant level (alpha level) such 0.1, 0.05, 0.01. According to Liou (2009), ordinary least square (OLS) regression model performs simulation results would be better than others. Besides, it produces more true statistically significant relationship than expectation at alpha levels 0.05 and 0.01. In this research, the significant level at 0.01 was being chosen. It is because of 1% level (confidence interval 99%) more conservative than 5% level (confident interval 95%) said by Perry (2014).



## 3.4 Data Analysis

### 3.4.1 Inferential Analysis

The data collected will be analysed by using the econometric analysis with the use of E-views software. The estimator that used to estimate the parameters in the linear regression model is Ordinary Least Squares (OLS) method. The data analysis that this research were going to analyse will provide the results on the significance of relationship between the dependent variable which is liquidity and the independent variables which are exchange rates, interest rates, reserve, and financial crisis. Time series data method will be based on a country in several years to compare in the selected period of time.

Multiple linear regressions can be defined as a statistical technique that used to forecast the relationship between two or more independent variables and a dependent variable which observe the data by fitting a linear equation.

Multiple linear regressions model:

$$Y = \beta_0 + \beta_1 X_1 - \beta_2 X_2 + \beta_3 X_3 - \beta_4 D + \varepsilon$$

Y = Liquidity of bank

X<sub>1</sub> = Reserve

X<sub>2</sub> = Interest rate

X<sub>3</sub> = Exchange rate

D = Financial crisis (Dummy variable equals one if there is financial crisis happen during the year, zero otherwise).

Where  $Y$  is the dependent variable and it is the liquidity of bank. There are four independent variables in this research such as  $X_1$  is the reserves where the depository institutions must hold the required funds as reserves with the central bank.  $X_2$  is the interest rates where the price that is charged to a borrower for the loan of money.  $X_3$  is the exchange rates where the price of a current market price which used to exchange with other country's currency.  $D$  is the dummy variable of financial crisis where it is a situation that happen when supply of money is excessive than the demand of money. This situation will cause the value of a financial assets dropping rapidly. All of these independent variables will be examined on the significance towards the liquidity of bank. This research was able to examine which independent variables will be significant to the liquidity of bank with the use of multiple regression analysis.

### **3.4.2 Scale Measurement**

#### **3.4.2.1 Ramsey-RESET Test**

The purpose of Ramsey-RESET Test is to test whether the model that this research selects is correctly specified. Model specification is the process of converting a theory into a regression model. There were possibilities that this research may select the wrong model or the misspecification of model. Therefore, there were four types of model specification errors where the first type is omitting a significant independent variable that plays an important role to explain the dependent variable. Second, includes an unnecessary, irrelevant or non-influential independent variable into model. Third, omitting and including relevant and irrelevant independent variables into model. Fourth, include the wrong functional form of dependent and independent variables into model (Gujarati, 2009).

### **3.4.2.2 Normality Test**

Normality of error terms plays an important role in OLS estimator in order to provide the precise result which is unbiased, consistent, and efficient. Jarque-Bera Test was carried out to test the normality of error terms. Jarque-Bera Test is based on the skewness and kurtosis to determine the normality of error terms. According to the Central Limit Theorem (CLT), when sample sizes increases, the model will become normally distributed even if it is not normally distributed when first detect (Gujarati, 2009).

### **3.4.2.3 Multicollinearity**

When some or all of the independent variables are highly correlated with each other, the multicollinearity problem would occur. If there is multicollinearity problem in the model, the regression model would have difficulty to determine which independent variables are influencing the dependent variable. There are several methods to detect the multicollinearity problem such as high R-squared but few significant in independent variables, high pair-wise correlation coefficients and variance inflation factor (VIF).

This research are going to carry out the VIF method to check whether there is a perfect, serious, or no serious multicollinearity problem in the model. So, this research will conduct 4 auxiliary models to calculate the VIF. If the VIF value falls between one and ten, then there is no serious multicollinearity. However, if VIF is more than ten, there will be serious multicollinearity problem in the auxiliary model. If there is no serious multicollinearity in the model, the estimated parameters would be unbiased, efficient, and consistent which is best linear unbiased estimator (BLUE). In contrast, if there is serious

multicollinearity in the model, the estimated parameters would be unbiased, inefficient, and consistent which is no longer BLUE (Gujarati, 2009).

#### **3.4.2.4 Autocorrelation**

In order to detect the autocorrelation problem in the model, this research would like to use Breusch-Godfrey Serial Correlation LM Test to detect it. Autocorrelation problem is often happen in time series data because time series residuals always serially correlated with their previous period. If there is autocorrelation problem in the model, the variance of errors would not achieved at optimal level, t and F statistics values would be biased or wrong, p-value for independent variable would be biased or wrong, and become inefficient estimator. Other than that, the estimated parameters would become biased, inefficient, and inconsistent if the model specification is error without including the relevant variables. Furthermore, the estimated parameters would become unbiased, inefficient, and consistent if the model specification is correct (Gujarati, 2009).

#### **3.4.2.5 Heteroscedasticity**

Heteroscedasticity problem would be detects by using the ARCH test. It is important to detect the heteroscedasticity because one of the assumptions in CLRM states that the disturbances should have an equal variance which is homoscedasticity. If there is heteroscedasticity in the model, the variance of errors would not achieved at optimal level, t and F statistics values would be biased or wrong, p-value for independent variable would be biased or wrong, and become inefficient estimator. Other than that, the estimated parameters would become biased, inefficient, and inconsistent if the model specification is

error without including the relevant variables. In addition, the estimated parameters would become unbiased, inefficient, and consistent if the nature of data and model specification is correct (Gujarati, 2009).

### **3.5 Conclusion**

In this chapter, these researches were explaining the empirical model, methodology and data set. This chapter was being a fundamental for the research in order to conduct the following empirical investigation in next chapter.

## CHAPTER 4: DATA ANALYSIS

### 4.0 Introduction

In this chapter, researchers examined the banking system in Malaysia for 10 years' length which was from year 2002 to 2011. The data used in this research was obtained from Bank Negara Malaysia (BNM) statistics database and Thomson DataStream in UTAR library. Meanwhile, the E-views software has been used to analyse in this research data and findings. Furthermore, this research also have carried out those relevant diagnostic testing in order to identify any presences of econometric problems by the use of E-views and statistical formula.

### 4.1 Scale Measurement

#### 4.1.1 Ramsey-RESET Test

Table 4.1.1.1: Ramsey-RESET Test

Test statistic value
Prob. Chi-Square = 0.8088

Source: E-views output

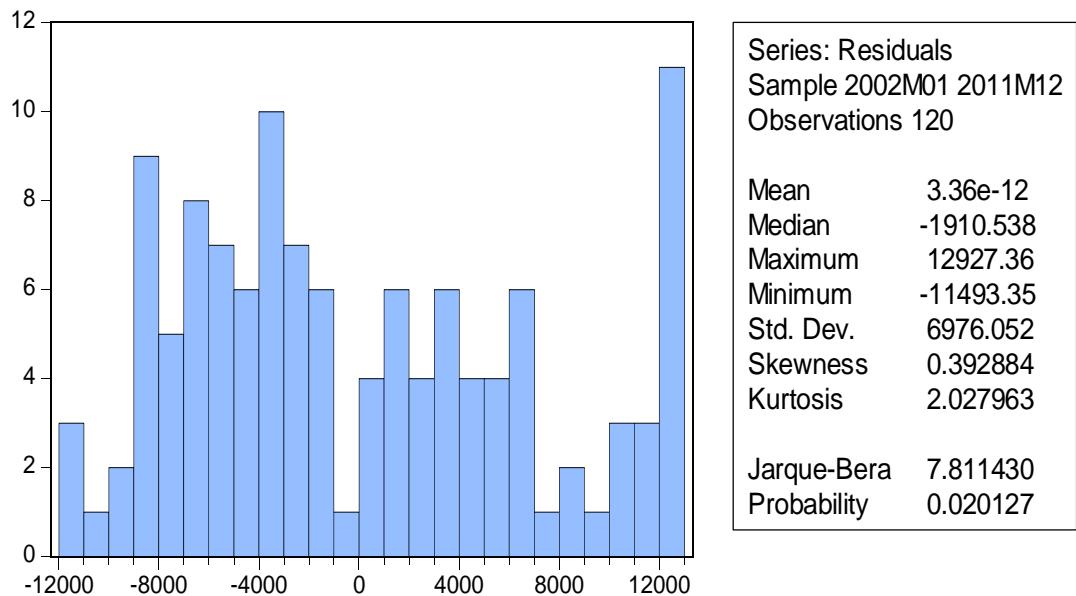
$H_0$ : The model specification is correct.

$H_1$ : The model specification is incorrect.

In order to select a correct estimated model, this research had conducted the Ramsey-RESET Test to check on the model specification. The null hypothesis stated that the model specification is correct, and the alternative hypothesis stated that the model specification is incorrect. From table 4.1.1.1, the researchers do not reject the null hypothesis because the p-value is 0.8088, which is greater than significance level of 0.01. Therefore, it can be conclude that the model specification is correct from year 2002 to 2011.

### 4.1.2 Normality Test

Table 4.1.2.1: Normality Test



Source: E-views output

$H_0$ : Error terms are normally distributed.

$H_1$ : Error terms are not normally distributed.

This research conducted the normality test to check on the normality of the error terms. The null hypothesis stated that the error terms are normally distributed. From graph 4.1.2.1, the p-value is 0.0201, which is greater than significance level of 0.01. So, the null hypothesis will not be rejected and the results can concluded that the error terms are normally distributed at significance level of 0.01.

### 4.1.3 Multicollinearity

Table 4.1.3.1: Correlation between dependent variable and each independent variables of the estimated model

	LIQUIDITY	RESERVE	INT	EXR	DUMMY
LIQUIDITY	1.000000	-	-	-	-
RESERVE	-0.256761	1.000000	-	-	-
INT	-0.796808	0.460420	1.000000	-	-
EXR	0.116865	-0.052479	0.115381	1.000000	-
DUMMY	0.224609	0.071980	-0.055919	-0.179186	1.000000

Source: E-views output

This research have been examined the existence of multicollinearity problem by using the correlation matrix between the dependent variable and independent variables in table 4.1.3.1 above. Based on the result of correlation analysis for each pair of variables in table 4.1.3.1, there is no correlation for each pair of



variables found to be higher than benchmarks of 0.80. Therefore, it can be concluded that there is no serious multicollinearity problem in the model.

Besides that, this research also carried out the 4 auxiliary models for all of the independent variables which included reserve, interest rate, and exchange rate to check whether there is perfect, serious, or no serious multicollinearity problem in the model. The purpose of conducting the auxiliary models are to calculate the VIF. The researchers will exclude the dependent variable and treat each of the independent variables as the dependent variable in the auxiliary models.

Table 4.1.3.2: Calculation of VIF for auxiliary models.

<b>Dependent variables</b>	<b>Calculation: <math>VIF = \frac{1}{1-R \text{ squared}}</math></b>	<b>VIF</b>
Reserve	$\frac{1}{1 - 0.229784}$	1.2983
Interest rate	$\frac{1}{1 - 0.235830}$	1.3086
Exchange rate	$\frac{1}{1 - 0.053343}$	1.0563
Financial crisis (Dummy variable)	$\frac{1}{1 - 0.041450}$	1.0432

Since all of the calculated VIF are less than 10, which means that there is no serious multicollinearity problem in the model. As the correlation matrix between dependent variable and independent variables and the VIF for auxiliary models also provided the same results, so the researchers have sufficient evidence to conclude that there is no serious multicollinearity problem in the model.

#### 4.1.4 Autocorrelation

Table 4.1.4.1: Breusch-Godfrey Serial Correlation LM Test

Test statistic value
Prob. Chi-Square = 0.0000

Source: E-views output

$H_0$ : No autocorrelation problem in the estimated model.

$H_1$ : There is autocorrelation problem in the estimated model.

This research has been conducted the diagnostic checking for autocorrelation with Breusch-Godfrey Serial Correlation LM Test. The null hypothesis is no autocorrelation problem in the estimated model. From table 4.1.4.1, researchers decided to reject null hypothesis since the p-value is 0.0000, which is lesser than the significance level of 0.01. Therefore, it can be conclude that there is autocorrelation problem exist in the estimated model at significance level of 0.01. This indicates that the error terms are correlated with the independent variables. Therefore, the researchers proceed to the Newey-west Test in order to solve the autocorrelation problem.

##### 4.1.4.1 Causes of autocorrelation problem and how to solve it

Autocorrelation problem will occur when the error term in one period is correlated with the error term in another time period. Autocorrelation generally occurs when using time series data. According to Wang & Akabay (1994, 1995), the researchers stated that autocorrelation problem will appeared due to several reasons. First of all, researchers often included only a few important variables in the estimated model due to the limited data or the data is not available for the

excluded variables. Moreover, it will become not functional when involved with too many variables that are not important in the model. In addition, if the omitted variables had strong autocorrelation, this will cause the residuals to become auto-correlated.

Next, there are several approaches that could be used to resolve the problems of autocorrelation. First, change the specification of the model so that the error term was not auto-correlated. Second, the autocorrelation problem can also be solved by logged or differencing the dependent variable. Third, estimate the parameters of the model with the OLS and account for autocorrelation while calculating standard errors. Moreover, another resolving problem that suggested by Wang & Akabay (1994, 1995) is to use an estimator that accounts for autocorrelation such as Nonlinear Least Squares. Lastly, the simplest way to resolving the autocorrelation problem is to increase the number of observations and finding the missing value.

#### 4.1.5 Heteroscedasticity

Table 4.1.5.1: ARCH Test

Test statistic value
Prob. Chi-Square = 0.0000

Source: E-views output

$H_0$ : No heteroscedasticity problem in the estimated model.

$H_1$ : There is heteroscedasticity problem in the estimated model.

In this researcher, it had conducted the diagnostic checking for heteroscedasticity with ARCH Test. The null hypothesis shows that there is no heteroscedasticity problem in the estimated model. From table 4.1.5.1, researchers decided to reject null hypothesis since the p-value is 0.0000, which is lesser than significance level of 0.01. Therefore, it can be conclude that there is heteroscedasticity problem exist in the estimated model at significance level of 0.01. The estimated parameter is no longer BLUE because of the inefficient parameter, the t and f statistic value and p-value will be biased and wrong. The researchers proceed to the White Test by E-views software in order to solve the heteroscedasticity problem.

#### **4.1.5.1 Causes of heteroscedasticity problem and how to solve it**

When the residual variance is correlated with any of the independent variables in the model, the heteroscedasticity will exist. According to Wang & Akabay (1994), there are three common factors that would always cause the heteroscedasticity. Firstly, at least one of the variables contained a large range of values. The gap in between the smallest and largest values is too large. The second factor would be the parity between the growth rate of dependent and independent variables have significant changes in the period of sampling. This factor is more applicable to this research because heteroscedasticity would only happen in this case on time series data. The last factor would be the existence of the heterogeneity in the data. However, this is not much relevant to this research as this would only occur more with the cross-sectional data.

Other than the causes of heteroscedasticity, Wang & Akabay (1994) also highlighted on the methods of solving the heteroscedasticity. Based on Wang & Akabay (1994), there are two methods to deal with the existence of heteroscedasticity which are logarithmic transformation and Generalized Least

Squares (GLS) method. The logarithmic transformation method would be easier to apply as compared to GLS method. In order to solve the heteroscedasticity, a logarithmic transformation of all the variables' values would be helpful. However, the logarithmic transformation might not be viable if the model contains negative or zero values. If the logarithmic transformation did not solve the heteroscedasticity, the correlation of residuals and independent variables would have to be examined carefully or else proceed to the GLS method. The procedure of GLS is to estimate the model by using OLS estimator after transforming the variables and the constant term with a suitable factor.

## 4.2 Inferential analysis

Table 4.2.1: Ordinary Least Square (OLS)

Variables	Coefficient	P-value
RESERVE	0.305767	0.0065
INT	-19341.70	0.0000
EXR	1109.634	0.0000
D01	12429.29	0.0000
R-square	0.744706	
Adjusted R-square	0.735826	
Prob. (F-statistics)	0.000000	

Source: E-views output

Econometric Model:

$$LIQUIDITY_t = \beta_0 + \beta_1 RESERVE_t - \beta_2 INT_t + \beta_3 EXR_t + \beta_4 D01_{Fct} + \varepsilon_t$$

LIQUIDITY = Liquidity of bank (RM in million)

RESERVE = Reserve Requirements (RM in million)

INT = Interest Rate (%)

EXR = Exchange Rate (Index)

D01= Dummy variable, 1 if there is financial crisis, 0 if otherwise.

$\varepsilon_t$  = Error term

#### **4.2.1 Multiple Regressions**

Researchers have used the Ordinary Least Squares (OLS) method to test whether the model consists of econometric problem or not, the above table is the output of OLS that computed from the E-views software. The R-squared is 0.744706, which means that 74.47% of the total variation of liquidity is explained by the total variation of interest rate, total variation of exchange rate, total variation of reserve and total variation of financial crisis. However, the adjusted R-squared is 0.735826, which means that 73.58% of the total variation of liquidity is explained by the total variation of interest rate, total variation of exchange rate, total variation of reserve, and total variation of financial crisis, taking into account the number of independent variables and sample size.

If R-squared is high, F-test will high, result will be misleading as F-test will only show the significance when come to single, it has the problem of multicollinearity. If standard error is big, whole t-test will become smaller, variance is high, the multicollinearity occurs. If t-ratio is insignificant means that independent variable is not important, so model would have to be drop in order to solve the multicollinearity problem. However, the R-squared and adjusted R-squared are found to be not very high which are 0.744706 and 0.735826, it is lower than the benchmark of 0.8. This result showed that the model did not consist of serious multicollinearity problem.

#### **4.2.2 F-statistics**

The F-distribution is right-skewed because it is the ratio of chi-square distributions. The minimum value for F-test is zero and all of the values are positive only. Apart from that, F-test is used to determine whether the whole model is significant at 1% significant level. Based on the result as above, the p-value of F-statistics is 0.0000, which is lesser than the significant level of 0.01. Therefore, researchers decided to reject the null hypothesis and there is sufficient evidence to conclude that the whole model is significant at significant level of 0.01. The null hypothesis and alternative hypothesis will be as followed:

$H_0$ : All of the independent variables are not important in explaining the dependent variable.

$H_1$ : At least one of the independent variables is important in explaining the dependent variable.

### 4.2.3 Reserve Requirements (Reserve)

In order to determine whether the researchers should reject the null hypothesis, the p-value of reserve requirements must be lesser than significant level to reject it. Based on the results in Table 4.2.1, the p-value of reserve requirements is 0.0065, which is lesser than the significant level of 0.01. Therefore, researchers decided to reject the null hypothesis and there is sufficient evidence to prove that the relationship between reserve requirements and liquidity is significantly positive at 1% significance of level based on the results in Table 4.2.1. If reserve increases by RM 1 million, on average, the liquidity tends to increase by RM 0.305767 million, holding other variables constant. The null hypothesis and alternative hypothesis will be as followed:

H<sub>0</sub>: Reserve requirement is insignificant in explaining the liquidity.

H<sub>1</sub>: Reserve requirement is significant in explaining the liquidity.

### 4.2.4 Interest Rate (INT)

In order to determine whether the researchers should reject the null hypothesis, the p-value of interest rate must be lesser than significant level to reject it. Based on the results in Table 4.2.1, the p-value of interest rate is 0.0000, which is lesser than the significant level of 0.01. Therefore, researchers decided to reject the null hypothesis and there is sufficient evidence to prove that the relationship between interest rate and liquidity is significantly negative at 1%<sup>2</sup>

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<sup>2</sup> **Interest rate insignificant and negative sign**

According to Vodova (2013), they have identified determinants of liquidity of Hungarian commercial banks, they analysis by using panel data regression. The result shows that bank liquidity positive related to bank profitability, capitalization, interest rate on loan. However, it negative related with the



significance of level based on the results in Table 4.2.1. If interest rate increases by one percentage point changed, on average, the liquidity tends to decrease by RM 19341.70 million, holding other variables constant. The null hypothesis and alternative hypothesis will be as followed:

H<sub>0</sub>: Interest rate is insignificant in explaining the liquidity.

H<sub>1</sub>: Interest rate is significant in explaining the liquidity.

#### **4.2.5 Exchange Rate (EXR)**

In order to determine whether the researchers should reject the null hypothesis, the p-value of exchange rate must be lesser than significant level to reject it. Based on the results in Table 4.2.1, the p-value of exchange rate is 0.0000, which is lesser than the significant level of 0.01. Therefore, researchers decided to reject the null hypothesis and there is sufficient evidence to prove that the relationship between exchange rate and liquidity is significantly positive at 1% significance of level based on the results in Table 4.2.1. If exchange rate increases by RM 1 million, on average, the liquidity tends to increase by RM 1109.63 million, holding other variables constant. The null hypothesis and alternative hypothesis will be as followed:

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bank size, interest rate of monetary policy and so on. According to Hassan & Ali (2012), they found that in the sizes, liquidity, capitalization and credit risk of Lebanese domestic bank have negative impact on interest margin. Besides, in Subedi & Neupane (2013) studies, they have examined that not only the interest rate is insignificant and **negatively impact** on bank liquidity but also the inflation rate growth rate of gross domestic product have the same impacts too. According to Asli & Harry (2000), **negative sign** of interest rate mean that the features is worthy to the lenders, while insignificant of interest rate may defined as the designing of the features not credible.

H<sub>0</sub>: Exchange rate is insignificant in explaining the liquidity.

H<sub>1</sub>: Exchange rate is significant in explaining the liquidity.

#### **4.2.6 Financial Crisis (Dummy variable-D01)**

In order to determine whether the researchers should reject the null hypothesis, the p-value of financial crisis must be lesser than significant level to reject it. Based on the results in Table 4.2.1, the p-value of financial crisis is 0.0000, which is lesser than the significant level of 0.01. Therefore, researchers decided to reject the null hypothesis and there is sufficient evidence to prove that the relationship between financial crisis and liquidity is significantly positive at 1% significance of level based on the results in Table 4.2.1.

If there is no financial crisis, the liquidity will be RM 21057.41 million. However, the liquidity in financial crisis is higher than liquidity without financial crisis by RM 12429.29 million. This mean that the liquidity in financial crisis will be RM 21057.41 million + RM 12429.29 million = RM 33486.65 million, holding other variables constant. The null hypothesis and alternative hypothesis will be as followed:

H<sub>0</sub>: Financial crisis is insignificant in explaining the liquidity.

H<sub>1</sub>: Financial crisis is significant in explaining the liquidity.

### **4.3 Conclusion**

As a conclusion in chapter 4, the researchers had shown that all of the scale measurement, regression analysis and the empirical result which included coefficient of determinations and testing of each independent variable are clearly stated. So, the next chapter will be discuss about the major findings, implications and limitations of this study, as well as providing some recommendations for future researchers.

## CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATION

### 5.0 Introduction

This chapter has consists the overall conclusion of the entire study. This chapter provides the summary of statistical analysis that is showed and discussed in chapter 4 in order to know more about the determinant of banking fragility. Besides that, this chapter also provides the much needed discussion on the major findings and implication of the study. Lastly, some recommendations based on the findings, limitation and conclusion will be provided for future researchers.

### 5.1 Summary of Statistical Analysis

Table 5.1.1: Result of diagnostic checking

<b>Diagnostic Checking</b>	<b>Decision Making</b>	<b>Problem</b>
1) Ramsey- RESET Test	Do not reject $H_0$	Model specification is correct.
2) Normality Test	Do not reject $H_0$	Error term is normally distributed.
3) Multicollinearity	-	No serious multicollinearity problem due to the correlation for each pair of variable are lower than 80% and all of the

		VIF also lower than 10.
4) Autocorrelation	Reject $H_0$	Autocorrelation problem.
5) Heteroscedasticity	Reject $H_0$	Heteroscedasticity problem.

Based on the result of diagnostic checking in table 5.1.1, this research had found that research model specification was correct due to large sample size and involved dummy variable. However, the estimated model would still have auto correlation problem existing. Unfortunately, this research was had heteroscedasticity problems in an estimated model after increase the sample size and included a dummy variable.

## 5.2 Discussions of Major Findings

Table 5.2.1: Discussion of Major Findings

	Not Supported	Supported
H <sub>1</sub> : There is a significant relationship between reserve and liquidity.		✓
H <sub>2</sub> : There is a significant relationship between interest rate and liquidity.		✓
H <sub>3</sub> : There is significant relationship between exchange rate and liquidity.		✓
H <sub>4</sub> : There is a significant relationship between financial crisis and liquidity.		✓

### **5.2.1 Reserve Requirements (Reserve)**

The result obtained from the previous chapters showed that reserve and liquidity have significant and positive relationship. The larger amount of deposits a bank holding, the more liquidity the bank would maintain. So, the relationship between reserve and deposits are positive, and the relationship between deposits and liquidity of bank are positive (Kolar et al., 2011). From year 2002 - 2011 the coefficient estimate of interest rate is 0.305767 and probability is 0.0065. It showed there were significant relationship between reserve and liquidity. As conclusion, based on result of year 2002-2011 this research will reject the first hypothesis.

### **5.2.2 Interest Rate (INT)**

The result obtained from the previous chapters' shows that interest rates and liquidity have significant and positive relationship. This result was supported by Tesfaye (2012), the researcher found that interest rates are statistically significant and positively influenced on bank liquidity. From year 2002 to 2011, the coefficient estimated of interest rate was -19341.70 and probability was 0.0000. There were significant relationship between interest rate and liquidity. As conclusion, based on result of year 2002 to 2011, this research would have to reject the second hypothesis.

### **5.2.3 Exchange Rate (EXR)**

The result obtained from the previous chapters shows that exchange rate and liquidity have significantly and positively relationship. This finding were similar with previous studies, Guillou & Schiavo (2011) and Chaney (2005) who found that appreciation in exchange rates significant positively affected the liquidity. From year 2002 - 2011 the coefficient estimated of interest rate were 1109.634 with its probability at 0.0000. It showed there were significant relationships between exchange rate and liquidity. As conclusion, based on result of year 2002-2011 this research will reject the third hypothesis.

### **5.2.4 Financial Crisis**

The result obtained from the previous chapters showed that financial crisis and liquidity have significant and positive relationship. According to Fadare (2011), this researcher pointed out that the saving banks are prone to facing significantly illiquidity issues during financial crisis periods. From year 2002 – 2011, this research includes the financial crisis. The coefficient estimate of financial crisis is 12429.29 and probability is 0.0000. It showed a significant relationship between financial crisis and liquidity. As conclusion, based on the result of 2002-2011 this research will reject the forth hypothesis.

## **5.3 Implications of the study**

### **5.3.1 Managerial Implications**

This research have shown many important information and the results would be useful to the economy in Malaysia. The stakeholders of bank, policy maker, and especially central bank (Bank Negara Malaysia) should be keep awareness to the determinants of banking fragility in Malaysia because any impact in banking industry would bring huge effect to economy. Thus, it is very important for central bank to take this research as a reference in order to make sure the soundness and safety in banking industry.

In this research, the relationship between reserves and liquidity are found to be significantly positive. This relationship had indicates that the banks in Malaysia may have to keep more reserves in Bank Negara Malaysia (BNM) in order to maintain high liquidity in banks. Therefore, the decision makers of Malaysia's banks could refer to the results of this research as their references or advices on the amount of reserves to be keep in BNM because it is not necessary just to keep the required amount of reserves in BNM. In addition, this research had shown that the more reserves to keep with BNM, the higher liquidity could have in banks.

Besides that, the interest rates had been found to have significantly negative relationship with the liquidity of banks in Malaysia through this research. In order to have higher liquidity in banks, the banks should offer lower interest rates to borrowers so that the probability of credit default will be lower as well. BNM should impose policies related to restriction on the minimum and maximum of interest rates that banks of Malaysia can offers to their customers.



With this kind of policies, BNM is able to help Malaysia's banks to maintain sufficient liquidity indirectly, which will reduce the banking system fragility in Malaysia too.

In addition, the exchange rates had been found to have significantly positive relationship with the liquidity of banks in Malaysia in this research. BNM had forced to pegged Malaysia's currency, Ringgit Malaysia to United States' currency, US Dollars for RM3.80/US\$ from 1998 until July of 2005 in order to reduce the volatility of Ringgit Malaysia exchange rate after the Asian financial crisis that happened in 1997. After that, BNM changed the exchange rate system from pegged exchange rate system to managed floating exchange rate system which is government may intervene occasionally when the exchange rates are moving too much in a certain direction beyond the implicit boundaries, otherwise the exchange rates are allowed to move freely based on forces of demand and supply. The managed floating exchange rate system has been implemented until current. BNM should continue with the current exchange rate system as the exchange rates are remained to be stable now, and the liquidity of banks would be stable as well since they are significant positively related.

Lastly, the financial crisis which is the dummy variable had been found to have significantly positive relationship with the liquidity of banks in Malaysia based on the results of this research. BNM should make sure the financial is always stable to prevent from financial crisis which will bring side effects to the economy. One of the BNM's objectives is to promote and maintain monetary and financial stability, so BNM have responsible to maintain a sound, stable and healthy financial system in Malaysia to help banks reduce the banking system fragility that might cause by financial crisis in Malaysia. Lastly, the decision makers of banks should also reduce their investments in higher risk assets during the financial crisis period.

## **5.4 Limitations of the study**

There were a few limitations of study in this research. The biggest limitation in this research is researchers are unable to examine the data among ASEAN countries to complete this research. Moreover, there were limitations for us to collect all complete data for those countries in UTAR library by using the Thomson DataStream. This research were being tried to find this data through the World Bank, or other countries' central bank's database but the results were the same. Therefore, this research was resorted back in Malaysia as benchmark to complete this research.

Besides that, the independent variables in this research only focused in the macroeconomic factors or external factors. The independent variables chosen in this research were interest rate, exchange rate, and reserve while the dummy variable was financial crisis; all of these variables were macroeconomic factors. Therefore, the results will only come from one aspect which is the macroeconomic aspect. The research was found to be lack of comprehensive in samples as it was only included the external factors. Even if the result in this research was accurate, however, the results cannot be looked into globally since the comprehensiveness of independent variables were not sufficient.

Apart from that, there were insufficient of journals on the determinants of banking fragility that is in both Malaysia, and also other countries. This research could hardly find any journals or articles on the determinants of banking fragility in Malaysia via the online database inside the UTAR library. As there was just a little previous researchers was researching on this topic because this topic is not very popular for other researchers to do it. In addition, it is also very difficult to look for the journals with the relationships between liquidity and exchange rate. In this research, there are limited with lesser evidence relating to the relationships between liquidity and exchange rate.

## 5.5 Recommendations for Future Research

First of all, this research would like to recommend the future researchers who would like to study on this topic need to expand the sample size in data. In this research, researchers just select only one country, which is Malaysia as sample. Due to the limited data, this research is unable to compare the results with other countries. Therefore, this research suggests that future researchers could have select more countries and prolong the date as sample in order to make better comparison among countries especially ASEAN countries because most of the previous researchers did not focus on ASEAN countries. Besides that, the future researchers could also consider to select countries with different types of development such as developed, developing, and under-developed countries so that there would have clear picture on the comparison.

Moreover, in order to increase the accuracy of the result from the data aspect, the researchers also suggest the future researchers that the data for independent variables should not only focus on the external factors; it should be including the internal factors as well. Including both the external and internal factors in the research will provide a more comprehensive result instead of just using the external factor to estimate the result. The internal factors that can be consider in this topic are bank size, bank capital, bank concentration, bank competition, returns on equity of bank, non-performing loans of bank and so on. If the future researchers consist of both external and internal factors into the independent variables in this topic, then the results for the research will be more general since it considers all sides of the aspects.

Lastly, this research would like to recommends more future research to conducts the topic that are related to the determinants of banking system fragility especially in Malaysia because there are really rare research to be found with the related topic. The determinant of banking system fragility is a very interesting topic because banking system often affects to the whole economy. In addition, bank is always too-big-to-fail

because if one of the banks failed, it will cause many banks to bank panics due to people have been loss confidence to all of the banks in that particular country. Hence, there should have more research to be done in this topic so that more discussion to bring out among the researchers and leads to more people to pay more attention to this topic.

## **5.6 Conclusion**

In conclusion, banks liquidity in Malaysia was influenced by reserve, interest rates, exchange rates and financial crisis. Reserve, exchange rates and financial crisis are strongly as well as positively related with the bank liquidity while interest rate is a strongly related with the bank liquidity in a negative way. Besides, banks are always too-big-to-fail because if one of the banks in the country fails, it would have caused other banks facing bank panics due to the people who lost confidence to all of the banks in this particular country. To avoid this kind of problems, this research would like to suggest that, the policymakers need to consider all of the factors that will cause the fragility problem for banks based on the internal factors of bank or the macroeconomic factors before implementing those policies in banking sector. Based on the overall research, this research can be concluded as the explanatory that being used have prodigious effect on the liquidity.

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## APPENDICES

Table 4.1.1.1: Ramsey-RESET Test.

Ramsey RESET Test:				
F-statistic	0.055616	Prob. F(1,114)	0.8140	
Log likelihood ratio	0.058528	Prob. Chi-Square(1)	0.8088	
Test Equation: Dependent Variable: LIQUIDITY Method: Least Squares Date: 08/10/14 Time: 18:35 Sample: 2002M01 2011M12 Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT	-20920.04	6796.631	-3.078001	0.0026
EXR	1206.391	458.1487	2.633187	0.0096
RESERVE	0.341816	0.188727	1.811163	0.0727
D01	13270.98	4557.883	2.911654	0.0043
C	21187.27	20172.22	1.050319	0.2958
FITTED^2	-1.55E-06	6.58E-06	-0.235829	0.8140
R-squared	0.744831	Mean dependent var	21246.45	
Adjusted R-squared	0.733639	S.D. dependent var	13806.69	
S.E. of regression	7125.656	Akaike info criterion	20.62950	
Sum squared resid	5.79E+09	Schwarz criterion	20.76887	
Log likelihood	-1231.770	Hannan-Quinn criter.	20.68610	
F-statistic	66.55241	Durbin-Watson stat	0.117837	
Prob(F-statistic)	0.000000			

Table 4.1.3.3: Auxiliary model of Reserve Requirements.

Dependent Variable: RESERVE				
Method: Least Squares				
Date: 07/02/14 Time: 22:23				
Sample: 2002M01 2011M12				
Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT	5068.629	874.6425	5.795087	0.0000
EXR	-189.2462	170.1117	-1.112482	0.2682
D01	2342.003	2367.872	0.989075	0.3247
C	4439.728	16909.27	0.262562	0.7934
R-squared	0.229784	Mean dependent var		15919.92
Adjusted R-squared	0.209865	S.D. dependent var		6724.131
S.E. of regression	5977.050	Akaike info criterion		20.26201
Sum squared resid	4.14E+09	Schwarz criterion		20.35492
Log likelihood	-1211.720	Hannan-Quinn criter.		20.29974
F-statistic	11.53571	Durbin-Watson stat		0.090302
Prob(F-statistic)	0.000001			

Table 4.1.3.4: Auxiliary model of Interest Rate.

Dependent Variable: INT				
Method: Least Squares				
Date: 07/02/14 Time: 22:23				
Sample: 2002M01 2011M12				
Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	4.43E-05	7.64E-06	5.795087	0.0000
EXR	0.024561	0.015824	1.552151	0.1234
D01	-0.179453	0.221660	-0.809588	0.4198
C	2.792412	1.559782	1.790258	0.0760
R-squared	0.235830	Mean dependent var		5.888333
Adjusted R-squared	0.216067	S.D. dependent var		0.631067
S.E. of regression	0.558747	Akaike info criterion		1.706525
Sum squared resid	36.21498	Schwarz criterion		1.799441
Log likelihood	-98.39149	Hannan-Quinn criter.		1.744259
F-statistic	11.93290	Durbin-Watson stat		0.030754
Prob(F-statistic)	0.000001			

Table 4.1.3.5: Auxiliary model of Exchange Rate.

Dependent Variable: EXR				
Method: Least Squares				
Date: 07/02/14 Time: 22:23				
Sample: 2002M01 2011M12				
Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	-5.58E-05	5.01E-05	-1.112482	0.2682
INT	0.828410	0.533717	1.552151	0.1234
D01	-2.268094	1.273672	-1.780751	0.0776
C	93.91031	2.881141	32.59483	0.0000
R-squared	0.053343	Mean dependent var		97.76792
Adjusted R-squared	0.028861	S.D. dependent var		3.292899
S.E. of regression	3.245033	Akaike info criterion		5.224893
Sum squared resid	1221.508	Schwarz criterion		5.317810
Log likelihood	-309.4936	Hannan-Quinn criter.		5.262627
F-statistic	2.178827	Durbin-Watson stat		0.085408
Prob(F-statistic)	0.094263			



Table 4.1.3.6: Auxiliary model of Financial Crisis (Dummy variable-D01).

Dependent Variable: D01				
Method: Least Squares				
Date: 08/17/14 Time: 15:57				
Sample: 2002M01 2011M12				
Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	3.57E-06	3.61E-06	0.989075	0.3247
INT	-0.031309	0.038673	-0.809588	0.4198
EXR	-0.011732	0.006588	-1.780751	0.0776
C	1.332866	0.648757	2.054492	0.0422
R-squared	0.041450	Mean dependent var		0.058333
Adjusted R-squared	0.016660	S.D. dependent var		0.235355
S.E. of regression	0.233387	Akaike info criterion		-0.039475
Sum squared resid	6.318441	Schwarz criterion		0.053441
Log likelihood	6.368530	Hannan-Quinn criter.		-0.001742
F-statistic	1.672046	Durbin-Watson stat		0.313322
Prob(F-statistic)	0.176865			

Table 4.1.4.1: Breusch-Godfrey Serial Correlation LM Test.

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	448.1677	Prob. F(2,113)	0.0000	
Obs*R-squared	106.5654	Prob. Chi-Square(2)	0.0000	
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 08/10/14 Time: 18:34				
Sample: 2002M01 2011M12				
Included observations: 120				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT	534.0176	400.2222	1.334303	0.1848
EXR	-141.1709	69.72473	-2.024688	0.0453
RESERVE	-0.041315	0.037323	-1.106952	0.2707
D01	-2971.866	985.2326	-3.016411	0.0032
C	11446.45	6861.842	1.668131	0.0981
RESID(-1)	0.792083	0.091831	8.625474	0.0000
RESID(-2)	0.168919	0.093254	1.811390	0.0727
R-squared	0.888045	Mean dependent var	-3.01E-11	
Adjusted R-squared	0.882101	S.D. dependent var	6976.052	
S.E. of regression	2395.331	Akaike info criterion	18.45699	
Sum squared resid	6.48E+08	Schwarz criterion	18.61960	
Log likelihood	-1100.420	Hannan-Quinn criter.	18.52303	
F-statistic	149.3892	Durbin-Watson stat	1.725532	
Prob(F-statistic)	0.000000			

Table 4.1.4.2: Newey-west Test.

Dependent Variable: LIQUIDITY				
Method: Least Squares				
Date: 07/14/14 Time: 18:36				
Sample: 2002M01 2011M12				
Included observations: 120				
Newey-West HAC Standard Errors & Covariance (lag truncation=4) <sup>3</sup>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	0.305767	0.168959	1.809711	0.0730
INT	-19341.70	1743.656	-11.09262	0.0000
EXR	1109.634	328.1669	3.381310	0.0010
D01	12429.29	2110.699	5.888707	0.0000
C	21057.41	33978.56	0.619726	0.5367
R-squared	0.744706	Mean dependent var		21246.45
Adjusted R-squared	0.735826	S.D. dependent var		13806.69
S.E. of regression	7096.338	Akaike info criterion		20.61332
Sum squared resid	5.79E+09	Schwarz criterion		20.72946
Log likelihood	-1231.799	Hannan-Quinn criter.		20.66049
F-statistic	83.86532	Durbin-Watson stat		0.119572
Prob(F-statistic)	0.000000			

### <sup>3</sup> Lag Length Selection

Sharp (2010) defined that in order to justify an economic theoretical framework, lag length can be apply in several econometric analysis or models. There are two common methods for select a lag length, which is look at the cross-equation restriction and information criteria. In our research, we using information criteria such Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC) to obtain a lag length. An information criterion was being used for lag length selection in order to obtained optimum length. In order to obtain a best lag length, it normally will be based on AIC or SIC which with minimize value said by Verbeek (2008). Generally, the selection rules for the SIC and the AIC have to select values of k that are small in order to choose the unit root tests to have the best. AIC and the SIC tend to select a truncation lag with the value is very small (Ng & Perron, 2001).

Table 4.1.5.1: ARCH Test.

Heteroskedasticity Test: ARCH				
F-statistic	405.4627	Prob. F(1,117)	0.0000	
Obs*R-squared	92.35121	Prob. Chi-Square(1)	0.0000	
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 08/10/14 Time: 18:34				
Sample (adjusted): 2002M02 2011M12				
Included observations: 119 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5444035.	3020462.	1.802385	0.0741
RESID^2(-1)	0.881724	0.043788	20.13610	0.0000
R-squared	0.776061	Mean dependent var	48177407	
Adjusted R-squared	0.774147	S.D. dependent var	49334454	
S.E. of regression	23445727	Akaike info criterion	36.79494	
Sum squared resid	6.43E+16	Schwarz criterion	36.84165	
Log likelihood	-2187.299	Hannan-Quinn criter.	36.81391	
F-statistic	405.4627	Durbin-Watson stat	1.788085	
Prob(F-statistic)	0.000000			

Table 4.1.5.2: White Test.

Dependent Variable: LIQUIDITY				
Method: Least Squares				
Date: 07/14/14 Time: 18:38				
Sample: 2002M01 2011M12				
Included observations: 120				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	0.305767	0.087077	3.511452	0.0006
INT	-19341.70	884.5208	-21.86687	0.0000
EXR	1109.634	171.6115	6.465967	0.0000
D01	12429.29	1352.138	9.192320	0.0000
C	21057.41	17537.23	1.200726	0.2323
R-squared	0.744706	Mean dependent var		21246.45
Adjusted R-squared	0.735826	S.D. dependent var		13806.69
S.E. of regression	7096.338	Akaike info criterion		20.61332
Sum squared resid	5.79E+09	Schwarz criterion		20.72946
Log likelihood	-1231.799	Hannan-Quinn criter.		20.66049
F-statistic	83.86532	Durbin-Watson stat		0.119572
Prob(F-statistic)	0.000000			

Table 4.2.1: Ordinary Least Square (OLS).

Dependent Variable: LIQUIDITY				
Method: Least Squares				
Date: 07/02/14 Time: 22:19				
Sample: 2002M01 2011M12				
Included observations: 120				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESERVE	0.305767	0.110235	2.773782	0.0065
INT	-19341.70	1179.207	-16.40230	0.0000
EXR	1109.634	203.0421	5.465044	0.0000
D01	12429.29	2823.120	4.402678	0.0000
C	21057.41	20081.74	1.048585	0.2966
R-squared	0.744706	Mean dependent var		21246.45
Adjusted R-squared	0.735826	S.D. dependent var		13806.69
S.E. of regression	7096.338	Akaike info criterion		20.61332
Sum squared resid	5.79E+09	Schwarz criterion		20.72946
Log likelihood	-1231.799	Hannan-Quinn criter.		20.66049
F-statistic	83.86532	Durbin-Watson stat		0.119572
Prob(F-statistic)	0.000000			