COMPARATIVE STUDY OF COMMERCIAL BANK'S CREDIT RISK IN MALAYSIA

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DECLARATION

We hereby declare that:

(1) This undergraduate FYP 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 FYP 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 FYP.
(4) The word count of this research report is 14,682 words.

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LIST OF ABBREVIATIONS

NPLs	Non Performing Loans
BP	Bank Profitability
BS	Bank Size
CE	Cost Efficiency
UR	Unemployment Rate
IR	Interest Rate
IRFs	Impulse Response Function
VAR	Vector Autoregressive Models
ADF	Augmented Dickey-Fuller
VECM	Vector Error-Correction Model
VDCs	Variance Decompositions
GDP	Gross Domestic Product
JB test	JarqueBera test

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PERFACE

This paper is conducted under the title of “COMPARATIVE STUDY OF COMMERCIAL BANK’S CREDIT RISK IN MALAYSIA”. Non-performing loan (NPLs) is an ongoing issue that banking institution is concern about. One of the factors that causes cost inefficiency that leads to bank failure and financial crisis is the NPL problem when banking institution did not manage well their NPL level. Next, regulatory authorities and management of banks were advised to reduce NPL rate in individual banks. Banking information context in this paper are able to enhance reader’s knowledge on banking industry.

ABSTRACT

This research paper focuses on examining the independent variables affecting Non-Performing Loan (NPL) banks in Malaysia. Bank size, bank profitability, cost efficiency interest rate and unemployment rate are the variables that will be used to conduct the research. Data of variables was collected on quarterly basis from year 2010 to 2018, consisting sample size of 36 observations for each variable. Data was obtained from Bank Negara Malaysia (BNM) statistics database and The World Bank statistics database. Impulse response function will be used for this research and Econometrics View (EViews) program will be used to test the presence of econometrics problem. The results of the research revealed that all independent variable are significant towards the NPLs.

CHAPTER 1: RESEARCH OVERVIEW

1.1 Overview

Commercial banks generally contribute as an integral part of economic growth in every region. As a financial broker, it offers individuals, businesses, and governmental entities with a wide variety of services. Loan process is one of the core function to increase banks profitability. Yet, not all of the loans given by bank will be repaid, the default loan which is known as Non-Performing Loans (NPLs), the uncollectable loan from borrower. Hence, NPLs is one of the problem that confront by Malaysia's banking industry. Consequently, this would restrict the bank's earning return. The key factors which could have an effect on NPLs are examined in this research. Moreover, the background, problem statement, objective, question, significant, and structure of this research are included in this chapter.

1.2 Research Background

Banks act as an intermediary in channelling funds to borrowers (deficit unit) from depositors (surplus units) through the lending process (Kwambai & Wandera, 2013). Lending is a procedure that provide an interest profit to bank by acquiring deposit from depositor and provide loans activities to those who need the funds. Loans able to provide large profit to the banks by obtaining interest from loans, but before authorizing

a loan, there are a few factors should be considered. Bank will go through the borrower's credit history, occupation, age, repayment period, relationship with the bank and purpose of the loan before authorizing a loan.

In addition to loan loss provision, bank also would involve in several risks through credit activities for example market risk, liquidity risk, credit risk, etc. Market risk also known as systematic risk, which is the potential of investors suffering losses because of the element that influencing the entire financial market's performance. However, when a bank not able to meet their financial requirement in short run which mean the bank is facing liquidity risk, which also mean that bank unable to transfer bank's asset to liquidity cash in short period. Also, credit risk occur when loans provided are impossible to have full collection, even default which known as Non-Performing Loans (NPLs).

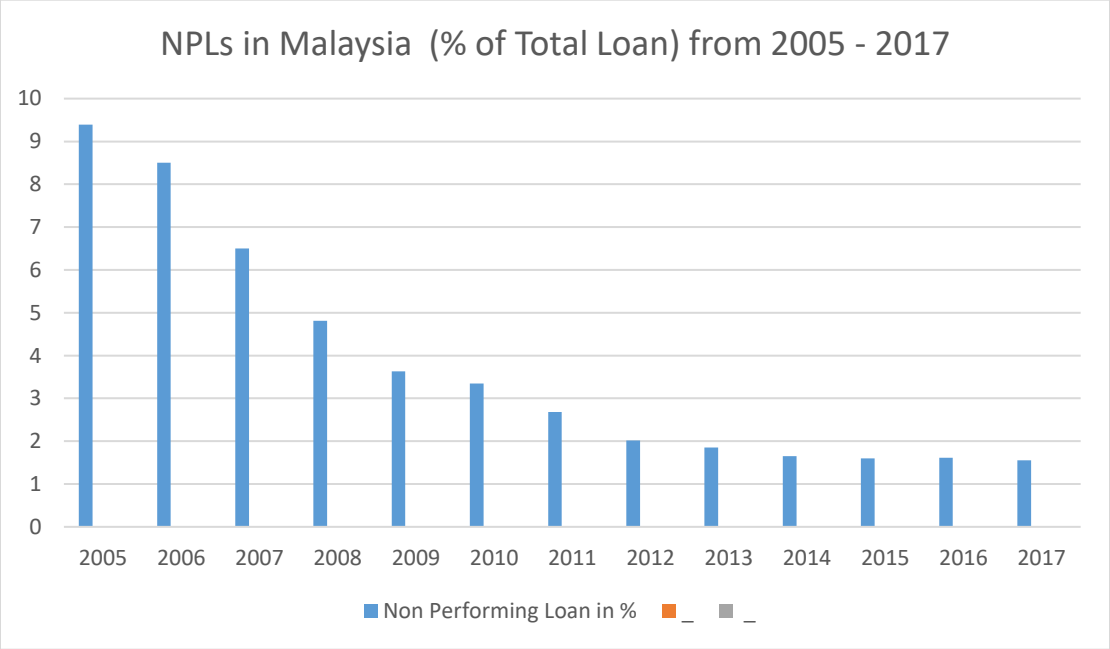

Figure 1.1 Table of NPLs in Malaysia (% of Total Loans) from 2005-2017

Since financial had crumble in year 2007, the collapse of several of the biggest loan institution in the worldwide, mechanisms started to realize the significance of credit risk management (Amadeo, 2019). Hence, credit risk is the major focus of banking industry currently. NPLs is total of loans that debtor has not paid the predetermined amount of repayment within the prescribed time limit (Segal, 2019). According to the definition of BASEL II, when borrower lags behind the contract payment by more than 90 days or when the debtor has failed to pay the remaining interest payments or unpaid payments to bank, and there is no bank recourse to actions such as realising security, hence the loan is considered not performed (Manish, 2017). Moreover, as stated by Bank Negara Malaysia, loans that overdue exceed than 90 days is considered as non-performed. Therefore, to reduce harassment caused by NPLs, in order to acquire a better understanding on determinants of NPLs, many studies from different countries have been conducted. The common encumbrance to the resolution of adverse reactions are relatively similar from result of different researchers. According to Anastasiou (2017), the lack of management of loss from NPLs method and NPLs' information, which are the most common obstacles to manage the non-performing loans. Moreover, bank have no guidance and ordinance to follow so as to minimize NPLs and preserve their capital adequacy.

In the past 20 years, there were number of bank disgraces happened in Malaysia, and these disgraces have either affected by NPLs or affected to NPLs. According to European Central Bank (2016), the balance of NPLs must be written off by banks based on different categories' percentage and lend the borrowers' collateral to reclaim the loan. Based on Zainol et al. (2018), NPLs have already became one of the main factors that stand for some point of view of the Malaysia's economic situation.

In this research, the main study is to investigate and compare the Non-Performing Loans of commercial bank which is CIMB Bank, Maybank and Public Bank, since these banks are the Top 3's commercial banks in Malaysia. Maybank, Malaysia local

bank that located in Malaysia and Southeast Asia. It is founded in year 1960 and now rapidly grew to become Malaysia's leading bank. Moreover, CIMB Bank is also a universal bank of Malaysian, which manipulating in ASEAN's rapid growth economies. Last but not least, Public Bank, one of the biggest banks in Southeast Asia. It providing financial services in Asia-Pacific region, including Malaysia. In this study, this three bank have been chosen as the research's bank is because they are the main bank in Malaysia as they have similar bank size, which is the total asset. The similar bank size of investigate banks is easy in order to make comparison fairly, hence get to have accurate result. Besides that, although these banks have similar bank size, but the data of Non-Performing Loans (NPLs) have major difference between them. Therefore, this research focuses to identify factors affecting Malaysian's non-performing loans to have better understanding to manage economic situation and causes of NPLs in Malaysia. In addition, this research also focuses on the comparison of the factors affecting in NPLs of CIMB Bank, Maybank and Public Bank to investigate how Malaysia's bank manage their Non-Performing Loans (NPLs) to obtain more profit.

1.3 Problem Statement

NPLs also known as default loans as the issued loan is no longer "performs". The BASEL definition has stated that a loan is counted as NPLs when the borrowers is 90 days or more than that on the contractual payment. The rise of NPLs is a warning signal or indicator for banking industry in the world to prevent the potential banking crisis.

In the case of Malaysia's commercial banking sector, CIMB Bank, Maybank and Public Bank have been chosen to investigate in this study as they are top three highest

performance bank in Malaysia, below are the NPLs for three banks from year 2016 till 2018.

Table 1.1

NPLs for CIMB Bank, Maybank and Public Bank from Year 2016-2018

	MAYBANK (%)	CIMB BANK (%)	PUBLIC BANK (%)
Year 2018	1.67%	2.22%	0.50%
Year 2017	1.79%	2.19%	0.50%
Year 2016	1.60%	1.88%	0.50%

Based on the data retrieved from bank annual report, Maybank and CIMB Bank show an increase in NPLs for the past three years, while Public Bank manage to maintain its performance for the past three years. The table shows that CIMB Bank has the highest rate for bad debt over net income compare to Maybank and Public Bank. This might due to poor credit rating and poor management of bank.

Maybank as the top performance bank in Malaysia, with total of 374 branches across Malaysia has relatively higher NPLs rate compare to Public Bank. This situation can be explained by the argument propose by Garciya-Marco and Robles-Fernandez (2008), which state that higher the level of return, the greater the risk, the policy of profit maximisation is followed by higher level of risk.

Maybank may be the top performance bank in Malaysia in terms of net income, while Public Bank still remain as the strongest bank by balance sheet evaluation in Malaysia, Public Bank has relatively stronger capital position, profitability ratio, risk management, and asset quality compare to other bank in Malaysia (The Asian Banker, 2018). This explained why Public Bank has much lower NPLs compare to Maybank and CIMB Bank.

As NPLs continue to rise, bank liquidity and its earning will be adversely affected as well. In order to reduce the NPLs ratio, it is important to analyse the root cause of bad debt. Internal bank factor such as the internal culture, effectiveness of bank policies, bank management and efficiency of employees does carry significant effect to the NPLs ratio. Public Bank successfully prove their effort in minimising and controlling the NPLs at the minimal level.

There are many evidence to prove that NPLs and interest rate are relating each other. Economic growth is favourable to increase in revenue and drop in financial distress which result in the employment rate are negatively related with the NPLs. Besides, inflation rate also will cause an impact to NPLs. The higher the inflation rate, the higher the NPLs.

The financial and economic downturn will effect in rise in level of NPLs throughout worldwide (Polodoo et al., 2015). During economic downturn, banks protect themselves by diversified their market, product and services in order to stay away from losses, but this action will indirectly lead to raise in the level of NPLs.

Every banks have different NPLs. In this research, CIMB Bank, Maybank and Public Bank will be chosen to compare on how the determinant affect the credit risk of the three banks in Malaysia. Determinant of NPLs will be discuss in later part which indicate five independent variable consist of macroeconomic factor (unemployment rate, interest rate) and microeconomic factor (bank size, cost efficiency, bank profitability).

1.4 Research Objectives

This study is to study the determinants that influencing NPLs of selected commercial banks. To answer these questions, it is important to analyze the objectives of this research.

1.4.1 Main Objective

This research is to examine the factors that influencing NPLs of the selected commercial banks. To answer these questions, it is important to analyze the objectives of this research.

1.4.2 Specific Objectives

i. To identify the relationship of bank size and NPLs
ii. To identify the relationship of bank profitability towards NPLs.
iii. To identify the relationship of cost efficiency towards NPLs.
iv. To identify the relationship of unemployment rate and NPLs.
v. To identify the relationship of interest rate and NPLs

1.5 Research Question

Six research questions were formed in order to examine the specified objectives above:

i. Is there significant relationship of bank size and NPLs?

ii. Is there significant relationship of bank profitability and NPLs?

iii. Is there significant relationship of cost efficiency and NPLs?

iv. Is there significant relationship of unemployment rate and NPLs?

v. Is there significant relationship of interest rate and NPLs?

1.6 Significant of study

The purpose of this study is to identify how important the determinants bring effects towards the NPLs that will influence the stability of the banking industry in Malaysia. Since there are limited resources from past researches on NPLs in Malaysia, thus this research will become more significant as it able to fulfil the research gap by examining the influence of bank-specific and macroeconomic variable for banking industry within Malaysia.

Throughout the research people able to figure out which variables have the significant effect and insignificant effect on the NPLs towards bank. This study also can contribute ideas for banks in order to generate some guidance before authorizing the loans to their customers. Banks also can understand the causes of NPLs and the problem related with

it so it can take response and make improvement on their problems. For example, bank able to enhance their monitoring and control of loans as well as provide advisor to the customer. This research also provide relevant information and knowledge for bank to have a better understanding on what customer's need.

Furthermore, this study is useful and helpful for other researches as it provides a good opportunity to understand more in depth concerning the factor of bank size, bank profitability, cost efficiency, unemployment rate, interest rate that will bring impact on NPLs towards Malaysia's bank. It will be useful for future researches who also doing this topic as it easily gather more information and provide understanding on the relationship between independent variables with NPLs regards banks. Besides, it will be helpful for researches who intend do this study in Malaysia as there are limited sources for this kind of topic in Malaysia.

Lastly, this research is significant source for the government that help to fulfil the objective of Bank Negara Malaysia which is promote financial stability. Hence, government able to know the currently level of NPLs of each banks in Malaysia and take appropriate action to improve loan qualities and implement the strategies to minimize the NPLs risk as well as manage the level of NPLs. It also consist purpose in convincing policy maker by present a better picture on how macroeconomic factors affect NPLs.

1.7 Structure of Study

This study is to understand how six different independent variables affects NPLs in Malaysia's Bank. The independent variables are bank profitability, bank size, cost efficiency, unemployment rate and interest rate to selected commercial banks.

The relationship between the independent and dependant variables will be investigated. Data used in this research is from the year 2010 to year 2018 on quarterly basis. This study is consisting five chapters

1.7.1 Chapter 1

Chapter one describes the background of the study, problems of the issues, research objectives, research question and significance of study.

1.7.2 Chapter 2

For chapter two, the content will be literature review by summarize the journal and describe what the past studies had done by other experts or researchers. The relationship of the selected variables in this study will be discussed according to the past studies done by other scholars, and the result from each past studies will be discussed for developing the proposed conceptual framework for this research.

1.7.3 Chapter 3

In chapter three, the methodology of directing will be designed in this study. The method and the ways used to collect data will be explained in this chapter. Moreover, the source of data also will be analysed and the definition of each variable will be clearly interpreted.

1.7.4 Chapter 4

In chapter 4, from each test the empirical result and data analysis will be obtained under this chapter. E-Views 10 program will be used to run the empirical testing and the result of the test will be interpreted to make decision in whether the hypotheses should be supported.

1.7.5 Chapter 5

For chapter five will be concluding completely from chapter one to four in this research. In this section major findings of this study will be concluded. Furthermore, the limitations that have been faced in this study will be assessed and recommendations will be proposed for future implications.

1.8 Conclusion

The purpose of this research is to investigate on how credit risk affect the banks in Malaysia. NPLs is still a continuing and important issue for all countries so this topic was investigable by referring to the past studies from other researchers. In this research, bank size, bank profitability, cost efficiency, unemployment rate and interest rate were used to determine the factors that affecting NPLs in Malaysia. The next chapter will be showing literature review of the findings and objectives.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

This chapter are going to cover analysis of past study that were related to the research which have been done by previous researchers. There were five variables in total that will be used to test for the response of the bank NPLs. These five variables included, interest rate, unemployment rate, cost efficiency, bank size and bank profitability. In order to provide a basic understanding about the determinants for the research, studies on all relevant journal were clarified and summarized. Also, conceptual framework, hypothesis development and suggestion of theoretical framework will be further discuss using diagram to identify the relationship between the determinant and NPLs

2.2 Theoretical Framework

This part indicates the structure that can support or hold the theory of this study.

2.2.1 Information asymmetry theory

Information asymmetry theory explain an imbalance information between two parties which is the buyer and seller or lender and creditor can result in inefficient in certain market. This theory was developed in the 1970s and 1980s. In the view of financial decision, asymmetry information basically look at the impact of decision made result from the difference in information available on both of the parties (Mishkin, 1992). Lender who offered credit facilities or a platform to borrower to get a loan face the risk of loan repayment, as they cannot get a full information on borrower's characteristic and action, hence causing it harder to evaluate credit quality of the borrower (Ariccia, 1998). Due to the information asymmetry, adverse selection lead to high quality borrower are being replace by low quality borrower, which result in the reduction in overall quality of bank loan portfolio in the long run. This situation will result in the higher NPLs and decrease in bank profitability (Bofondi & Ropele, 2011; Makri et al., 2014).

2.2.2 Agency theory

Agency theory used to justifying the relationship between the management in an organisation and the owner of the organisations which is the stockholders who hold the stock of the organisations. Agency theory is increasing popularity recently in explaining the financial performance in a business or an organisations. This theory pointed out that there is an agency conflict between two parties. The management of the organisations act as the contracted agent by the shareholders to work on behalf on the shareholders which is to maximise the shareholders' value through enhancing the financial performance of the organisations. Therefore, the

management team are assumed to act in the best interest of the shareholders (Macharia, 2012).

However, this theory state that the agent or the managers may involve in action that are aimed in provide personal interest instead of focus in maximise shareholders' value. When this problem arises, it will greatly affect the performance of the organisations. For instance, in order to reduce NPLs by certain percentage, bank management might need to put in a lot of effort in this problem, which made the bank operation difficult and time consuming. Thus in order not wasting their time and effort on this problem, bank management might ignore the effort on reducing NPLs. In order to get rid of this problem, multiple solution has been proposed and applied to ensure management always act in shareholders' interest (Munoz, 2013).

2.2.3 Bad management hypothesis

Bad management hypothesis was firstly presented by Berger and De Young (1997). This theory showed that in respond to the rise in NPLs rate due to adverse selection, the management of the bank tend to pump in more method to control the bad loans, which result in high cost-to-income ratio in the long run. A high ratio of cost-to-income indicate a mark of weak management by the bank in managing and monitoring the loan portfolio (Muratbek, 2017). As a proxy of profitability, NPLs is expected to have a negative relationship with cost-to-income ratio.

2.2.4 Credit default theory

Credit default represents financial failure of a person or a company. This theory is suitable for situation explaining the indirect relationship related to the impact of default that cause an impact to the financial performance of an entity. In most cases, credit default theory does not directly link with the effect of credit default, which result in this theory is unable to assess the credit risk in fast changing market (Sy, 2007). This theory can be systematically used to explain the lending risk and dynamically measure the credit risk for a stable financial system.

Sy (2007) conclude both insolvency and delinquency can caused default risk. Situation of delinquency happens when borrower fail to make payment when due date hit. This may lead to the lender unable to collect back the loan payment as promised which result in the expectation of losses by lender. In conclusion this theory can be used in identify the relationship between NPLs and financial performance which emphasis on the concept of delinquency and insolvency.

2.3 Review of Literature

In this part will describe, evaluate, clarify and summarize the past research regarding to this study. It helps in determining the idea and provides a theoretical basis of this research.

2.3.1 Non-PerformingLoans (NPLs)

In recent decades, banks' NPLs has attracted many attention around the world. The empirical literatures conducting on variables of NPLs of the banks are relatively wide. Many researchers have investigated on issue of loans, NPLs and the similar default rate in the past studies in many countries. The empirical literatures that used some countries' data as their study results, for instant Eurozone (Makri et al., 2014). There are also researchers who only focus studies on one country for examples Nigeria (Nyor & Kolawole, 2013), Kenya (Joseph & Kenneth, 2011), Ethiopia (Aynalem, 2016) and Czech Republic (Petkovski et al., 2018).

NPLs is considered significant because they show directly in a country that NPLs can affect the credit worthiness of the banking sector's loan portfolio (Ozili, 2019). According to Mohd et al (2010), in the banking institutions, poor bank management results in poor quality loans, hence, it will cause an increase in the NPLs. The higher the banks' management quality, the lower the NPLs, however for moral hazard incentives for instant low equity, it will leads to higher NPLs (Petkovski et al., 2018).

According to Messai & Jouini (2013), other than bank management, the macroeconomic condition that affects the results of loan borrowers and their capability to borrow the loan. Findings show that NPLs are affected by macroeconomic variables, for example inflation rate, real GDP growth rate and real lending rate (Abid et al., 2014). In addition, according to Rajha, (2017) investigation, it shows positive relationship between NPLs and unemployment rate, interest rate, exchange rate, lending rate, public debt and inflation, meanwhile there is negative relationship of NPLs and economic growth. Furthermore, the outcomes results show that on average, the bank with lower profitability turn out in a higher

NPLs and bank size has a negative impact on NPLs, therefore, this can conclude that larger banks have more experience in settle the problems of information asymmetry than smaller banks. (Petkovski et al., 2018)

2.3.2 Bank Profitability

Bank profitability can be define into two different sector, internal and external determinant. The internal determinant bank profitability can be explained as micro factors or bank explicit factor for instance brand image, competition, cost of production and more while external determinant are those macroeconomics that might affect the profitability of the bank for example interest rate, unemployment rate , inflation rate and more(Morshedur et al., 2015). Bank profitability is a big deal in the financial environment. The increment of bank profit will lead to financial stability (Kawshala & Panditharathna, 2017).

There are few researchers had found that there is a significant negative relationship between bank profitability and NPLs. Based on Kagecha, (2014) and Koju et al., 2017, the negative correlate on of quality of asset and the efficiency and effectiveness of the bank will cause increment of NPLs yet decrease of the bank profitability. Other than that, Kagecha and Koju found that for those bank with high profit, they should have only few non-performing loans because the profitable bank have a strong regulatory capital and bank's risk –adjusted capital are able to help bank in avoiding the high risk lending. These could prove that when there is rise on bank profitability, non-performing loan will depreciate at the same time. Other than that, Messai & Jouini (2013) who study on the micro and macro determinant of NPLs in Tunisia had shown that bank size is one of the factor that is negative related

with NPLs. Furthermore, Kwan & Eisenbeis (1997) found that for those bank with excellent performance will have a great management and more caution on the risk of lending. In the other side, for those bank with lower profit are less efficient in investigating their client and have a high cost. In this case, bank with lower profit will have higher level of NPLs. Furthermore, the factor that cause bad performance on bank's profit and increment of problem loans is due to the poor banking management. (Koju et al., 2018) Moreover, low level of profit could not change the fact of the amount of human resources needed keep on increase to control and handle the high no-performing loans stock.

Since there is no findings on positive relationship between bank profit and non-performing loan, this study could conclude that there is significant negative relationship between bank profitability and non-performing loan.

2.3.3 Bank Size

Bank size is the proportion between bank's asset in a certain year to bank size of all commercial bank in certain year and it is computed as the log of bank size. Calculation of bank size is able to examine the ability of the bank and the accuracy of the information. For larger size bank have the greater ability to examine the ability and the accuracy of information for the bank with large amount of base level fund, man power and advance technology (Brahmaiah & Ranajee, 2018).

There are some of the researcher had found that there is significant negative relationship between bank size and NPLs. According Baudino & Yun (2018),

Ismail, Damia et al. (2017) , Makri et al. (2014) when the bank size is big enough, it is able to spread risk into few diverse in order to lower down non-performing loans. The larger the bank, the greater the ability of spreading risk, the better the ability of giving out a loan to customer. Based on Awour (2015), increase of bank size will lead to decrease of NPLs. The bank with bigger size have the greater opportunity and advantage to compete with its competitor compare with the smaller size of bank. In this case , bank should came out a policy in focusing and giving a hand to the smaller size's bank to avoid the consequences that brought from NPLs. Furthermore, the bigger the size of bank, the more the resources to examine the quality of product (Hu et al., 2004). For big size bank will always take control and observe loans, a greater risk management strategy and high expansion chance (Koju et al., 2018).

Allthough some of the scholars stated that there is negative relationship between bank size and NPLs, but there is also a researcher shown that there is positive relationship between bank size and financial performance. According to the research in Kenya from Muturi, Alex, et al. (2018), the different between small bank and big size bank. The different between them is the bank's branches. There is large customer deposit and large base level of funding while small bank have tiny customer deposit and tiny base level of funding. In this case, big size bank will perform better than small bank hence have a better financial performance .Moreover, Khalil & Khalil, (2017) also state that the bigger size of bank will receive the gather of superior value and processing price. The finding also shown that big size bank will earn more and higher profit than the small bank. In this case, the better the financial performance, the larger the size of the bank which lower down the NPLs.

2.3.4 Cost efficiency

Banks efficiency is the most significant trouble that need to be concern within the economic market because the banks performance will affect the stability of the banking enterprise and also the validity of a whole financial device (Kocisoca, 2016). According to Farrell (1957) who was studying about the measurement of productive efficiency had shown that there I two different efficiency which is technical efficiency and allocative efficiency. Technical efficiency is using a set of input to obtain a maximum output. While allocative efficiency display the ability of a firm in using the input with appropriate proportion, cost given and manufacturing technology.

Most of the scholars had proved that there is significant negative relationship between NPLs and bank efficiency for those bank that does not fail (Kwan & Eisenbi, 1995). Other than that, Karim et al. (2010) who study about the connection between NPLs and cost efficiency in Malaysia and Singapore had proved that there is significant negative relationship between non-performing loans and cost efficiency. For those bank which are having a bad situation and poor management, DeYoung (2017) recommend to increase the standard of NPLs which able to decrease the cost efficiency. According to the research on credit risk and commercial bank performance from Kaaya and Pastry (2013) in Tanzania, by using the return on asset had measured that there is negative relationship between credit hazard and NPLs. Furthermore, based on the research of Keeton (1999), some of the American has a better way to increase the speed of credit growth which is decrease the credit level in order to increase the loan losses. Moreover, Altunbas et al. (2000) had shown that there is positive relationship between NPLs and cost inefficiency in Japanese commercial bank between 1993 and 1996.

Other than those scholars above had shown that there is significant negative relationship between NPLs and cost efficiency, there is also researcher found that there is a negative relationship between inflation and cost efficiency. An inverse relationship between inflation and cost efficiency able to recommend bank to discover it's difficult to control their cost in time of high inflation. The lower the inflation, the higher the cost efficiency, the lower the NPLs (Hien Thu Phan et al., n.d).

In conclusion, most of the researcher found that there is significant relationship between NPLs and cost efficiency and there is also researcher found that there is negative relationship between inflation and cost efficiency.

2.3.5 Unemployment rate

There are some of the professional scholars found that there is significantly positive relationship between unemployment rate and NPLs. For example, when there is increment of unemployment rate will lower down the household's income. Decrease of household's income cause household unable to pay for their debt. In addition, increment of unemployment rate shown that there is decline in the effective demand which will lead to decline of production. In this case, the finding have shown that there is positive relationship between unemployment rate and NPLs. When there's an increase in unemployment rate, there's an increase in NPLs (Clichici, 2014). Other than that, based on the research from Lazea & Iuga (2012) in Romania, the finding also shown that there is strong relationship between unemployment rate and NPLs. Based on Waqas et al. (2017) state that when unemployment rate increase will make some changes appear in non-performing

loans in both market and bank based economies. Moreover, German banking sector approve debt service to private sector due to professional trained and labour with fully experience in order to dodge the opportunity of default. Unemployment rate that over average will lead to high non-performing loans due to insufficient economic and lack of capabilities to repay loan. The increment of unemployment will cause high default risk. According to finding from Radivojevic & Jovovic (2017), the increment of unemployment rate will decline the income of household cut down the borrower capabilities to repay for repayment. Other than that , increment of unemployment rate will confine the ability to purchase goods and services which will lead to lower down in production due to reduce in customer demand ability (Messai & Jouini, 2013). Unemployment rate and NPLs positively correlated due to households are facing financial problem when there is appearance of losing income. In this case, company will lower down their production because only fewer customer able to purchase their product and services (Kupcinskas & Paskevicius, 2017). When company is facing financial problem, they were forced cutting off staff which will increase the rate of unemployment (Zikovic et al., 2015).

On the other side, based on the finding in Gambia from (Kasseh, 2018) there is negative relationship between inflation and unemployment rate. When unemployment rate increase, inflation rate decrease. This have bring policy provider a big challenge due to decrease of unemployment rate will increase the inflation rate. Other than that, when inflation increase, it will decrease the proportion or value of the debt which will lead to decrease of NPLs and make the service of debt more uncomplicated. Decrease of NPLs will lower down the unemployment rate. In this case, the increase of inflation will lower down the unemployment rate (Mazreku, Ibish, et al, 2018).

2.3.6 Interest Rate

In view of the research, numerous other qualified scholars (Messai & Jouini, 2013), (Nezianya & Izuchukwu, 2014), (Sheefeni, 2016), and (Murthy et al., 2017) dispute that there is a roughly positive connection between interest rate and NPLs which is contrary viewpoint of (Chege, 2014). Other than that, there is some cases in UK had shown that how financial crisis result in lower interest rate will cause lower banks performance and decrease in NPLs (Bahruddin et al., 2018) Based on the research of Murthy et al. (2017), the low interest rate caused the reduce of NPLs, hence in contrast the customers will try to obtain their interest on mortgage loan with lower rate and more affordable housing payment by refinanced their properties. In the opposite way, the increasing features on the real interest rates may straight away leads to a rise of NPLs particularly that with floating rate. Moreover, the reducing of borrowers' ability to meet obligations are always due to high interest rate in the loan. Hence, while the interest rate increase will bring about more management on interest rate and so there is more the level of growth in economic in Nigeria, which cause by the NPLs can prompt or prevent growth relying on their qualities (Nezianya & Izuchukwu, 2014). However, the study of Johannes (2004) use an example of the data from year 2001 to year 2015 in Namibia to explain why the relationship between interest rate and NPLs is positive. It indicates the positive collision of interest rate differential that raise the spread may increase likelihood of customers' NPLs.

On the other hand, the research from Chege, (2014) stated that the same knife may cuts bread and fingers, while there is an increase of interest rate, the NPLs will reduce indirectly owing to the encumbrance to the financial mechanism's development. However, this is cause by the obstruction of potential savers because of deposit's low returns and thereby limits the borrowers. Forasmuch, it shows a

negative relationship, the non-performing loans will be reduce, since there is obstruction of quantity of potential borrowers when interest rate raise.

As a conclusion, the findings from these qualified scholar is mostly quarrel that is positive relationship among interest rate and NPLs. However, there is only research from Chege, M. (2014) figure out that it is negative relationship between them.

2.4 Conceptual Framework

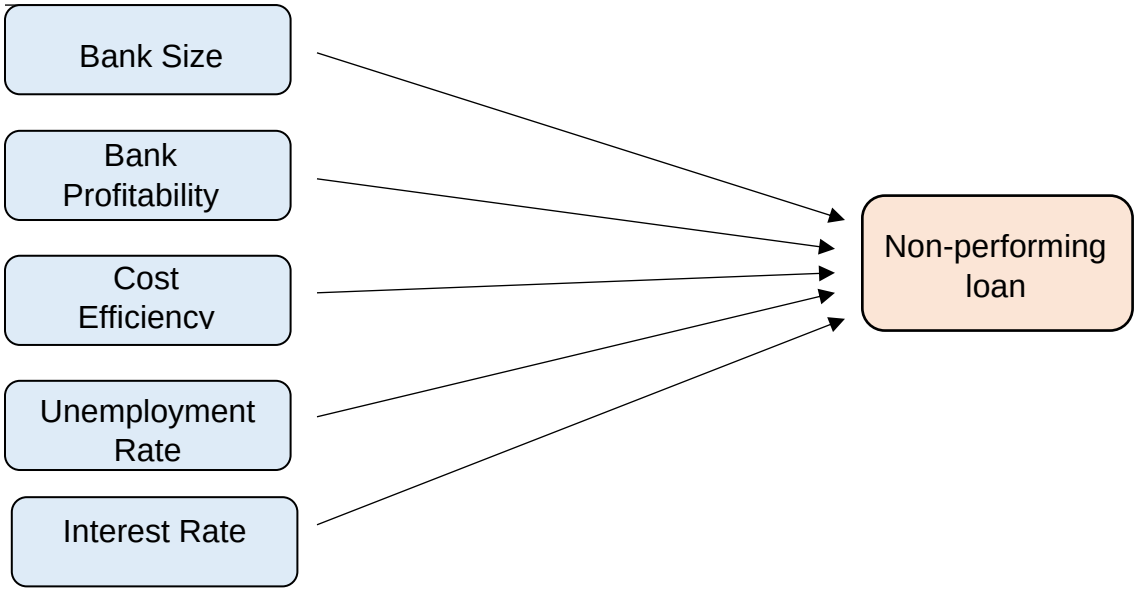

Figure 2.1: Develop for Research

Based on figure 2.1 indicates the conceptual framework that developed in this study. The figure has shown the determinants that has an impact on NPLs. The independent

components that investigate in this research are bank size, bank profitability, cost efficiency, interest rate and unemployment rate.

There are some important reasons for using these independent variables in this research. First of all, one of the chosen factor in this study is bank size. Based on Petkovski et al. (2018), bank size can reflect the bank potentiality and stability in order to adapt to the issue of information asymmetry, which lead to a lower level of NPLs. Rajha (2017) has stated that, too large to fail hypothesis assumes that bigger banks take over risks by extending loans to lower quality borrowers and rising too much of their leverage, and in this way will cause more NPLs. Oppositely, smaller banks got lesser resources to efficiently acknowledge the credit analysis.

Bank profitability is the next variable that chosen. This is because the banks' profitability is always connected to the banks' risk-taking behaviour (Makri et al., 2014). The more the profitability of banks, the lesser the incentives for the banks to involve in high-risk activities. However, banks with fewer profitability are obliged to permit credits considered risky and finally caused an increasing in the level of impaired loans (Messai & Jouini, 2013). Many authors have considered the impacts of banks' past performance measured by profitability (ROA) on future problem loans ratios. It is expected that the higher profitable the banks are, the lower the levels of NPLs (Petkovski et al., 2018).

In addition, the next variable, cost efficiency is chosen in this research because the issue on cost efficiency and NPLs are related in some important ways. Berger and DeYoung (1997) stated that in the future, cost efficiency might be a significant signal of potential problematic loans. According to Hien et al. (n.d.) the most cost efficiency is always the largest bank. Hence, bank managers can increase cost efficiency by applying better technologies, additionally, they can increase capital through increasing profit

efficiency by embracing new marketing and pricing methods. An effective intermediation process is very important for supporting economic. The lower the cost efficiency of a bank caused an increase in the total NPLs, which higher the chances of the bank failures (Abel, 2018).

Furthermore, another significant variable that chosen in this study is unemployment rate. For unemployment, bad macroeconomic performance can relate to the increasing in NPLs in advance economies (Makri et al., 2014). According to Petkovski et al. (2018), it is rational to assume that the cash flow streams of household can be negatively affect by the rising in unemployment rate yet higher up the debt burden. For company, a rising in unemployment might cause an impact to decline in the production and lead to an in-effective demand. This can cause a decrease in profits and a weak debt status.

Last but not least, interest rate is chosen as independent variable in this research because based to Petkovski et al. (2018), the importance of interest rates and economic growth as the most persuasive factors behind the soundness of the banking. The fewer the economic growth, the higher the interest rates which cause an increase in NPLs (Rajha, 2017). Interest rate are positively correlated with NPLs because a raise in interest rate will decrease the ability of the borrower's loan payment. According to Messai and Jouini (2013), the result indicates that when there's an increase in bank real interest rate, which can cause a raise in NPLs. This relationship can also be clarified by the reduction in the borrowers' ability to carry through their obligations. (Messai & Jouini, 2013).

2.5 Hypothesis Development

Hypothesis is the prediction of the relationship between two or more variables in this research. Hence, each independent variables with its null and alternate hypotheses are presented as below:

H1: There is a relationship between bank size and NPLs.

H2: There is a relationship between bank profitability and NPLs.

H3: There is a relationship between cost efficiency and NPLs.

H4: There is a relationship between unemployment rate and NPLs.

H5: There is a relationship between interest rate and NPLs.

2.6 Conclusion

Chapter 2 generally discussed the introduction of the research. This chapter are completely done by referring to the journals and articles that publish by previous researches. These studies contribute a wise and clear understanding toward non-performing loans through various aspects. The hypothesis that establish in this chapter carried out from theories of literature review. Moreover, development of methodology will be discussed and completed in the following chapter.

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CHAPTER 3: METHODOLOGY

3.1 Overview

In this chapter there will be various types of alternative research methods and the approach to adopt in this given analysis. This research focuses on the impact of bank size, bank profitability, cost efficiency, interest rate and unemployment rate on non-performing loan in Malaysia from year 2010 until 2018 on quarterly basis. Hence, it will clearly explain the methods that used to analyse the data.

3.2 Descriptive statistics

The objective of descriptive statistics is help to summarize, analysis, organizing the data in a simple way. There are three types of descriptive statistics measures which is measures of distribution, measures of central tendency as well as measures of variability or spread. In order for people to more understand about the meaning of the analysed data easily, it can present in a simple form for example by using graph or table to present. Furthermore, central tendency measure is a techniques by using mean, median and mode for central position of frequency distribution. It able to generate the large amount of data into a simple summary. Next, the measures of variability or spread means spreading the principles among the core tendency. It consists two similar measures of dispersion which is the range and standard deviation. Meanwhile, distribution is overview of the frequency of personal values or ranges for a variable.

3.3 Research Design

Quantitative method has been used in this study to examine the variables of NPLs in Malaysia. Quantitative research is about collect the data in a numerical form and convert it into numerical information and it can be measured (Mcleod, 2017). The data employ in this study is time series data and secondary data will be collected from Bank's annual report database and IMF database. Next, the Impulse Response Function (IRFs) model under the E-view 7.1 software has been used for the economic analysis. A total 9 years of sampling period will be used in this research which is from year 2010 until 2018. Data is collected based on quarterly basis, a sum of 36 observations will be studied. Bank size, bank profitability, cost efficiency, interest rate and unemployment rate will be used as the independent variables, in order to analyse and interpret their relationship.

3.4 Research Framework

This research consists of one dependent variable and five independent variables. NPLs will be the dependent variable in this study while the independent variables are bank size, bank profitability, cost efficiency, interest rate and unemployment rate. The relationship will be discovered based on this study.

NPLs will be affected by the factors of bank size. When there is an increment in bank size, it will caused a decrease in Malaysia's NPLs. Next, when a rise in bank profitability can reduce the NPLs rate. Besides that, cost efficiency have a negative relationship with NPLs. An increase in cost efficiency tend to decrease the NPLs.

Futthermore, there is a positive relationship between NPLs with interest rate. The NPLs will rise when there is an increase in interest rate. Moreover, unemployment rate also will bring impact on NPLs. When a rise in an unemployment rate leads an increase in NPLs. Lastly, NPLs also will decline while the bank's profitability increase.

3.5 Definition of variables

Table 3.1

Definition of variables

Variables	Definition	Sources	Measurement
Non-Performing Loans	Non-performing loans occur when borrowers overdue the contract payment by more than 90 days or when the debtor is unable to make the remaining interest payments or unpaid payments to bank.	Segal (2019)	Thousands of Ringgit Malaysia (RM'000)
Bank profitability	Bank profitability is created by bank's services and the benefits received by bank for its assets.	Thismatter	Ringgit Malaysia (RM)
Bank Size	Bank size means that bank owned assets'	Nguyen (2018)	Ringgit Malaysia (RM)

	ownership. The more bank assets are owned, the more banks can provide more financial services at lower cost.		
Cost Efficiency	The cost of a particular bank and the cost of a best practice bank generate similar profitability based on identical environmental prerequisite.	Isik and Hassan (2002)	Percentage (%)
Unemployment Rate	The percentage of people that are pleased to work and active in seeking job.	Asif (2013)	Percentage (%)
Interest Rate	Interest rate is the amount that the lender collects from the borrower for the use of asset, and also represents the percentage of the principal.	Banton (2019)	Percentage (%)

3.6 Data Collection Method

The purpose of this study is to examine the variables of NPLs in Malaysia. Bank profitability, bank size, cost efficiency, interest rate and unemployment rate will be selected as the independent variables, used to examine the effect of the economic variables. To identify the relationship between independent variables and NPLs in Malaysia, hypothesis testing will be perform to obtain the result.

Besides, secondary data method will be employ in this study as it able measured in unit of measurement and obtain an objective results in comparison with primary data. Next, secondary data is cost effective and easily to obtain through the online information or website as there have several studies done by the previous researches in Malaysia.

Moreover, only licensed financial institutions are able to grant loans to the public. The banks required licensed under FSA for commercial bank and approval ISFA for Islamic bank. According to the Bank Negara Malaysia official webpage, it consist total of 27 licensed commercial bank and 16 licensed Islamic banks in Malaysia which means only these banks are fulfil the qualification to admit loans to the society in Malaysia. Hence, banking institutions are the target population to obtain the data from and 3 commercial banks which is Maybank, Public Bank and CIMB bank were selected for this research.

The table below shows data source and unit measurement of each variables for secondary data in this study.

Table 3.2

Source of data

Variables	Data Sources
Bank Size	Bank's Annual Report
Bank Profitability	Bank's Annual Report
Cost Efficiency	Bank's Annual Report
Unemployment Rate	IMF
Interest Rate	IMF

All the data is rearrange in Microsoft Excel file after the data is obtained and the data will be used for carry out the test in this research.

3.7 Theoretical Model

Economic function

Non-performing loan = f (Bank size, Bank's Profitability, Cost Efficiency, Unemployment rate, Lending Interest Rate)

Economic Model

$$NPL_t = \beta_0 + \beta_1 BP_{1t} + \beta_2 BS_{2t} + \beta_3 CE_{3t} + \beta_4 UR_{4t} + \beta_5 IR_{5t} + \mu_t$$

Where, NPL_t = Non-Performing Loans (thousands of RM)

BP_{1t} = Bank Profitability (in RM)

BS_{2t} = Bank size (in RM)

CE_{3t} = Cost Efficiency (in %)

UR_{4t} = Unemployment Rate (in %)

IR_{5t} = Interest Rate (in %)

3.8 Impulse Response Function (IRFs)

In this paper, Impulse Response has been chosen as the research techniques in order to examine the relationship between the dependent variable and independent variables. Vector Autoregressive Models (VAR) is the technique of impulse response in describing whether the variables have response to a shock in one or more variables. VAR model can lower the estimation uncertainly and the degree of small-sample bias of assessment in impulse response by combining the information of the cointegration characteristics of data (Gospodinow, Herrera and Pesavento, 2013).

Firstly, all begins with the step by carry out the unit roots to identify the variable are whether stationary I(0) or non-stationary I(1). It will next proceed with the Augmented Dickey-Fuller (ADF) test and choose optimal length lag. To identify co- integration, the study used Johansen Cointegration test to obtain the results regarding the relationship among the variables. If there is cointegration relationship in the model then it can lead to the step of estimate long-run VECM model. Next, after determine variables are stationary at I(1), then can continue to estimate the vector error-correction model (VECM) and choose the optimal length lag for VECM model. However, assume that the variable are stationary at I(0), it should continue with the VAR model while if

the variable are at I(1), it can move to cointegration test. Meanwhile, the study proceed to variance decompositions (VDCs) or impulse response functions (IRFs) to identify the characteristics of the dynamic interactions among variables.

3.9 Diagnostic Testing

There are several tests that can be conducted using the E-view software to detect the problems with econometric models.

3.9.1 Autocorrelation Analysis

Autocorrelation is the feature of data in which relation among same variables' value based on correlated object ("autocorrelation", n.d.).

This research can use the residuals plot data order to discover the autocorrelation problem by visually check the autocorrelation of residuals. Residual assembling with the same vestige recognized the positive autocorrelation. However, speedy changes in continuous residual symbols will recognized the negative autocorrelation. Next, existence of autocorrelation can also test by the Durbin-Watson statistic (DW test). However, Durbin Watson test is unable to identify autocorrelation problem in impure serial correlation that consists of specification bias (ignorance of important variables or application of incorrect form). Hence, this study can use the Breusch-Godfrey LM test for test of autocorrelation problem in impure serial correlation.

Breusch-Godfrey LM test is carried out as:

Assume that,

$H_0 =$ There is no autocorrelation problem

$H_1 =$ There is autocorrelation problem

Critical value of Breusch-Godfrey LM test formula:

$$\text{Critical Value} = X^2 \alpha, \rho$$

Where,

$X^2 =$ Chi squared

$\rho =$ Fitted lagged lane

$\alpha =$ Level of significance

Test statistic of Breusch-Godfrey LM test formula:

$$\text{Test Statistic} = (n - \rho)R^2$$

Where,

$n =$ Number of observations

$R^2 =$ R squared

$\rho =$ Fitted lagged lane

3.9.2 Heteroscedasticity Analysis

Heteroscedasticity problem refers that the variance of error terms are indefinite, there are constant variance of error term, which mean there is not homogeneous of error term in nature, while it is homoscedasticity. The Ordinary Least Square estimator did not achieve the best linear unbiased estimator due to heteroscedasticity, which means it can build inaccurate biased parameter estimates (William, 2015).

There are number of ways to detect the heteroscedasticity such as Breusch-Pagan test, Glesjer test, Harvey-Godfrey test, Park test, Engle's ARCH test, Goldfeld-Quandt test, and White's test (Asteriou & Hall, 2007). However, the best ways to discover the heteroscedastisity problem for time series data is White's test.

White's test carried out as:

Assume that,

$$H_0 = \text{There is no heteroscedasticity problem}$$
$$H_1 = \text{There is heteroscedasticity problem}$$

Critical value of White's test formula:

$$\text{Critical Value} = X^2\alpha, k$$

Where,

X^2 = Chi squared

k = Number of variables

α = Level of significance

Test statistic of White's test formula:

$$\text{Test statistic} = nR^2$$

Where,

n = Number of observations

R^2 = R squared

This test reject H_0 when the p value < α (significance level of 0.05) OR test statistic > critical value, which conclude the model is having heteroscedasticity problem. Otherwise, no heteroscedasticity problem present in the model.

3.9.3 Normality Test of Error Terms

Normality assumption is particularly considerable for a lot of statistical procedures involving rehabilitation due to the hypothesis can draw trustworthy and exact conclusion about the reality. To discover the normality of data, can observe at histogram of data, values of Skewness, Kolmogorov-Smirnov test and Shapiro-Wilk test. Besides that, there are the virtual instrument and normality tests such as

JarqueBera test (JB test) to be make use for a model to appraise the normality, (Ghasemi & Zahediasl, 2012).

JarqueBera test carried out as:

Assume that,

$H_0 =$ Error terms are normally distributed

$H_1 =$ Error terms are not normally distributed

Test statictic formula for JarqueBera test:

$$JB = n[\frac{S^2}{6} + \frac{(K-3)^2}{24}]$$

Where,

n = Number of observations

S = Skewness sample

K = Kurtosis sample

Then, reject H_0 if JB test statistic < α (significance level of 0.05), since the error terms are normally distributed with sufficient evidence. Otherwise, do not reject the H_0.

3.10 Conclusion

In this chapter of study, the methodology that conducts throughout the study is the main focus in present of the research.

It discussed the basic model of the theoretical model and the content of the extended model, the empirical review represent the expected variable sign. After that, this chapter has shown the variables' definition in a table form. Furthermore, in the research design, this study used the quantitative method and the impulse response function estimation as the best model which more appropriate for carry out this research. However, at the end of this chapter, this study discussed the diagnostic testing including Autocorrelation, Heteroscedasticity and Normality test. Meanwhile, in the following chapter will conduct the data analysis and also convey a series of empirical testing by using the EView.

CHAPTER4: RESULTS AND INTERPRETATION

4.1 Overview

Based on the current goals of this study, all related information are collected to satisfy the use of all tests and conduct the empirical studies. In this segment it includes the description from all historically derived empirical findings.

4.2 Descriptive Statistic

In this study, there will be 36 observations from 3 banks in time-series quarterly data. They are collected from each bank's annual report from 2010 to 2018.

4.2.1 CIMB Bank

Table 4.1

Empirical result of Descriptive Statistic of CIMB Bank

	NPLs	BP	BS	CE	IR	UR
Mean	2.859167	1136579.	249729868.95	0.547222	3.020833	3.20889
Median	2.230000	710717.0	247500908.5	0.540000	3.000000	3.19000

Maximum	5.300000	3719697.	321935304	0.720000	3.250000	3.60000
Minimum	1.800000	19106.00	161287325	0.370000	2.250000	2.74000
Std.Dev.	1.041538	943301.3	56906776	0.068436	0.218559	0.20414
Skewness	0.847563	1.269578	-0.153902	0.278882	-1.461850	-0.2566
Kurtosis	2.410286	3.289732	1.465299	4.032333	6.093545	2.47455
Jarque-Bera	4.831828	9.796881	3.675073	2.065219	27.17707	0.80912
Probability	0.089286	0.007458	0.159209	0.163922	0.000001	0.66727
Observation	36	36	36	36	36	36

The above table 4.1 showed NPLs in CIMB Bank has the average value of 2.859167% with the standard deviation of 1.041538%. Next, the mean value of bank profitability in CIMB bank which is RM1136579000 and the standard deviation of RM943301.3 %. Next, bank size has average value of RM249729868940 with standard deviation of 56906776% while for the variable cost efficiency showed the mean value of 0.547222% and the standard deviation of 0.278882%. Moreover, interest rate and unemployment rate have the mean value of 3.020833 and 3.208889 respectively with the standard deviation of 0.218559% and 0.204140% respectively in Malaysia.

To examine the skewness of the distribution, it can be determine by the skewness value in the table computed. When the value of the skewness is greater than 0, it means the value is a positive skewed and vice versa. The data above indicated the skewness of NPLs, bank profitability, bank size, interest rate and unemployment rate are 0.847563, 1.269578, -0.153902, 0.278882, -1.461850 and -0.256574 respectively. It showed NPLs, bank profitability and cost efficiency are positive skewed while other variables is smaller than 0 which are the negative skewed.

Another approach of shape measurement is kurtosis. Higher values of kurtosis reflect sharper and higher peaks while lower values of kurtosis result in lower peaks. Besides, there are three types of kurtosis shapes in the distribution which is Mesokurtic, Platykurtic and Leptokurtic. The distribution has a kurtosis value of exactly 3 is called Mesokurtic while for the kurtosis value is smaller than 3 which is called Platykurtic. Moreover, Leptokurtic has a kurtosis value of greater than 3 and has a higher and sharper central peak. Therefore, the table showed that the kurtosis value of bank profitability, cost efficiency and interest rate are 3.289732, 4.032333 and 6.093545 respectively which show that it is a Leptokurtic distribution and has a larger and sharper centre peak. In addition, the kurtosis value of NPLs, bank size and unemployment rate are 2.410286, 1.465299 and 2.474553 respectively which is under Platykurtic distribution and have smaller and wider peaks than the normal distribution.

Jarque-Bera Test also called Normality Test and the purpose is to test the distribution of data. When the p-value of Jarque-Bera data is larger than 1%, 5%, and 10% significance levels which is assumed to be normal distributed. According to above table, the p value for NPLs, bank size, cost efficiency and unemployment rate are 0.089286, 0.159209, 0.356077 and 0.667269 respectively which indicated that these two data are normally distributed. The p-value for bank profitability and interest rate are 0.007458and 0.000001 respectively which showed that these data are not normally distributed. It means that the bank profitability change year by year.

The definition of maximum value which is the highest value in the data set. According to the above table showed the variable, bank profitability has the highest value data among the remaining five variables, which is 3719697.0. Therefore, bank profitability has the highest maximum. Other than that, minimum value is the

lowest value data in the result. From the above table provided that cost efficiency has the lowest value among the other five variables, which is 0.370000.

4.2.2 Maybank

Table 4.2

Empirical result of Descriptive Statistic of Maybank

	NPLs	BP	BS	CE	IR	UR
Mean	1.586111	1384352.	408880800.03	0.437500	3.020833	3.208889
Median	1.485000	1153816.	419813958.5	0.425000	3.000000	3.190000
Maximum	3.320000	2818054.	538652882	0.640000	3.250000	3.600000
Minimum	0.900000	533018.0	246938461	0.340000	2.250000	2.740000
Std.Dev.	0.574582	622730.6	91836825	0.060775	0.218559	0.204140
Skewness	1.297387	0.815963	-0.358724	1.027154	-1.461850	-0.256574
Kurtosis	4.457651	2.595064	1.770725	4.730124	6.093545	2.474553
Jarque-Bera	13.28639	4.240730	3.038776	10.82027	27.17707	0.809123
Probability	0.001303	0.119988	0.218846	0.004471	0.000001	0.667269
Observation	36	36	36	36	36	36

From the above data which was computed in Table 2, the average value of NPLs in Maybank is 1.586111% with the standard deviation of 0.574582%. Next, the variable of bank profitability has the mean value of RM1384352000 with the standard deviation of RM622730.6%. For the mean value of bank size in Maybank which is RM408880800028 and the standard deviation of 91836825% In addition, the average value of cost efficient in Maybank is 0.437500% while the standard

deviation is 0.060775%. The mean value of interest rate and unemployment rate in Malaysia are 3.020833% and 3.208889% respectively while the standard deviation are 0.218559% and 0.204140% respectively.

The table above showed the skewness value of NPLs, bank profitability, bank size, cost efficiency, interest rate and unemployment rate are 1.297387, 0.815963, -0.358724, 1.027154, -1.461850 and -0.256574. It indicated that bank size, interest rate and unemployment rate are negative skewed as their skewness value are smaller than 0. Moreover, the value of skewed of NPLs, bank profitability and cost efficiency which exceed 0 show a positive skewed.

Other than that, the above results provided that the variables, NPLs, cost efficiency and interest rate have a kurtosis value greater than 3 which are 4.457651, 4.730124 and 6.093545 respectively. It represent that these variables are under Leptokurtic distribution and have a higher and sharper central peak. Furthermore, the kurtosis value of bank profitability, bank size and unemployment rate are 2.595064, 1.770725 and 2.474553 respectively which are smaller than 3. It also known as Platykurtic distribution and have a lower and wider peaks.

The data above also show the result of Jarque-Bera test. The p- value for bank profitability, bank size and unemployment rate are 0.119988, 0.218846 and 0.667269 which indicated that it is a normally distributed. Furthermore, the p-value for NPLs, cost efficiency and interest rate are 0.001303, 0.004471 and 0.000001 respectively which showed these data are not normally distributed.

In addition, bank profitability has the highest value among the other remaining variables which is 2818054.0. Hence, bank profitability has the highest maximum

value. Next, the table also showed cost efficiency has the lowest value over the five variables which is 0.340000.

4.2.3 Public Bank

Table 4.3

Empirical result of Descriptive Statistic of Public Bank

	NPLs	BP	BS	CE	IR	UR
Mean	0.680556	992303.2	261275223.7	0.442222	3.020833	3.208889
Median	0.700000	971755.5	271428151	0.430000	3.000000	3.190000
Maximum	1.300000	1633522.	331786540	0.790000	3.250000	3.600000
Minimum	0.500000	594683.0	178808390	0.310000	2.250000	2.740000
Std.Dev.	0.201167	220592.3	50562215	0.095502	0.218559	0.204140
Skewness	1.038945	0.815963	-0.312418	1.557402	-1.461850	-0.256574
Kurtosis	3.664033	2.595064	1.632607	6.666500	6.093545	2.474553
Jarque-Bera	13.28639	4.240730	3.441021	10.82027	27.17707	0.809123
Probability	0.001303	0.119988	0.178975	0.004471	0.000001	0.667269
Observation	36	36	36	36	36	36

The table above indicates that the average value of NPLs in Public Bank is 0.680556% with the standard deviation of 0.201167%. Besides, bank profitability has the mean value of RM992303200 million and the standard deviation of RM220592.3%. For the next variables, bank size and cost efficiency have the mean value of RM261275223680 and 0.442222% respectively with the standard

deviation of 50562215% and 0.095502% respectively. Moreover, the average value of interest value is 3.020833% and the standard deviation is 0.218550%. Lastly, unemployment rate has the 3.208889% of mean and 0.204140% of the standard deviation. From the table showed the skewness value of five variables are 1.038945, 0.751492, -0.312418, 1.557402, -1.461850 and -0.256574 respectively. It indicated bank size, interest rate and unemployment rate are negative skewed since these data are smaller than 0 while the NPLs, bank profitability and cost efficient are positive skewed as the skewness value greater than 0.

According to the results, the kurtosis value of NPLs, bank profitability, cost efficiency and interest rate are 3.664033, 3.720775, 6.666500 and 6.093545 respectively which show that it is a Leptokurtic distribution. Besides, the kurtosis value of bank size and unemployment rate are 1.632607 and 2.474553 respectively which are smaller than 3 and classified as Platykurtic distribution.

Moreover, NPLs, bank profitability, bank size and unemployment rate have the p-value of 0.028186, 0.124449, 0.183574 and 0.667269 which greater than the significance levels and considered as normally distributed. Next, the p-value for the cost efficiency and interest rate are 0.000000 and 0.000001 respectively which showed that these data are not normally distribution.

Last but not least, bank profitability has the highest value of 1633562.0 among the other five variables, so bank profitability has the highest maximum. On the other side, cost efficiency has the lowest value among the other five variables which is 0.310000, it mean that cost efficient has the lowest minimum.

4.3 Interpretation of Result

Overall, NPLs of each bank showed a significant relationship with the variables in this research.

4.3.1 Unit Root Test

Table 4.4

ADF Test Results for Unit Roots

	CIMB Bank	**Maybank**	**Public Bank**
Variables	P-Value	P-Value	P-Value
NPLs	0.0185	0.1642	0.6084
Bank Profitability	0.0000	0.0012	0.0034
Bank Size	0.4947	0.1080	0.2415
Cost Efficiency	0.0000	0.0109	0.0001
Interest Rate	0.0015	0.0015	0.0015
Unemployment Rate	0.1771	0.1771	0.1771

Table 4.5

Co-integration Test Results

	CIMB Bank	**Maybank**	**Public Bank**
Hypothesized No. of CE(s)	P-Value	P-Value	P-Value
None	0.0000	0.0000	0.0000
At most 1	0.0006	0.0017	0.0000
At most 2	0.0020	0.0439	0.0021
At most 3	0.0062	0.0602	0.0240
At most 4	0.0382	0.0886	0.0602
At most 5	0.0844	0.0151	0.1191

Based on Table 4.5, the NPLs of CIMB Banks can be conclude as I(0) and the NPLs of Maybank and Public Bank can be conclude as I(1), since their P-value is more than the significance level at 5%. Moreover, all studied banks' profitability, cost efficiency and interest rate can be conclude as I(0), since the P-value is lower than the significance level 5%. However, the bank size and unemployment rate are concluded as I(1), as their P-value is more than the significance level at 5%.

As the result shown, there are some variables are I(1), so Johansen Cointegration test is required to carry out. Table 4.5 showed the result of Johansen Cointegration test of 3 banks, and the result showed that the analysis can still continue to run, since P-value are less than 5% significance level.

4.3.2 Impulse Response Function (IRFs)

4.3.2.1 CIMB Bank

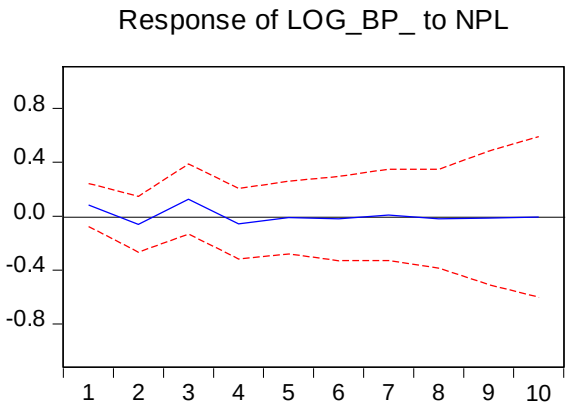

Figure 4.1 Response to Log (BP) to NPLs

According to the Figure 4.1, the response of bank profitability is significant to the NPLs of CIMB Bank. In the 1st quarter, the response of bank profitability to NPLs is depreciating from the starting point of 0.08, which mean that the positive relationship between bank profitability and NPLs of CIMB Bank become not obvious in this period. However, there is a clear appreciation shown in 2nd quarter, but following by a depreciation in the 3rd quarter. After that, the following quarters have a result that remain around the equilibrium level, which can conclude that the bank profitability of CIMB Bank are not effecting the NPLs of CIMB Bank in these periods. However, the positive relationship shown in Figure 4.1 is supported by Kawshala, H & Panditharathna (2017), which stated the increment of bank profit will lead to financial stability.

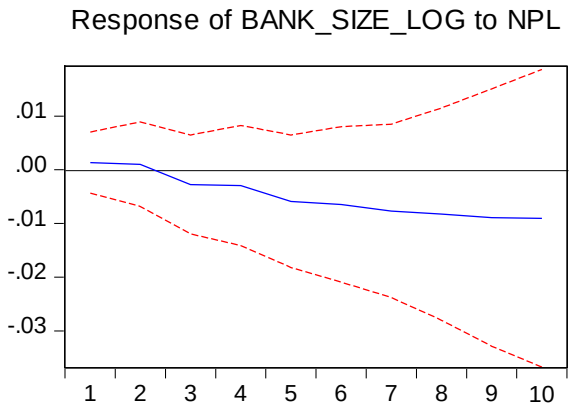

Figure 4.2 Response of Log(BS) to NPLs

Besides that, as the Figure 4.2 shown, the response of bank size of CIMB Bank to NPLs of CIMB Bank is maintain at slightly above of the equilibrium level in the 1st quarter. However, there is a very clear depreciation shown in the following quarters. Hence, there is a significant and negative relationship between bank size and NPLs of CIMB Bank which similar as the research by Awour, F (2015).

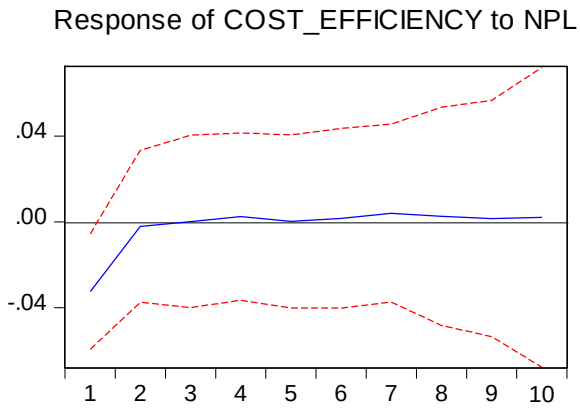

Figure 4.3 Response of Cost Efficiency to NPLs

Moreover, based on Figure 4.3, the response of CIMB Bank's cost efficiency to bank's NPLs appreciate rapidly from 1st quarter to 2nd quarter. However, from 2nd quarter to 6th quarter, the results remain around the equilibrium level. At the 6th quarter, the response of cost efficiency to NPLs of CIMB Bank experienced a slightly appreciation, but then rebound back to the equilibrium level at the

following quarters. Based on the Figure 4.3, the result gained is same as Karim et al. (2010) which also proved that there is significant negative relationship between non-performing loans and cost efficiency

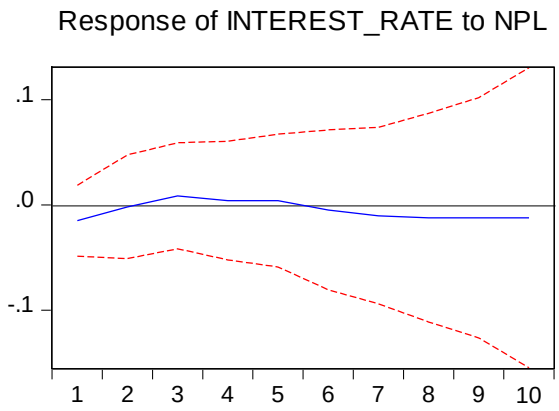

Figure 4.4 Response of Interest Rate to NPLs

Next, the relationship between interest rate and NPLs of CIMB Bank is also significant. Refer to Figure 4.4, it shows that the response of interest rate to NPLs appreciate from negative response to positive response from 1st quarter to 3rd quarter. However, the response of interest rate rebound to negative relationship which supported by Murthy U et al. (2017), and then maintain at the negative level after the 7th quarter.

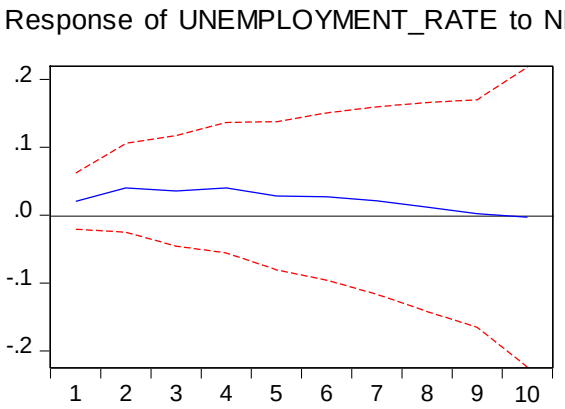

Figure 4.5 Response of Unemployment Rate to NPLs

Last but not least, the response of unemployment rate to NPLs of CIMB Bank is positive and appreciate in the 1st quarter. After that, it maintain the positive relationship from the 2nd quarter to the 4th quarter. Then, in the following quarters the response of unemployment rate to NPLs of CIMB Bank experience a steady depreciation until it reach the equilibrium level. However, there is also a positive relationship between unemployment rates to NPLs as stated by Clichici, D. (2014).

4.3.2.2 Maybank

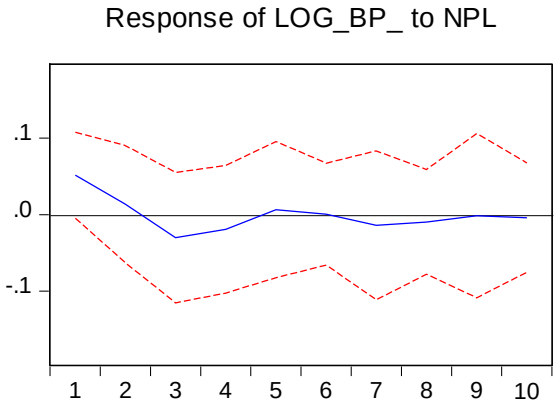

Figure 4.6 Response of Log(BP) to NPLs

Based on the Figure 4.6, there showed a signficant relationship between the bank profitability and NPLs of Maybank. At first, the response of bank profitability to NPLs experiencing deprecition from starting point 0.05, which is a positive relationship to negative relationship around 0.03. However, at 3rd quarter, it appreciate steadily which reinstate the relationship become positive at the 5th quarter. In the folowing quarters, the response of bank profitability to NPLs of Maybank depreciate and then rebound at the 7th quarter. Lastly, it remain at slightly above of the equilibrium level which same review fron the study of Kawshala, H & Panditharathna, K. (2017)

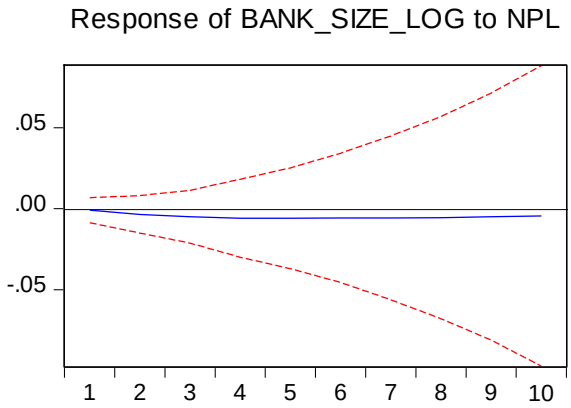

Figure 4.7 Response of Log(BS) to NPLs

As Figure 4.7 shown, in the 1st quarter, the response of bank size to NPLs of Maybank slightly depreciate from equilibrium level to negative level. After that, from the 4th quarter, the response of bank size to NPLs remain at the negative level until the 10th quarter. Hence, there is a signifcant negative relationship between bank size and NPLs of Maybank (Makri, V et al., 2014).

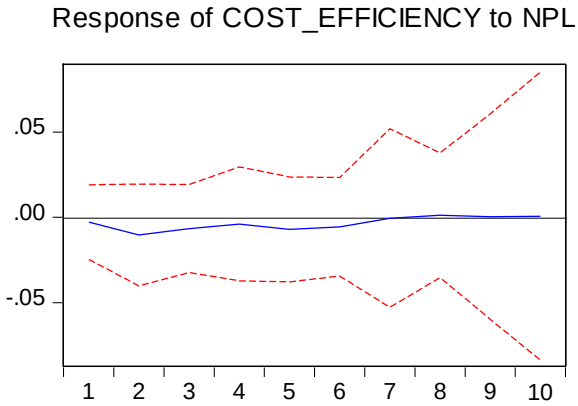

Figure 4.8 Response of Cost Efficiency to NPLs

In Figure 4.8, it indicate that cost efficiency of Maybank has a significant relationship to NPLs of Maybank (Hien Thu Phan et al., n.d). The response of cost efficiency to NPLs of Maybank experiencing depreciatiation in the 1st quarter. However, it appreciate steadily until the equilibrium level from 2nd quarter to 7th quarter and then remain.

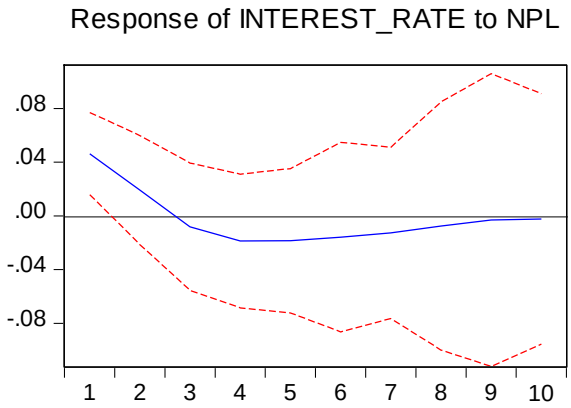

Figure 4.9 Response of Interest Rate to NPLs

At the 1st quarter to 4th quarter, the response of interest rate to NPLs of Maybank experience a radical depreciation which indicate the relationship between interest rate and NPLs of Maybank change from positive to negative relationship. Nevertheless, in the following quarters, it appreciate steadily and remain slightly below the equilibrium level. Hence. There is a negative relationship which similar as the example provided by Johannes (2004).

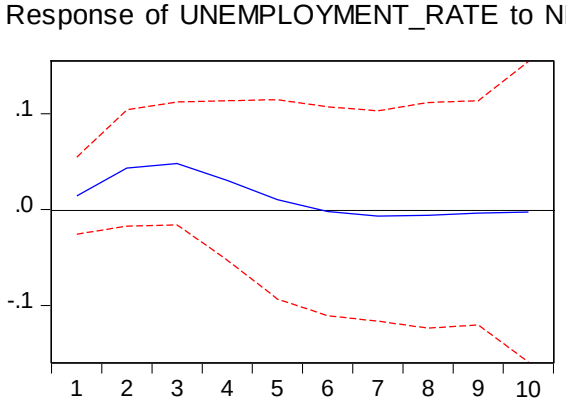

Figure 4.10 Response of Unemployment Rate to NPLs

Refer to Figure 4.10, it shows there is a significant relationship between unemployment rate and NPLs. Besides, it also indicate that the response of unemployment rate to NPLs of Maybank rose steadily from the 1st quarter to 3rd quarter. Yet, the response rebound to negative level from the 3rd quarter to 7 quarter. Then, it experience a slightly increase but still negative relationship

between unemployment rate and NPLs of Maybank. In overall, the relationship between unemployment rate and NPLs is still positive (Lazea, R., & Iuga, I, 2012)

4.3.2.3 Public Bank

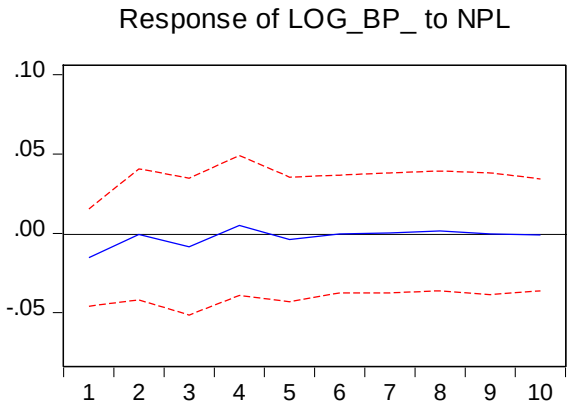

Figure 4.11 Response of Log(BP) to NPLs

In Figure 4.11, it shows that the relationship between Public Bank's profitability and Public Bank's NPLs is significant. Moreover, in the 1st quarter, the response bank profitability to NPLs increase from point of -0.020 to the equilibrium level. However, it reinstate back to negative level in 2nd quarter, but then following by a appreciation in 3rd quarter. After that, in the 4th quarter, the response of bank profitability to NPLs decrease and then remain at the equilibrium level in the following quarters. As stated in Morshedur, M et al. (2015), the result from Figure 4.11 also showing a positive relationship between bank profitability and NPLs.

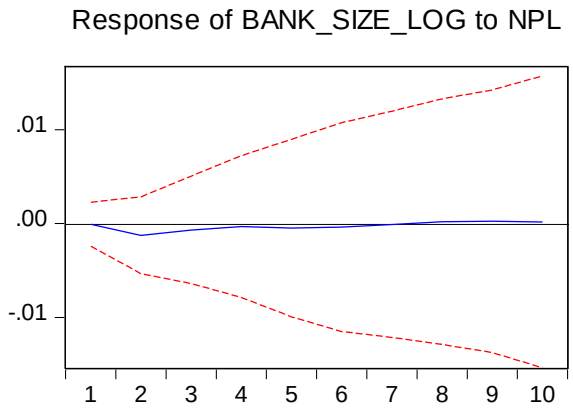

Figure 4.12 Response of Log(BS) to NPLs

Refer to the Figure 4.12, it can conclude that there is a significant relationship between bank size of Public Bank and NPLs of Public Bank. In the 1st quarter, the response of bank size to NPLs depreciate to negative level. However, in the 2nd quarter, it rebound back to the equilibrium level and then maintain in the following quarters. Hence, it conclude that the bank size not effect the NPLs of Public Bank in these periods. Yet, overall observation in Figure 4.12 show that there is a negative relationship which supported by Khalil, R., & Khalil, M. A. (2017).

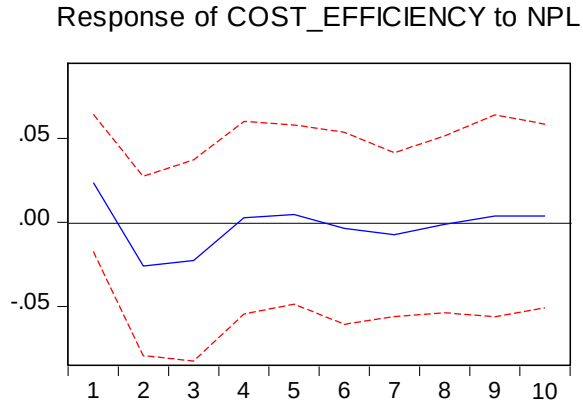

Figure 4.13 Response of Cost Efficiency to NPLs

As shown in Figure 4.13, the response of cost efficiency to NPLs has a significant depreciation from a positive relationship between cost efficiency and NPLs to

negative relationship in the first quarter. However, in the 2nd quarter, the response of cost efficiency slightly increase and then sudden appreciate to positive level in 3rd quarter. Yet, in the 5th quarter, it decrease back to negative level, but then the response of cost efficiency to NPLs of Public Bank rebound back to positive level in the following quarters. The result shown in Figure 4.13 had different with other banks, which also does not supported by previous researchers.

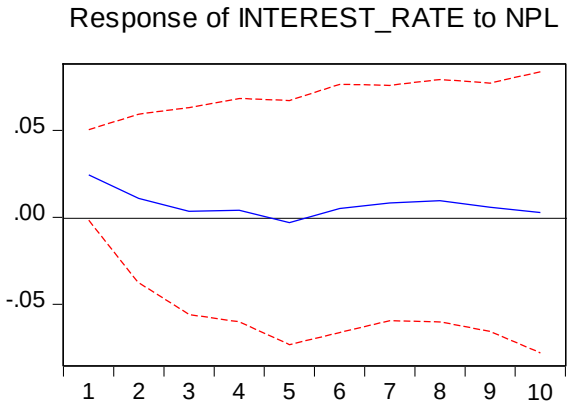

Figure 4.14 Response of Interest Rate to NPLs

Based on Figure 4.14, the response of interest rate to NPLs of Public Bank depreciate steadily from the 1st quarter to 5th quarter. However, in the 5th quarter to 8th quarter, the response rebound back to positive level, but then slightly decrease in he following quarters. Hence, it shows that there is a positive and significant relationship between the interest rate and NPLs (Sheefeni, 2016) of Public Bank.

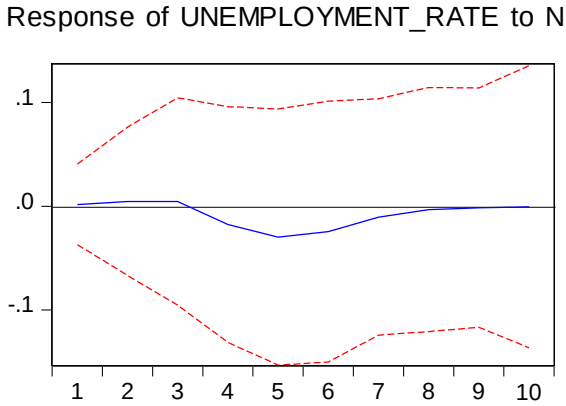

Figure 4.15 Response of Unemployment rate to NPLs

Lastly, the Figure 4.15 shows that there a significant relationship between unemployment rate with NPLs of Public Bank. Figure 4.15 also shows that the response of unemployment rate to NPLs of Public Bank is experiencing a slightly appreciation from the 1st quarter to the 3rd quarter. Then, in 3rd quarter, it shows a radical depreciation of the response and also negative relationship between unemployment rate and NPLs (Kasseh, P. A., 2018) of Public Bank. However, the response rebound back to equilibrium level in the 5th quarter and then remain equilibrium from the 9th quarter.

4.3.2.4 Comparison between CIMB Bank, Maybank and Public Bank

For the bank's profitability part, Maybank show that it has more sensitivity toward bank's profitability than CIMB Bank and Public Bank as the response of NPLs of Maybank toward bank's profitability is more dynamic. This is because Maybank have lower restriction in lending process. Moreover, only CIMB Bank show that bank size has obviously affect the NPLs, since CIMB Bank have the smallest bank size between studied bank which cause lesser bargaining power in lending process. However, Maybank and Public Bank show that their bank size only slightly affect their NPLs, and the Maybank's NPLs are slightly more sensitive towards the bank size by comparing between Maybank and Public Bank. Furthermore, as mentioned above, Public Bank's NPLs can be conclude as the most sensitive towards its cost efficiency following by Maybank and then CIMB Bank. Yet, Public Bank's NPLs has a positive relationship towards cost efficiency, but there are negative relationship in Maybank and CIMB Bank. This can be conclude as Public Bank have more focus on their management on lending activities rather than other profitable activities. Next, the Figure 4.9 showed that NPLs of Maybank has high sensitivity towards the interest rate as it have the

largest bank size among the studied banks, which increase the impact of interest rate. However, as Figure 4.4 and Figure 4.14 shown, CIMB Bank's and Public Bank's NPLs have a very less sensitivity towards interest rate by comparing it with NPLs of Maybank. As mentioned above, bank size of CIMB Bank is lesser than Public Bank and Maybank, hence CIMB Bank have lesser lending capacity, so the impact of interest rate toward its NPLs is lesser. Last but not least, the sensitivity of NPLs towards unemployment rate of 3 banks are almost same, but Maybank's NPLs is slightly more sensitive than other banks. However, Public Bank's NPLs have different relationship towards unemployment with Maybank and CIMB Bank, since it is negative relationship and the others is positive relationship. This is cause by a better quality of management of lending process by Public Bank, which have higher restriction to lend out money when unemployment rate is high.

4.4 Diagnostic Checking

A sum of three diagnostic checking will be carry out. Following are the results from EViews program.

Table 4.6

Empirical result of Autocorrelation, Heteroscedasticity and Normality Test

	Auto-correlation Test		**Heteroscedasticity Test**			**Normality Test**	
	P-value	Significant level	P-value	Chi-square	Significant Level	P-value	Significant level
CIMB Bank	0.0151	0.05	0.5224	501.553	0.05	0.0014	0.05

Maybank	0.1454	0.05	0.3843	512.729	0.05	0.0013	0.05
Public Bank	0.6169	0.05	0.3967	511.691	0.05	0	0.05

4.4.1 Testing of Auto-correlation

Based on the table 4.5 above had shown that there is autocorrelation for CIMB Bank because the p-value (0.0151) is lesser than the significant level (0.05). On the other side, there is no autocorrelation for Maybank because the p-value (0.1454) is larger than the significant level (0.05). On the other side, Public Bank had a same situation with Maybank which is no autocorrelation because the p-value (0.6169) is larger than significant level (0.05).

4.4.2 Testing of Heteroscedasticity

According to table 4.5, the null hypothesis will be rejected if p-value is less than 0.05 significant level. The p-value (0.5224) is higher than the significant level of 5% for CIMB Bank. Therefore, there is insufficient evidence to conclude that there is a heteroscedasticity problem. Meanwhile for Maybank, the p-value (0.3843) is greater than the significant level of 5%. Hence, there is no heteroscedasticity problem. Besides the CIMB Bank and Maybank, Public Bank also has a greater p-value of 0.3967 compared to the 5% significant level. Hence, there is insufficient evidence to conclude that there is a heteroscedasticity problem in the model at 5% significant level.

4.4.3 Testing of Normality

The above table 4.4 shows the null hypothesis should be rejected if p-value is less than significant level of 0.5. The p-value (0.4796) is higher than significant level of 5% for CIMB Bank. Hence, there is sufficient evidence to conclude that the error terms in this regression model are normally distributed. For Maybank, null hypothesis is rejected as the p-value (0.0257) is lesser than significant level of 5%. Therefore, there is insufficient evidence to conclude that the error terms in this regression model are normally distributed. As for Public Bank, the null hypothesis is being rejected as well since the p-value (0.0000) is smaller than significant level of 5%. Hence, there is insufficient evidence to conclude that the error terms in this regression model are normally distributed.

4.5 Conclusion

In summary, among this part, most of the thesis checking and diagnosis screening was conducted entirely. The regression model, according to findings created from the EViews system, also included meaningful and important independent indicators including bank profitability, bank size, cost efficiency, cost efficiency, interest rate and unemployment rate to explain NPLs.

CHAPTER 5: DISCUSION, CONCLUSION AND POLICY IMPLICATION

5.1 Overview

This section explains the analytical results in the fourth chapter, and will address key findings. Additionally, this chapter also include implications of policy, drawback of this research and suggestions provided for future studies. At the last section of the whole segment, it will be the conclusion for the entire study. After running some series of test, the result are stated as below:

- Negative relationship between NPLs and bank profitability
- Negative relationship between NPLs and bank size
- Negative relationship between NPLs and cost efficiency
- Positive relationship between NPLs and unemployment rate
- Positive relationship between NPLs and interest rate.

5.2 Discussion of Major Finding

Table 5.1

Summary of Regression Model

Variables	Sign	Significant/Not Significant	Sign	Significant/Not Significant	Sign	Significant/Not Significant
The Relationship Between NPLs and Bank Size	-	**Significant**	-	**Significant**	-	**Significant**
The Relationship Between NPLs and Bank Profitability	+	**Significant**	+	**Significant**	+	**Significant**
The Relationship Between NPLs and Cost Efficiency	-	**Significant**	-	**Significant**	+	**Significant**
The Relationship Between NPLs and Interest Rate	+	**Significant**	+	**Significant**	+	**Significant**
The Relationship Between NPLs and Unemployment Rate	+	**Significant**	+	**Significant**	-	**Significant**

According to the Table 5.2, the Eviews' result shown that all the variables that investigated in this paper are significant with NPLs. Moreover, most of the results are similar with the expected signs of variables which mentioned in Chapter 2, except for the relationship between NPLs and bank profitability.

For bank size, it have negative relationship with NPLs of 3 investigated banks in this research. Larger bank size will increase the difficulty for bank to manage their asset. Hence, there are a high chance that bank fall into dilemma and cause bank's NPLs increase due to improper asset management (Sadaqat et al., 2011).According to the research, CIMB Bank had a high sensitivity on NPLs towards bank size compare with Maybank and Public Bank while by comparing between Maybank and Public Bank, Maybank's NPLs is more sensitive to bank size but not as sensitive as CIMB Bank.

Secondly, as for bank profitability, the result indicate a significant positive relationship with NPLs of all investigated banks, which is different with the expected sign of major finding by previous researchers. Due to unexpected result that different with previous researchers, hence it can suspended as the bank had focus on other profitable activities and ignore management in NPLs. So, NPLs will be increase when bank's profitability increase. In addition, based on this research, by comparing with CIMB Bank, Maybank and Public Bank, Maybank Bank is more sensitive to NPLs towards bank profitability.

Besides that, for CIMB Bank and Maybank, there is a negative relationship between cost efficiency and non-performing loan, which means a rise in cost efficiency will lead a decrease in non-performing loan. But for public bank, there is a positive relationship between cost efficiency and non-performing loan, might due to inflation problem, which will lead to increase in cost efficiency and rise in non-performing loan. Moreover, the result of this research had conclude that. Public Bank is more sensitive to NPLs towards cost efficiency by comparing with Maybank and CIMB Bank.

Next, based on the research of Bredl (2018), he found that there are roughly positive relationship between interest rate and NPLs as the actual results in this research. As result, high interest rate will cause a rise in NPLs as when the interest rate increase, bank may not restrict their lending activities. This is due to the higher risk that bank

obtained, the higher return will the bank gain. However, higher interest rate will reduce the repayment ability of bank's debtors. Hence, when interest rate increase and bank does not restrict their lending activities, the debtors unable to pay for the repayment, then the bank's NPLs increase. Moreover, the research had conclude that CIMB Bank and Public Bank is less sensitive on NPLs towards interest rate while there is high sensitivity for NPLs of Maybank towards interest rate.

Last but not least, for CIMB Bank and Maybank, when a rise in unemployment rate will cause the bank's NPLs also increase. As stated in research of Kurumi and Bushpepa (2017), appreciation in unemployment rate will lead to reduction of debtors' repayment ability, since unemployment will increase the difficulties for debtors to pay their debts. However, for Public bank, the increase of unemployment rate will lead to decrease of NPLs. Refer to I. Mazreku et al., (2018), bank's performance play a very important role to control NPLs when unemployment rate increase. Public bank have a negative relationship between unemployment rate and their NPLs, because of their performance in asset management, which cause increase of NPLs in the condition of depreciation of unemployment rate. On the other side, the sensitivity of NPLs towards unemployment rate between Maybank, CIMB Bank and Public Bank are almost same. There is only Maybank is slightly sensitive by comparing with other bank.

5.3 Implications of Study

This paper is to examine the determinants of Non- performing loans (NPLs) in Malaysia. The targeted bank in this paper are the three largest bank in Malaysia which is Maybank, CIMB Bank and Public Bank. Five determinant that used to examine the NPLs in Malaysia are bank size, bank profitability, cost efficiency, interest rate and

unemployment. The aim of this implications of studies is to enable other parties or researcher to further understand how the determinants affect the NPLs and how will it affect the bank performance. Yet, several unpredictable factors could also greatly affect the level of NPLs in Malaysia financial system. For instance, the unpredictable factors consist of government policies, credit score and etc.

In this research, the relationship between bank size and NPLs are found to be significantly negative. The relationship shows that NPLs tend to be higher as the bank size increase. Decision maker of CIMB Bank and Maybank could refer the result of this research as their references or advice and make comparison with Public Bank as Public Bank as the top 3 largest bank in Malaysia manage to control its NPLs at optimal level. Bank's decision maker could link cost efficiency when searching for advancement or improvement because larger bank size usually having difficulties in management problem. A good management system should be able to have better control on NPLs level. Based on the NPLs date collected, Public Bank has few times lower NPLs level compare to CIMB Bank and Maybank indicate that Public Bank are doing extremely well in controlling their NPLs.

Besides that, unemployment rate had been found to have negative relationship with NPLs as well. Unemployment rate usually increase due to bad economic performance. When economic turns bad, inflation rate increase, lower purchasing power, and increase in interest rate lead to loan borrower unable to pay their loan on time which lead to high bankruptcy possibility and higher NPLs. Currently decision on loan approval are made based on the Central Credit Information Report (CCRIS) of the borrower. Through CCRIS, bank can have a deeper understanding on borrower ability to repay the loan, thus, bankers able to make a better decision. Bank should consider levelling up the borrower requirement when it comes to loan approval during economic downturns in order to reduce possibilities of default loans.

Throughout this research, reader could understand the relationship between the determinant and NPLs and it clearly explain the nature of NPLs. Rise in NPLs indicate that bank may have a poor performance in either weak management, poor credit risk management or both, which will cause a decrease in bank profitability and bank liquidity. When the bank NPLs level increase, it results in bank having a lower bank liquidity which means bank having lesser fund available to make new lending. At the same time, bank needs to provision for NPLs which result in lower bank profitability. This will greatly affect the decision for allocation of fund due to NPLs provision.

As a conclusion, there are still a lot of improvement can be made in banking sector to have a improved control on NPLs. Improvement and evolving takes time but in some cases, banking system are difficult to change due to government intervention, some policy implication due to government intervention in the financial system has causes financial repression which could discourage savings and investment among Malaysian citizen. Therefore, having a good coordination in policies is important in the process of improving the policies implication.

5.4 Limitation of study

After working through this study for the past few months, there were a few limitations encountered in the study. Firstly, this study only focused on credit risk. There are some others major bank risks other than credit risk for example liquidity risk and operational risk. The bank can cause failure when it is overexposure to any of the major risk yet affect millions of people. However, government can have a stake in setting better regulations and restrictions by understanding the risks constituted to the bank.

In addition, the dependent variable, NPLs is not only affected by the chosen independent variables. In fact, there are some other macroeconomic variables not included in this paper such as gross domestic product (GDP). The reason why GDP is not involved in this study is because of the test result obtained is insignificant when GDP is included in the test. The test result became not reliable and precisely when it show insignificant. In order to get a perfect result, some of the variables are excluded but they have their built-in relationship.

Last but not least, another problem encountered in this paper is the data collection problem. In this research, time series data was conducted with a sample of 36 observation for each variables from year 2010 to 2018. However, it is considered as a small sample size, the credibility of the result might be judged as the test normally needed a larger sample size in order to raise the credibility of the result.

5.5 Recommendation

The recommendation part is important and useful for the researches as it provide suggestions and generate ideas for future researches. It also can prevent the same problems that mentioned in the limitations repeat by the researches in the future time. Furthermore, some recommendation are provide for future searches who are intended in doing this topic as it able to gather and carry out reliability research.

First of all, as mentioned in the limitations showed that other than credit risk will bring impact on NPLs, liquidity risk and operational risk also known as one of the factors that influence NPLs. Therefore, future researches can be conducted on bank's inner

variables such as lending requirement, lending policy and credit analysis. Besides, bank should improve the risk management and evaluate the ability and profile of the customers before loan out. Hence, it provide accurate and adequate data for future researcher who interested in conduct related topic.

Moreover, the future studies are recommended to increase some macroeconomic factors in the research such as inflation rate. The level of inflation rate will bring the impact on NPLs. When there is a rise in inflation rate, it will cause an increase in NPLs. For example, GDP is one of the factor that will cause the purchasing power of the consumers. Therefore, when the GDP economy decline, it will cause the rise of inflation rate and followed by increase in the level of NPLs.

In this study, total 36 observation from year 2010 to 2018 for each variables were employed. Researches will face trouble to generate the unreliable results due to the smaller sample size in this studies. Hence, it is important to have a larger sample size in the research. Therefore, researches are recommend to collect a weekly or daily data and find more data from reliable source to make the results become more precise and accurate.

5.6 Conclusion

Overall, this report analysed how the investigated variables such as bank profitability, bank size, cost efficiency, unemployment rate, and interest rate cause effects on the Non-Performing Loans in Maybank, Public Bank and CIMB Bank. This study used impulse response regression to make analysis on the data acquired from Maybank,

Public Bank, and CIMB Bank's financial reports and also Bank Negara Malaysia's official website. The Non-Performing Loans' data of three investigated bank is referred from year 2010 to year 2018 on quarterly basis. Therefore, there are sum of 36 sample sizes in this study. EViews software is useful for inferential statistics and analytical screening data analysis. The outcomes obtained demonstrate continuity with many other scholars ' hypotheses and observations. It is reasonable that this study has its drawbacks. However, based on the suggested suggestions, potential investigators may be able to further develop this report.

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APPENDICES

Appendix 4.1 Empirical Result of Descriptive Statistic for CIMB Bank

	NPL	BANK_PROF...	BANK_SIZE	CE	IR	UR
Mean	2.859167	1136579.	2.50E+08	0.547222	3.020833	3.208889
Median	2.230000	710717.0	2.48E+08	0.540000	3.000000	3.190000
Maximum	5.300000	3719697.	3.22E+08	0.720000	3.250000	3.600000
Minimum	1.800000	19106.00	1.61E+08	0.370000	2.250000	2.740000
Std. Dev.	1.041538	943301.3	56906776	0.068436	0.218559	0.204140
Skewness	0.847563	1.269578	-0.153902	0.278882	-1.461850	-0.256574
Kurtosis	2.410286	3.289732	1.465299	4.032333	6.093545	2.474553
Jarque-Bera	4.831828	9.796881	3.675073	2.065219	27.17707	0.809123
Probability	0.089286	0.007458	0.159209	0.356077	0.000001	0.667269
Sum	102.9300	40916861	8.99E+09	19.70000	108.7500	115.5200
Sum Sq. Dev.	37.96808	3.11E+13	1.13E+17	0.163922	1.671875	1.458556
Observations	36	36	36	36	36	36

Appendix 4.2 Empirical Result of Descriptive Statistic for Maybank

	NPL	BANK_PROF...	BANK_SIZE	CE	IR	UR
Mean	1.586111	1384352.	4.09E+08	0.437500	3.020833	3.208889
Median	1.485000	1153816.	4.20E+08	0.425000	3.000000	3.190000
Maximum	3.320000	2818054.	5.39E+08	0.640000	3.250000	3.600000
Minimum	0.900000	533018.0	2.47E+08	0.340000	2.250000	2.740000
Std. Dev.	0.574582	622730.6	91836825	0.060775	0.218559	0.204140
Skewness	1.297387	0.815963	-0.358724	1.027154	-1.461850	-0.256574
Kurtosis	4.457651	2.595064	1.770725	4.730124	6.093545	2.474553
Jarque-Bera	13.28639	4.240730	3.038776	10.82027	27.17707	0.809123
Probability	0.001303	0.119988	0.218846	0.004471	0.000001	0.667269
Sum	57.10000	49836671	1.47E+10	15.75000	108.7500	115.5200
Sum Sq. Dev.	11.55506	1.36E+13	2.95E+17	0.129275	1.671875	1.458556
Observations	36	36	36	36	36	36

Appendix 4.3 Empirical Result of Descriptive Statistic for Public Bank

	NPL	BANK_PROF...	BANK_SIZE	CE	IR	UR
Mean	0.680556	992303.2	2.61E+08	0.442222	3.020833	3.208889
Median	0.700000	971755.5	2.71E+08	0.430000	3.000000	3.190000
Maximum	1.300000	1633522.	3.32E+08	0.790000	3.250000	3.600000
Minimum	0.500000	594683.0	1.79E+08	0.310000	2.250000	2.740000
Std. Dev.	0.201167	220592.3	50562215	0.095502	0.218559	0.204140
Skewness	1.038945	0.751492	-0.312418	1.557402	-1.461850	-0.256574
Kurtosis	3.664033	3.720775	1.632607	6.666500	6.093545	2.474553
Jarque-Bera	7.137856	4.167715	3.390278	34.71785	27.17707	0.809123
Probability	0.028186	0.124449	0.183574	0.000000	0.000001	0.667269
Sum	24.50000	35722916	9.41E+09	15.92000	108.7500	115.5200
Sum Sq. Dev.	1.416389	1.70E+12	8.95E+16	0.319222	1.671875	1.458556
Observations	36	36	36	36	36	36

Appendix 4.4 Empirical Result of Vector Autoregression Estimation for CIMB Bank

Vector Autoregression Estimates
Date: 02/18/20 Time: 22:26
Sample (adjusted): 2010Q3 2018Q4
Included observations: 34 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	NPL	LOG_BP	LOG_BS	CE	IR	UR
NPL(-1)	0.785381	-1.000331	-0.002565	-0.089828	0.133017	0.106112
	(0.20564)	(0.56549)	(0.01742)	(0.08969)	(0.10612)	(0.12372)
	[3.81914]	[-1.76897]	[-0.14728]	[-1.00151]	[1.25340]	[0.85765]
NPL(-2)	0.192190	0.860274	-0.004015	0.169359	-0.044977	0.016302
	(0.22340)	(0.61431)	(0.01892)	(0.09744)	(0.11529)	(0.13441)
	[0.86031]	[1.40040]	[-0.21221]	[1.73815]	[-0.39014]	[0.12129]
LOG_BP (-1)	0.171412	-0.437133	0.011011	0.035821	-0.025640	0.040223
	(0.08517)	(0.23421)	(0.00721)	(0.03715)	(0.04395)	(0.05124)
	[2.01252]	[-1.86640]	[1.52650]	[0.96425]	[-0.58333]	[0.78494]
LOG_BP (-2)	0.191272	-0.041441	-0.001954	-0.003634	0.007709	-0.103385
	(0.08784)	(0.24153)	(0.00744)	(0.03831)	(0.04533)	(0.05285)
	[2.17762]	[-0.17157]	[-0.26262]	[-0.09486]	[0.17008]	[-1.95635]
LOG_BS (-1)	-4.114147	1.720850	0.644959	0.974930	-0.202835	1.659273
	(2.85044)	(7.83827)	(0.24140)	(1.24324)	(1.47101)	(1.71496)
	[-1.44334]	[0.21954]	[2.67172]	[0.78418]	[-0.13789]	[0.96753]
LOG_BS_(-2)	4.525843	-2.185461	0.288738	-0.119094	1.847885	-0.104022
	(2.50651)	(6.89253)	(0.21228)	(1.09324)	(1.29352)	(1.50804)
	[1.80563]	[-0.31708]	[1.36020]	[-0.10894]	[1.42857]	[-0.06898]
CE(-1)	0.028116	-3.135782	0.012193	-0.115177	0.250475	-0.159494
	(0.52551)	(1.44506)	(0.04450)	(0.22920)	(0.27119)	(0.31617)
	[0.05350]	[-2.17000]	[0.27398]	[-0.50251]	[0.92360]	[-0.50446]
CE(-2)	0.278144	-2.238912	0.035694	0.303853	0.029980	0.049426
	(0.53477)	(1.47052)	(0.04529)	(0.23324)	(0.27597)	(0.32174)
	[0.52012]	[-1.52253]	[0.78814]	[1.30273]	[0.10863]	[0.15362]
IR(-1)	0.193920	-0.803740	-0.008921	-0.201203	0.497149	0.137466
	(0.41349)	(1.13704)	(0.03502)	(0.18035)	(0.21339)	(0.24878)
	[0.46898]	[-0.70687]	[-0.25474]	[-1.11563]	[2.32979]	[0.55257]
IR(-2)	0.164798	-0.273491	0.008254	0.120023	-0.098344	-0.018771
	(0.36299)	(0.99818)	(0.03074)	(0.15832)	(0.18733)	(0.21839)
	[0.45399]	[-0.27399]	[0.26850]	[0.75809]	[-0.52498]	[-0.08595]
UR(-1)	0.160668	0.419285	-0.011748	0.022729	-0.094414	0.866017
	(0.33614)	(0.92433)	(0.02847)	(0.14661)	(0.17347)	(0.20224)
	[0.47798]	[0.45361]	[-0.41267]	[0.15503]	[-0.54427]	[4.28221]
UR(-2)	-0.276047	-0.383193	-0.011916	-0.166370	-0.291848	-0.310352
	(0.33730)	(0.92752)	(0.02857)	(0.14712)	(0.17407)	(0.20294)
	[-0.81840]	[-0.41314]	[-0.41713]	[-1.13087]	[-1.67663]	[-1.52931]
C	-6.476060	19.01393	0.584078	-6.459747	-10.99076	-11.90072
	(14.7486)	(40.5565)	(1.24906)	(6.43274)	(7.61122)	(8.87347)
	[-0.43910]	[0.46883]	[0.46762]	[-1.00420]	[-1.44402]	[-1.34116]
R-squared	0.980453	0.334538	0.988504	0.335872	0.821917	0.854407
Adj. R-squared	0.969283	-0.045725	0.981935	-0.043630	0.720155	0.771211
Sum sq. resids	0.506426	3.829423	0.003632	0.096340	0.134872	0.183315
S.E. equation	0.155292	0.427029	0.013152	0.067732	0.080140	0.093431
F-statistic	87.77715	0.879753	150.4783	0.885034	8.076859	10.26980
Log likelihood	23.27061	-11.12192	107.2086	51.48211	45.76252	40.54551
Akaike AIC	-0.604154	1.418937	-5.541680	-2.263654	-1.927207	-1.620324
Schwarz SC	-0.020545	2.002545	-4.958071	-1.680045	-1.343599	-1.036716
Mean dependent	2.718824	5.918981	8.395745	0.542647	3.058824	3.191765
S.D. dependent	0.886053	0.417588	0.097850	0.066301	0.151493	0.195331

Determinant resid covariance (dof adj.)	7.34E-14
Determinant resid covariance	4.08E-15
Log likelihood	273.8024
Akaike information criterion	-11.51779
Schwarz criterion	-8.016136
Number of coefficients	78

Appendix 4.5 Empirical Result of Vector Autoregression Estimation for Maybank

Vector Autoregression Estimates
Date: 02/18/20 Time: 22:36
Sample (adjusted): 2010Q3 2018Q4
Included observations: 34 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	NPL	LOG_BP_	LOG_BS_	CE	IR	UR
NPL(-1)	0.385910	0.006062	-0.002959	-0.014119	-0.008475	0.056104
	(0.16230)	(0.08589)	(0.00973)	(0.03001)	(0.04600)	(0.05071)
	[2.37781]	[0.07058]	[-0.30421]	[-0.47049]	[-0.18423]	[1.10641]
NPL(-2)	-0.005973	-0.024801	0.002380	-0.017779	-0.000484	0.006424
	(0.16011)	(0.08474)	(0.00960)	(0.02961)	(0.04538)	(0.05003)
	[-0.03730]	[-0.29267]	[0.24797]	[-0.60051]	[-0.01066]	[0.12841]
LOG_BP_(-1)	0.027846	-0.078486	0.010068	-0.062512	-0.048122	-0.185365
	(0.38829)	(0.20550)	(0.02327)	(0.07180)	(0.11005)	(0.12132)
	[0.07171]	[-0.38193]	[0.43262]	[-0.87067]	[-0.43727]	[-1.52793]
LOG_BP_(-2)	0.262869	-0.565881	-0.013616	0.084672	-0.118411	-0.012909
	(0.36635)	(0.19388)	(0.02196)	(0.06774)	(0.10383)	(0.11446)
	[0.71754]	[-2.91865]	[-0.62012]	[1.24995]	[-1.14042]	[-0.11278]
LOG BS (-1)	-2.373488	-3.556679	0.991903	0.189791	1.169244	-0.928049
	(5.03313)	(2.66373)	(0.30166)	(0.93067)	(1.42650)	(1.57256)
	[-0.47157]	[-1.33523]	[3.28818]	[0.20393]	[0.81966]	[-0.59015]
LOG BS (-2)	0.517057	4.516327	-0.011026	-0.286938	-0.436022	1.582310
	(4.97941)	(2.63530)	(0.29844)	(0.92073)	(1.41128)	(1.55578)
	[0.10384]	[1.71378]	[-0.03695]	[-0.31164]	[-0.30896]	[1.01705]
CE(-1)	-0.790470	-0.626876	0.031066	0.035774	-0.121824	-0.536093
	(1.25908)	(0.66636)	(0.07546)	(0.23281)	(0.35685)	(0.39339)
	[-0.62781]	[-0.94075]	[0.41167]	[0.15366]	[-0.34138]	[-1.36275]
CE(-2)	-0.203473	0.364369	0.017483	0.044423	-0.143156	0.575025
	(1.09237)	(0.57813)	(0.06547)	(0.20199)	(0.30960)	(0.34130)
	[-0.18627]	[0.63026]	[0.26704]	[0.21993]	[-0.46239]	[1.68479]
IR(-1)	0.736108	0.346482	-0.042327	-0.124375	0.552070	0.434893
	(0.83278)	(0.44074)	(0.04991)	(0.15399)	(0.23603)	(0.26020)
	[0.88392]	[0.78614]	[-0.84803]	[-0.80770]	[2.33900]	[1.67141]
IR(-2)	-1.607377	-0.031414	0.015992	-0.104266	-0.141211	-0.323171
	(0.64636)	(0.34208)	(0.03874)	(0.11952)	(0.18319)	(0.20195)
	[-2.48680]	[-0.09183]	[0.41280]	[-0.87239]	[-0.77083]	[-1.60024]
UR(-1)	1.238042	-0.330382	-0.013584	0.216140	0.006237	0.996843
	(0.65021)	(0.34412)	(0.03897)	(0.12023)	(0.18428)	(0.20315)
	[1.90406]	[-0.96009]	[-0.34858]	[1.79773]	[0.03384]	[4.90686]
UR(-2)	0.113298	0.155511	-0.006784	-0.258452	-0.197282	-0.363162
	(0.69430)	(0.36745)	(0.04161)	(0.12838)	(0.19678)	(0.21693)
	[0.16318]	[0.42322]	[-0.16302]	[-2.01314]	[-1.00255]	[-1.67410]
C	13.92982	1.564460	0.318866	1.979307	-2.749164	-3.700669
	(9.35703)	(4.95211)	(0.56081)	(1.73019)	(2.65199)	(2.92353)
	[1.48870]	[0.31592]	[0.56858]	[1.14398]	[-1.03664]	[-1.26582]
R-squared	0.832082	0.557231	0.977331	0.500269	0.799857	0.853698
Adj. R-squared	0.736129	0.304220	0.964377	0.214708	0.685490	0.770096
Sum sq. resids	1.886990	0.528535	0.006778	0.064518	0.151579	0.184208
S.E. equation	0.299761	0.158645	0.017966	0.055428	0.084959	0.093658
F-statistic	8.671741	2.202401	75.44746	1.751881	6.993755	10.21154
Log likelihood	0.909511	22.54420	96.60276	58.29794	43.77727	40.46291
Akaike AIC	0.711205	-0.561424	-4.917809	-2.664585	-1.810427	-1.615466
Schwarz SC	1.294814	0.022185	-4.334201	-2.080976	-1.226819	-1.031857
Mean dependent	1.608824	6.109512	8.611920	0.437059	3.058824	3.191765
S.D. dependent	0.583551	0.190192	0.095189	0.062548	0.151493	0.195331

Determinant resid covariance (dof adj.)	5.22E-14
Determinant resid covariance	2.90E-15
Log likelihood	279.6024
Akaike information criterion	-11.85897
Schwarz criterion	-8.357315
Number of coefficients	78

Appendix 4.6 Empirical Result of Vector Autoregression Estimation for Public Bank

Vector Autoregression Estimates
Date: 02/18/20 Time: 22:38
Sample (adjusted): 2010Q3 2018Q4
Included observations: 34 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	NPL	LOG BP	LOG BS	CE	IR	UR
NPL(-1)	0.225152	0.065033	-0.001526	-0.307221	0.022882	-0.067217
	(0.20496)	(0.20606)	(0.01263)	(0.22954)	(0.20412)	(0.22674)
	[1.09849]	[0.31560]	[-0.12074]	[-1.33843]	[0.11210]	[-0.29645]
NPL(-2)	0.256491	-0.097344	-0.000764	-0.318694	-0.089199	-0.184048
	(0.21563)	(0.21678)	(0.01329)	(0.24148)	(0.21473)	(0.23853)
	[1.18952]	[-0.44905]	[-0.05748]	[-1.31977]	[-0.41539]	[-0.77158]
LOG BP (-1)	0.017883	-0.249627	0.006616	0.470648	-0.038271	0.494367
	(0.26085)	(0.26224)	(0.01608)	(0.29212)	(0.25977)	(0.28857)
	[0.06856]	[-0.95189]	[0.41142]	[1.61112]	[-0.14732]	[1.71319]
LOG BP (-2)	-0.098707	-0.108789	-0.010251	0.290883	0.396144	0.322830
	(0.27774)	(0.27922)	(0.01712)	(0.31104)	(0.27659)	(0.30725)
	[-0.35539]	[-0.38961]	[-0.59875]	[0.93520]	[1.43222]	[1.05071]
LOG BS (-1)	-0.853516	1.685704	1.122151	-4.261326	-4.836332	-7.555032
	(4.22505)	(4.24759)	(0.26045)	(4.73159)	(4.20759)	(4.67393)
	[-0.20201]	[0.39686]	[4.30855]	[-0.90061]	[-1.14943]	[-1.61642]
LOG_BS_(-2)	0.283193	-0.524777	-0.143797	1.229739	4.896729	6.410367
	(3.84789)	(3.86842)	(0.23720)	(4.30921)	(3.83199)	(4.25671)
	[0.07360]	[-0.13566]	[-0.60623]	[0.28537]	[1.27785]	[1.50595]
CE(-1)	0.088170	-0.108370	-0.021227	-0.044618	-0.298993	-0.063118
	(0.20075)	(0.20182)	(0.01237)	(0.22482)	(0.19992)	(0.22208)
	[0.43921]	[-0.53696]	[-1.71535]	[-0.19846]	[-1.49557]	[-0.28422]
CE(-2)	-0.068344	-0.070034	0.004528	-0.254035	-0.048538	0.425066
	(0.19659)	(0.19764)	(0.01212)	(0.22016)	(0.19578)	(0.21748)
	[-0.34764]	[-0.35435]	[0.37366]	[-1.15385]	[-0.24792]	[1.95451]
IR(-1)	-0.292630	-0.295820	-0.016938	0.233053	0.627299	0.663466
	(0.21620)	(0.21735)	(0.01333)	(0.24212)	(0.21531)	(0.23917)
	[-1.35353]	[-1.36102]	[-1.27097]	[0.96256]	[2.91354]	[2.77406]
IR(-2)	-0.053193	0.026109	0.010294	0.329392	-0.061660	-0.274769
	(0.17447)	(0.17540)	(0.01076)	(0.19539)	(0.17375)	(0.19301)
	[-0.30488]	[0.14885]	[0.95710]	[1.68581]	[-0.35487]	[-1.42360]
UR(-1)	0.111625	0.090495	-0.000224	-0.161340	-0.141731	0.838672
	(0.17900)	(0.17995)	(0.01103)	(0.20046)	(0.17826)	(0.19802)
	[0.62361]	[0.50288]	[-0.02032]	[-0.80485]	[-0.79509]	[4.23538]
UR(-2)	-0.114394	-0.145749	-0.008547	0.301846	-0.087246	-0.177008
	(0.17223)	(0.17315)	(0.01062)	(0.19288)	(0.17152)	(0.19053)
	[-0.66419]	[-0.84176]	[-0.80508]	[1.56496]	[-0.50867]	[-0.92904]
C	6.668737	-0.525314	0.268121	19.79999	-0.339029	4.686660
	(5.83039)	(5.86149)	(0.35941)	(6.52939)	(5.80630)	(6.44983)
	[1.14379]	[-0.08962]	[0.74601]	[3.03244]	[-0.05839]	[0.72663]
R-squared	0.895475	0.450485	0.997674	0.454361	0.820089	0.866465
Adj. R-squared	0.835747	0.136477	0.996345	0.142567	0.717283	0.790159
Sum sq. resids	0.137389	0.138859	0.000522	0.172306	0.136256	0.168133
S.E. equation	0.080885	0.081316	0.004986	0.090582	0.080550	0.089478
F-statistic	14.99242	1.434629	750.6242	1.457248	7.977057	11.35518
Log likelihood	45.44820	45.26728	140.1853	41.59839	45.58898	42.01521
Akaike AIC	-1.908718	-1.898075	-7.481489	-1.682258	-1.916999	-1.706777
Schwarz SC	-1.325109	-1.314467	-6.897880	-1.098650	-1.333391	-1.123169
Mean dependent	0.667647	5.996467	8.417728	0.440588	3.058824	3.191765
S.D. dependent	0.199576	0.087506	0.082472	0.097823	0.151493	0.195331

Determinant resid covariance (dof adj.)	1.23E-16
Determinant resid covariance	6.85E-18
Log likelihood	382.4134
Akaike information criterion	-17.90667
Schwarz criterion	-14.40502
Number of coefficients	78

Appendix 4.7 Empirical Result of Unit Root Test for CIMB Bank

Null Hypothesis: Unit root (individual unit root process)
Series: NPL, LOG_BP_, LOG_BS_, CE, IR, UR
Date: 02/18/20 Time: 23:05
Sample: 2010Q1 2018Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 209
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	72.9541	0.0000
ADF - Choi Z-stat	-5.96655	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
NPL	0.0185	0	8	35
LOG_BP_	0.0000	0	8	35
LOG_BS_	0.4947	1	8	34
CE	0.0000	0	8	35
IR	0.0015	0	8	35
UR	0.1771	0	8	35

Appendix 4.8 Empirical Result of Unit Root Test for Maybank

Null Hypothesis: Unit root (individual unit root process)
Series: NPL, LOG_BP_, LOG_BS_, CE, IR, UR
Date: 02/18/20 Time: 23:41
Sample: 2010Q1 2018Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 210
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	47.0616	0.0000
ADF - Choi Z-stat	-4.67227	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
NPL	0.1642	0	8	35
LOG_BP_	0.0012	0	8	35
LOG_BS_	0.1080	0	8	35
CE	0.0109	0	8	35
IR	0.0015	0	8	35
UR	0.1771	0	8	35

Appendix 4.9 Empirical Result of Unit Root Test for Public Bank

Null Hypothesis: Unit root (individual unit root process)
Series: NPL, LOG_BP_, LOG_BS_, CE, IR, UR
Date: 02/18/20 Time: 23:49
Sample: 2010Q1 2018Q4
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Total number of observations: 208
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	50.0391	0.0000
ADF - Choi Z-stat	-4.38369	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
NPL	0.6084	2	8	33
LOG_BP_	0.0034	0	8	35
LOG_BS_	0.2415	0	8	35
CE	0.0001	0	8	35
IR	0.0015	0	8	35
UR	0.1771	0	8	35

Appendix 4.10 Empirical Result of Johansen Cointegration Test for CIMB Bank

Date: 02/18/20 Time: 23:33
Sample (adjusted): 2011Q2 2018Q4
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: NPL LOG BP LOG BS CE IR UR
Lags interval (in first differences): 4 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.744885	131.9099	95.75366	0.0000
At most 1 *	0.605537	89.56261	69.81889	0.0006
At most 2 *	0.534575	60.72548	47.85613	0.0020
At most 3 *	0.487916	37.01657	29.79707	0.0062
At most 4 *	0.348671	16.26932	15.49471	0.0382
At most 5	0.091606	2.978380	3.841466	0.0844

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.744885	42.34731	40.07757	0.0273
At most 1	0.605537	28.83713	33.87687	0.1775
At most 2	0.534575	23.70891	27.58434	0.1452
At most 3	0.487916	20.74725	21.13162	0.0565
At most 4	0.348671	13.29094	14.26460	0.0708
At most 5	0.091606	2.978380	3.841466	0.0844

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NPL	LOG BP	LOG BS	CE	IR	UR
0.790927	-1.496904	7.438184	9.693835	-2.972788	-1.262143
-0.336684	-1.650487	-3.756000	-19.22431	-3.781859	-4.430489
-2.420611	-2.643766	-32.63565	-11.66346	1.513668	5.551383
-2.920228	0.109830	-20.18704	-2.746925	-8.512208	2.969834
1.959168	-0.931910	32.72873	-2.043274	-2.764034	-2.735837
-3.350643	-0.860403	-24.72447	-4.085737	0.798172	-1.594517

Unrestricted Adjustment Coefficients (alpha):

D(NPL)	-0.068957	-0.013440	0.001400	0.031720	0.027470	0.017604
D(LOG BP)	0.235606	0.069530	0.237574	-0.021291	0.143838	0.022049
D(LOG BS)	-0.000771	0.002864	-0.002136	-0.000142	-0.004271	0.002487
D(CE)	-0.047733	0.034478	0.000922	-0.001323	-0.013193	-0.004495
D(IR)	0.031417	0.032087	-0.028240	0.021810	0.016827	0.006407
D(UR)	-0.021520	0.011905	-0.030210	-0.052909	0.011938	0.012281

1 Cointegrating Equation(s): Log likelihood 220.7923

Normalized cointegrating coefficients (standard error in parentheses)

NPL	LOG BP	LOG BS	CE	IR	UR
1.000000	-1.892594	9.404388	12.25630	-3.758613	-1.595777
	(0.53828)	(3.08259)	(3.47888)	(1.55342)	(1.14820)

Adjustment coefficients (standard error in parentheses)

D(NPL)	-0.054540
	(0.01611)
D(LOG BP)	0.186347
	(0.07341)
D(LOG BS)	-0.000610
	(0.00197)
D(CE)	-0.037753
	(0.00971)
D(IR)	0.024848
	(0.01252)
D(UR)	-0.017021
	(0.01640)

Appendix 4.11 Empirical Result of Johansen Cointegration Test for Maybank

Date: 02/18/20 Time: 23:46
Sample (adjusted): 2011Q2 2018Q4
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: NPL LOG_BP_ LOG_BS_ CE IR UR
Lags interval (in first differences): 4 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.834442	141.2744	95.75366	0.0000
At most 1 *	0.697602	85.52284	69.81889	0.0017
At most 2 *	0.464471	48.44647	47.85613	0.0439
At most 3	0.389310	29.08695	29.79707	0.0602
At most 4	0.224802	13.79884	15.49471	0.0886
At most 5 *	0.173444	5.905112	3.841466	0.0151

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.834442	55.75154	40.07757	0.0004
At most 1 *	0.697602	37.07637	33.87687	0.0200
At most 2	0.464471	19.35952	27.58434	0.3872
At most 3	0.389310	15.28812	21.13162	0.2692
At most 4	0.224802	7.893723	14.26460	0.3896
At most 5 *	0.173444	5.905112	3.841466	0.0151

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NPL	LOG_BP_	LOG_BS_	CE	IR	UR
-1.202570	-4.446705	-2.341520	-19.64765	-4.021022	2.429118
2.325966	3.492794	11.04826	7.252978	-6.774854	-4.639032
-2.054791	4.568819	-13.88550	-4.561214	-3.557992	5.715556
-0.062907	-1.292865	12.25935	16.13018	-5.508384	0.165021
1.225291	-0.461862	3.364351	-1.313594	1.368654	3.263913
0.878857	-0.791832	-14.57524	7.373232	4.094720	1.520327

Unrestricted Adjustment Coefficients (alpha):

D(NPL)	-0.071109	-0.076001	0.031539	0.049797	-0.023951	-0.050376
D(LOG_BP_)	0.088346	-0.074442	-0.094459	0.050896	-0.006020	0.004592
D(LOG_BS_)	0.001396	0.002672	0.003987	0.001494	-0.005432	0.003029
D(CE)	0.022594	0.003625	0.003109	-0.029806	-0.007554	-0.009811
D(IR)	0.015918	0.038173	-0.020195	0.026062	-0.013161	-0.013045
D(UR)	-0.036948	-0.003994	-0.046268	-0.029443	-0.018875	-0.000364

1 Cointegrating Equation(s): Log likelihood 233.0714

Normalized cointegrating coefficients (standard error in parentheses)

NPL	LOG_BP_	LOG_BS_	CE	IR	UR
1.000000	3.697670	1.947097	16.33805	3.343692	-2.019940
	(0.57135)	(1.76938)	(1.82701)	(0.85797)	(0.50491)

Adjustment coefficients (standard error in parentheses)

D(NPL)	0.085514
	(0.04690)
D(LOG_BP_)	-0.106242
	(0.04734)
D(LOG_BS_)	-0.001679
	(0.00384)
D(CE)	-0.027171
	(0.01425)
D(IR)	-0.019142
	(0.02024)
D(UR)	0.044432
	(0.02341)

Appendix 4.12 Empirical Result of Johansen Cointegration Test for Public Bank

Date: 02/18/20 Time: 23:52
Sample (adjusted): 2011Q2 2018Q4
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: NPL LOG_BP_ LOG_BS_ CE IR UR
Lags interval (in first differences): 4 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.894902	177.6807	95.75366	0.0000
At most 1 *	0.782189	107.8420	69.81889	0.0000
At most 2 *	0.596217	60.59409	47.85613	0.0021
At most 3 *	0.431838	32.48091	29.79707	0.0240
At most 4	0.332404	14.95512	15.49471	0.0602
At most 5	0.075360	2.428882	3.841466	0.1191

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.894902	69.83864	40.07757	0.0000
At most 1 *	0.782189	47.24792	33.87687	0.0007
At most 2 *	0.596217	28.11318	27.58434	0.0428
At most 3	0.431838	17.52579	21.13162	0.1486
At most 4	0.332404	12.52624	14.26460	0.0924
At most 5	0.075360	2.428882	3.841466	0.1191

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

NPL	LOG_BP_	LOG_BS_	CE	IR	UR
10.17647	10.96593	7.225308	4.253137	3.063582	-0.365519
11.98721	-1.203632	32.64470	10.16967	-1.887792	1.929006
-3.216226	3.413803	-21.14278	4.102640	8.401609	2.394423
5.404373	-12.72506	8.673135	-8.669608	4.140148	0.597738
0.767502	3.615036	12.79812	-3.488172	2.248239	-1.735897
0.500148	5.567424	-7.821104	-8.374235	-0.407608	6.277405

Unrestricted Adjustment Coefficients (alpha):

D(NPL)	-0.056623	-0.032211	-0.003497	-0.033025	-0.010354	-0.004689
D(LOG_BP_)	-0.053041	0.016297	-0.017819	0.040236	-0.019068	-0.006051
D(LOG_BS_)	0.002023	-0.002594	-0.002059	0.000616	-0.001861	0.000135
D(CE)	0.006112	-0.041446	0.014013	-0.002786	0.014191	0.014176
D(IR)	-0.004677	-0.027711	-0.057677	-0.002725	0.009669	0.003463
D(UR)	0.023871	-0.032610	0.016255	0.010125	0.042249	-0.014233

1 Cointegrating Equation(s): Log likelihood 319.5789

Normalized cointegrating coefficients (standard error in parentheses)

NPL	LOG_BP_	LOG_BS_	CE	IR	UR
1.000000	1.077577	0.710002	0.417938	0.301046	-0.035918
	(0.12900)	(0.18213)	(0.11371)	(0.07222)	(0.05034)

Adjustment coefficients (standard error in parentheses)

D(NPL)	-0.576224
	(0.14798)
D(LOG_BP_)	-0.539768
	(0.17148)
D(LOG_BS_)	0.020582
	(0.01118)
D(CE)	0.062194
	(0.16189)
D(IR)	-0.047592
	(0.17781)
D(UR)	0.242927
	(0.21394)

Appendix 4.13 Empirical Result of VAR Residual Serial Correlation LM Test for CIMB Bank

VAR Residual Serial Correlation LM Tests
Date: 02/18/20 Time: 22:55
Sample: 2010Q1 2018Q4
Included observations: 34

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	58.78651	36	0.0096	1.967359	(36, 46.7)	0.0151
2	55.07910	36	0.0218	1.782748	(36, 46.7)	0.0318
3	29.51435	36	0.7691	0.764500	(36, 46.7)	0.7971
4	43.98466	36	0.1694	1.290366	(36, 46.7)	0.2048

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	58.78651	36	0.0096	1.967359	(36, 46.7)	0.0151
2	109.4802	72	0.0029	1.819993	(72, 27.6)	0.0406
3	NA	108	NA	NA	(108, NA)	NA
4	NA	144	NA	NA	(144, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Appendix 4.14 Empirical Result of VAR Residual Serial Correlation LM Test for Maybank

VAR Residual Serial Correlation LM Tests
Date: 02/18/20 Time: 22:56
Sample: 2010Q1 2018Q4
Included observations: 34

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	46.33356	36	0.1161	1.387577	(36, 46.7)	0.1454
2	44.65926	36	0.1525	1.317919	(36, 46.7)	0.1862
3	29.53657	36	0.7682	0.765219	(36, 46.7)	0.7962
4	48.79113	36	0.0756	1.493197	(36, 46.7)	0.0984

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	46.33356	36	0.1161	1.387577	(36, 46.7)	0.1454
2	105.9771	72	0.0057	1.700043	(72, 27.6)	0.0607
3	NA	108	NA	NA	(108, NA)	NA
4	NA	144	NA	NA	(144, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Appendix 4.15 Empirical Result of VAR Residual Serial Correlation LM Test for Public Bank

VAR Residual Serial Correlation LM Tests
Date: 02/18/20 Time: 22:56
Sample: 2010Q1 2018Q4
Included observations: 34

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	33.75278	36	0.5759	0.906358	(36, 46.7)	0.6169
2	34.85179	36	0.5231	0.944709	(36, 46.7)	0.5661
3	37.95602	36	0.3803	1.056680	(36, 46.7)	0.4253
4	41.03314	36	0.2593	1.173192	(36, 46.7)	0.3011

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	33.75278	36	0.5759	0.906358	(36, 46.7)	0.6169
2	91.55833	72	0.0598	1.271324	(72, 27.6)	0.2443
3	NA	108	NA	NA	(108, NA)	NA
4	NA	144	NA	NA	(144, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Appendix 4.16 Empirical Result of VAR Residual Heteroscedasticity Test for CIMB Bank

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 02/18/20 Time: 22:49
Sample: 2010Q1 2018Q4
Included observations: 34

Joint test:

Chi-sq	df	Prob.
501.5528	504	0.5224

Individual components:

Dependent	R-squared	F(24,9)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.876676	2.665764	0.0642	29.80697	0.1912
res2*res2	0.814394	1.645414	0.2217	27.68941	0.2734
res3*res3	0.553681	0.465205	0.9349	18.82514	0.7612
res4*res4	0.726041	0.993820	0.5381	24.68541	0.4230
res5*res5	0.733930	1.034402	0.5098	24.95361	0.4083
res6*res6	0.684342	0.812996	0.6767	23.26764	0.5040
res2*res1	0.911278	3.851697	0.0203	30.98346	0.1543
res3*res1	0.503904	0.380902	0.9715	17.13273	0.8429
res3*res2	0.830926	1.842965	0.1711	28.25149	0.2496
res4*res1	0.861279	2.328274	0.0941	29.28350	0.2096
res4*res2	0.807816	1.576258	0.2433	27.46575	0.2832
res4*res3	0.630885	0.640943	0.8160	21.45009	0.6121
res5*res1	0.678354	0.790877	0.6946	23.06403	0.5160
res5*res2	0.500177	0.375266	0.9733	17.00602	0.8484
res5*res3	0.546692	0.452252	0.9416	18.58752	0.7736
res5*res4	0.530886	0.424379	0.9547	18.05013	0.8006
res6*res1	0.797694	1.478626	0.2777	27.12159	0.2988
res6*res2	0.725293	0.990093	0.5407	24.65998	0.4244
res6*res3	0.424929	0.277094	0.9943	14.44759	0.9359
res6*res4	0.778236	1.315984	0.3470	26.46001	0.3302
res6*res5	0.524345	0.413386	0.9593	17.82772	0.8113

Appendix 4.17 Empirical Result of VAR Residual Heteroscedasticity Test for Maybank

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 02/18/20 Time: 22:50
Sample: 2010Q1 2018Q4
Included observations: 34

Joint test:

Chi-sq	df	Prob.
512.7287	504	0.3843

Individual components:

Dependent	R-squared	F(24,9)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.858094	2.267585	0.1011	29.17518	0.2136
res2*res2	0.668905	0.757605	0.7218	22.74276	0.5350
res3*res3	0.762434	1.203509	0.4051	25.92276	0.3571
res4*res4	0.600257	0.563104	0.8741	20.40875	0.6733
res5*res5	0.804303	1.541225	0.2550	27.34629	0.2886
res6*res6	0.624418	0.623451	0.8296	21.23022	0.6251
res2*res1	0.564885	0.486841	0.9230	19.20609	0.7409
res3*res1	0.709533	0.916024	0.5955	24.12412	0.4545
res3*res2	0.702815	0.886839	0.6179	23.89570	0.4676
res4*res1	0.717104	0.950578	0.5695	24.38155	0.4400
res4*res2	0.694334	0.851828	0.6455	23.60735	0.4842
res4*res3	0.611586	0.590464	0.8544	20.79392	0.6509
res5*res1	0.826086	1.781241	0.1854	28.08693	0.2564
res5*res2	0.623905	0.622088	0.8306	21.21276	0.6261
res5*res3	0.711406	0.924401	0.5891	24.18779	0.4509
res5*res4	0.716347	0.947037	0.5721	24.35580	0.4414
res6*res1	0.761452	1.197014	0.4087	25.88938	0.3588
res6*res2	0.652306	0.703534	0.7660	22.17840	0.5686
res6*res3	0.755809	1.160684	0.4296	25.69751	0.3687
res6*res4	0.722448	0.976096	0.5508	24.56322	0.4298
res6*res5	0.717922	0.954421	0.5666	24.40936	0.4384

Appendix 4.18 Empirical Result of VAR Residual Heteroscedasticity Test for Public Bank

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 02/18/20 Time: 22:51
Sample: 2010Q1 2018Q4
Included observations: 34

Joint test:

Chi-sq	df	Prob.
511.6910	504	0.3967

Individual components:

Dependent	R-squared	F(24,9)	Prob.	Chi-sq(24)	Prob.
res1*res1	0.741307	1.074593	0.4830	25.20443	0.3947
res2*res2	0.810160	1.600345	0.2355	27.54543	0.2797
res3*res3	0.777042	1.306934	0.3513	26.41944	0.3322
res4*res4	0.862207	2.346476	0.0921	29.31504	0.2085
res5*res5	0.902592	3.474802	0.0284	30.68814	0.1630
res6*res6	0.653625	0.707642	0.7626	22.22325	0.5659
res2*res1	0.565006	0.487081	0.9228	19.21021	0.7407
res3*res1	0.683369	0.809344	0.6796	23.23455	0.5060
res3*res2	0.894562	3.181583	0.0376	30.41510	0.1714
res4*res1	0.663552	0.739587	0.7366	22.56078	0.5458
res4*res2	0.814383	1.645290	0.2218	27.68903	0.2734
res4*res3	0.890829	3.059976	0.0425	30.28818	0.1754
res5*res1	0.752703	1.141397	0.4410	25.59191	0.3742
res5*res2	0.702051	0.883604	0.6205	23.86973	0.4691
res5*res3	0.804291	1.541110	0.2551	27.34589	0.2886
res5*res4	0.728029	1.003822	0.5310	24.75297	0.4193
res6*res1	0.775200	1.293151	0.3581	26.35681	0.3353
res6*res2	0.807759	1.575679	0.2435	27.46382	0.2833
res6*res3	0.473327	0.337017	0.9840	16.09313	0.8847
res6*res4	0.763002	1.207294	0.4030	25.94208	0.3561
res6*res5	0.498849	0.373278	0.9740	16.96088	0.8503

Appendix 4.19 Empirical Result of VAR Residual Normality Test for CIMB Bank

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 02/18/20 Time: 22:53
Sample: 2010Q1 2018Q4
Included observations: 34

Component	Skewness	Chi-sq	df	Prob.*
1	0.061457	0.021403	1	0.8837
2	-0.833173	3.933670	1	0.0473
3	-0.779447	3.442715	1	0.0635
4	-0.848257	4.077396	1	0.0435
5	0.509085	1.468617	1	0.2256
6	-0.254642	0.367441	1	0.5444
Joint		13.31124	6	0.0384

Component	Kurtosis	Chi-sq	df	Prob.
1	3.237689	0.080036	1	0.7772
2	5.711878	10.41857	1	0.0012
3	5.191098	6.801288	1	0.0091
4	3.033868	0.001625	1	0.9678
5	2.423781	0.470374	1	0.4928
6	2.172398	0.970312	1	0.3246
Joint		18.74220	6	0.0046

Component	Jarque-Bera	df	Prob.
1	0.101439	2	0.9505
2	14.35224	2	0.0008
3	10.24400	2	0.0060
4	4.079021	2	0.1301
5	1.938991	2	0.3793
6	1.337752	2	0.5123
Joint	32.05344	12	0.0014

*Approximate p-values do not account for coefficient estimation

Appendix 4.20 Empirical Result of VAR Residual Normality Test for Maybank

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 02/18/20 Time: 22:53
Sample: 2010Q1 2018Q4
Included observations: 34

Component	Skewness	Chi-sq	df	Prob.*
1	-0.315567	0.564302	1	0.4525
2	0.177744	0.179026	1	0.6722
3	-1.049864	6.245885	1	0.0124
4	1.140062	7.365205	1	0.0066
5	0.221025	0.276828	1	0.5988
6	0.019200	0.002089	1	0.9635
Joint		14.63333	6	0.0233

Component	Kurtosis	Chi-sq	df	Prob.
1	2.499096	0.355448	1	0.5510
2	2.570647	0.261154	1	0.6093
3	6.162594	14.16950	1	0.0002
4	4.396288	2.761964	1	0.0965
5	2.790124	0.062401	1	0.8027
6	2.828318	0.041756	1	0.8381
Joint		17.65223	6	0.0072

Component	Jarque-Bera	df	Prob.
1	0.919750	2	0.6314
2	0.440180	2	0.8024
3	20.41539	2	0.0000
4	10.12717	2	0.0063
5	0.339229	2	0.8440
6	0.043845	2	0.9783
Joint	32.28556	12	0.0013

*Approximate p-values do not account for coefficient estimation

Appendix 4.21 Empirical Result of VAR Residual Normality Test for Public Bank

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 02/18/20 Time: 22:54
Sample: 2010Q1 2018Q4
Included observations: 34

Component	Skewness	Chi-sq	df	Prob.*
1	2.817176	44.97338	1	0.0000
2	-1.039319	6.121043	1	0.0134
3	0.338739	0.650215	1	0.4200
4	0.997817	5.641958	1	0.0175
5	-0.096813	0.053113	1	0.8177
6	-0.005939	0.000200	1	0.9887
Joint		57.43991	6	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	13.99432	171.2398	1	0.0000
2	6.379867	16.18329	1	0.0001
3	2.369725	0.562766	1	0.4531
4	5.722070	10.49703	1	0.0012
5	2.032757	1.325376	1	0.2496
6	2.675382	0.149284	1	0.6992
Joint		199.9576	6	0.0000

Component	Jarque-Bera	df	Prob.
1	216.2132	2	0.0000
2	22.30433	2	0.0000
3	1.212981	2	0.5453
4	16.13899	2	0.0003
5	1.378488	2	0.5020
6	0.149484	2	0.9280
Joint	257.3975	12	0.0000

*Approximate p-values do not account for coefficient estimation