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THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND NON PERFORMING LOAN: EVIDENCE FROM SELECTED ASEAN COUNTRIES

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THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND NON PERFORMING LOAN: EVIDENCE FROM SELECTED ASEAN COUNTRIES

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Thesis Submitted to

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ABSTRACT

High non-performing loans (NPLs) create the problem for the banking sector as financial intermediary and signal of banking crisis. Many attempts have been made to investigate the determinant of NPLs yet the crucial issue has remained unexplained. The motivation of this research paper is to study the relationship between macroeconomic variables and global financial crisis on NPLs in the Association of Southeast Asian Nations (ASEAN) countries. Using panel data of 6 countries of the ASEAN for 2005-2015, the model of NPL is regressed using Generalized Method of Moment (GMM) method. Based on the empirical finding reveals that the inflation, gross domestic product (GDP) and global financial crisis significantly effect NPL. In the area of policy implications, the policymaker should focus and reengineering the institutions together with these indicators could reduce the probability of NPLs in bank of ASEAN countries.

**Keyword:** Non-performing loan, ASEAN countries, macroeconomic variables, GMM, panel data
ABSTRAK


Keyword: pinjaman tidak berbayar, negara-negara ASEAN, pembolehubah makroekonomi, GMM, data panel
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LIST OF ABBREVIATIONS

ASEAN  Association of Southeast Asian Nations
CESEE  Central, Eastern and South Eastern Europe
CPI    Consumer Price Index
DCRISIS  Global Financial Crisis as dummy variable
FE     Fixed Effect Model
GDP    Gross domestic product
GMM    Generalized Method of Moment
IMF    International Monetary Fund
NPA    Non-Performing Asset
NPL    Non-Performing Loan
POLS   Panel Ordinary Lease Square
RE     Random Effect Model
CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter provides a brief discussion on the non-performing loan and macroeconomic variables. The chapter begins with the discussion about the background of the study and followed by the problem statement in section 1.4. Then, explanation about the research questions in section 1.5 and in section 1.6 explains the objectives of the study. While, section 1.7 discusses scope of the study and section 1.8 explains the contribution of the study. The organization of the study is discussed in section 1.9. Lastly, the conclusion of this chapter is explained in section 1.10.

1.2 Introduction of Non-Performing Loan

Bank lending is executed as a complex process, centered on the fundamental principles of credit, assuming, firstly and objectively, the responsibility of repaying the borrowed money amounts and paying the related interest by the borrower in favor of the creditor banks. The significance of a strong and healthy banking sector to a country’s economic growth and development is well-established in literature (Adekunle, Salami and Oluseyi, 2013). The effective banking systems help countries to grow, partly by widening access to external finance and channeling resources to the helping sectors (Mugume, 2007). They can do so, if banks create the necessary income to cover their
operational cost they incur in due course (Ongore and Kusa, 2013). However, in their business of lending, banks are challenged with default by loan borrowers that result in non-performing loans (NPLs) a hindrance to the efficiency of bank activities (Haneef et al., 2012). NPLs construct problems for the banking sector’s balance sheet on the asset side, and have a negative impact on the income statement as a result of provisioning for loan losses (Kumar and Tripathi, 2012).

According to International Monetary Fund (IMF, 2006), NPL means the "principal (the loan amount – o.n.) or interest unpaid for 90 days or longer". Similarly, by other authors (Louzis, Vouldis and Metaxas, 2012), NPL are coming from the current loans for which happened delays in payments to creditor banks over 90 days from their maturities. Also, occasionally the expression "non-performing loan" means that loan being in the position of either "lost" or to become "lost" (Saba, Kouser and Azeem, 2012), or for which there are establishing obvious weaknesses either of the loan itself or of the borrower (Barisitz, 2011).

1.3 Overview of Non-Performing Loan in ASEAN Countries

The Association of Southeast Asian Nations (ASEAN) have established on 1967 with five members which is Indonesia, Malaysia, Philippines, Singapore and Thailand. Followed by Brunei (1984), Vietnam (1995), Myanmar and Laos (1997) and then in year 1999, Cambodian joint as member in ASEAN. The ASEAN countries objectives are to
accelerate economic growth, social progress, and cultural development among members and to promote regional peace.

According to Kim, Chu and Nguyen (2017), the degree of financial – banking integration among ASEAN countries is still quite low compared with others and the financial systems in ASEAN countries are developing in favor of bank-based, rather than market-based system. As the gap in banking system development across group members still insists, the willingness to banking integration contrasts among countries. The figure 1.1 below shows that the total of non-performing loan in ASEAN countries.

Figure 1.1: 
*Non-Performing Loan in ASEAN countries*

*Source: World Bank, 2017*
Figure 1.1 shows that the fluctuations of the percentage of non-performing loan to total loan gross in ASEAN countries. The higher percentage of NPL is in Vietnam country in year 2015. The lower percentage of NPL is in Singapore country. However, within the year 2008 to 2009 the percentage of NPL shows increasing due to global financial crisis.

For Malaysia, NPL show the decrease trend from year 2005 to 2015 which is 9.39% in 2005 to 1.601% in year 2015. Then, within global financial crisis in year 2008 to 2009, are not affect the NPL in Malaysia. It showed that; in year 2008-2009, NPL are decrease from 4.808% to 3.627%.

For this study, only focus on six countries namely, Indonesia, Malaysia, Singapore, Thailand, Philippines and Vietnam. While for other countries such as Brunei, Cambodia, Myanmar and Laos were not selected because there are limitations in obtaining full data from every bank for every country. Some of central bank for ASEAN countries is not provide the data for NPL and others variable.

1.4 Problem Statement

Banking activities is always associated with risks and there is hardly banking operation without the risk (Anderson, 2001). Banks will face lot of problems when exposed to NPLs. In order to monitor the NPL, bank has to take effective measures which are critical to credit assessment.
Most of the studies on factors clarifying NPL in cross country have existed carried out in the advanced economies. This contains to Svetozar and Maja (2015) on their study of NPLs on selected Central and Eastern and South-Eastern Europe (CESEE); and Makri, Tsaganos and Bellas (2014), in their study on determinants of NPL rate in Euro areas. These studies have been showed under unique regulatory and economic environments where the level of market efficiency is advance compared to those of emerging and developing countries like ASEAN countries. However, the problem of NPL has continuous unanswered and not completely unstated due to inconsistencies of the studies (Idris and Nayan, 2016).

A few studies found that gross domestic product (GDP) has a significant variable in explaining NPL. Beck, Jakubik and Piloiu (2015) said that GDP rate to have significant results to NPLs. This has confirmed previous studies by Thiagarajan, et al (2011); Derbali (2011); and Aly and Daly (2010). However in Warue (2013) studies the effect on NPL in Kenya; and Salas and Saurina (2002) in their studies on credit risk in Spanish, these studies indicated that banks accumulate risks more rapidly in economic boom.

The effect of inflation towards NPLs is an important and complicated issue. It is important to lenders and borrowers. Higher inflation can make debt servicing easier by reducing the real value of loans, but it can also reduce the borrowers’ real income when wages are sticky (Klein, 2013). In countries where loan rates are variable, higher inflation can also lead to higher interest rates resulting from the monetary policy actions to combat
inflation (Nkusu, 2011). If high budget deficits are financed by domestic banks, adverse macroeconomic influence on NPLs can be effectuated through potential crowding out effect. However, if domestic banks mobilize significant funds from abroad, this effect will be smaller (Svetozar and Maja, 2015).

Since the effect of macroeconomic variables and the quality of loans has been the concern of many researchers (Nkusu, 2011; Louzis et al., 2012), it has been maintained that at the expansionary stage of the economy, bad debts are relatively low because both consumers and firms’ revenues do not enable them to repay their debts. However, banks allocate credits to lower-quality debtors in times of economic growth. Consequently, bad debts are doomed to be multiplied in case of recession.

The high level of NPLs in the banking system poses a systemic risk, inviting a panic run on deposits and sharply limiting financial intermediation, and subsequently, investment and growth (Istrate, Debasree and Weissburg, 2007); which could be further exacerbated if it is combined with external shocks, an unfavorable phase of the macroeconomic cycle, or inadequate political or legal support (Tiwari, 2011). Moreover, a high ratio of NPLs to total outstanding loans is in itself an indication of a banking crisis (Latif, Kyereboah-Coleman and Andoh, 2014). In fact, researchers have ascertained that the financial/banking crises in East Asia and Sub-Saharan African countries were followed by high NPLs (Collins and Wanjau, 2011; Vatansever and Hepsen, 2013; Rono, Wachilonga and Simiyu, 2014; Latif et al., 2014).
1.5 Research Question

In this study, three research questions have come out in order to achieve the objectives of this study. The research questions are as follows:

1. Does inflation have positive effect on non-performing loan of ASEAN countries?

2. Does gross domestic product (GDP) that influence non-performing loan of ASEAN countries?

3. Does global financial crisis affect the non-performing loan in ASEAN countries?

1.6 Research Objective

The objectives of this study such as follows:

1. To investigate the relationship between inflation and the non-performing loan in ASEAN Countries.

2. To determine the impact of gross domestic product on non-performing loan in ASEAN Countries.

3. To examine whether global financial crisis influence on non-performing loan in ASEAN countries.
1.7 Scope of study

The study attempts to examine inflation, gross domestic product (GDP) and global financial crisis have a significant towards NPL. The study is based on panel data consisting of NPL data in ASEAN countries which are Malaysia, Singapore, Indonesia, Thailand, Philippine and Vietnam. The data has been collected for 11 years from the year 2005 until 2015. The data gathered are from the Central bank of ASEAN countries, International Monetary Fund (IMF), The World Bank, Trading Economic and Data Stream. The dependent variable is Non-Performing loan (NPL), and independent variables are inflation, GDP and global financial crisis.

Although there are many studies on NPL, very few studies discuss on NPL and macroeconomic variables in ASEAN countries. This research paper complements existing literatures on NPL and macroeconomic variables since there is lack of research discussing on that. This aimed to determine the NPL and macroeconomic variables and also to provide empirical evidence from panel data.

1.8 Contribution of Study

This study will contribute to the banking literature on the macroeconomic variables that affect NPL. And it expected to extend the boundary of knowledge, specifically in the type macroeconomic variables that influence NPL. Furthermore, the output of this study can contribute a thought to reference sources and useful materials that
can contribute a thought to others researchers in the framework of development who want to write about NPL.

1.9 Organization of Study

The organization of this study is as follows. Chapter two will review the related literature. Chapter three discusses the methodology used to answer the research objectives. Chapter four will report the results and discuss the findings. Lastly, Chapter five summaries the research paper, underlines the limitations and give suggestions for future research.

1.10 Concluding Remarks

Basically, this chapter discussed the overview of non-performing loan in ASEAN countries; problem statement; research question; research objective; contribution of the study; scope of the study and structure of the research.
CHAPTER TWO

LITERATURE REVIEWS

2.1 Introduction

This chapter is focusing on the discussion from previous literature. Basically, there are three sections that covered under this chapter. There are about the concept and definition of non-performing loan, theoretical studies, and previous empirical studies.

2.2 Concept and definition of Non-performing loan

In banking the term NPLs or non-performing assets (NPAs) has been definite by numerous researchers to mean any loan that its interest and/or principal consumes be left unpaid for over 90 days.

Joseph et al. (2012) describe NPL as loans that are ninety days or more past their due date or not accruing interest anymore. Badar and Javid (2013) state that a loan is considered as nonperforming if it is in default or close to being in default. High NPLs stock is a noteworthy predictor of bank failure, and distorts banks cost structure and efficiency (Maggi and Guida, 2009; Lu and Whidbee, 2013; Cucinelli, 2015).

According to Klein (2013) a NPL is a loan on which interest payments and/or principal repayment is not existence made for a period of over 90 days. Akinlo and Emmanuel (2014) defined the NPLs as loans which for an actual lengthy duration of time
(over 90 days) discontinue generating interest income to the banks. In other words they are the total loans that are lengthy overdue with over 90 days, that is, loans left unpaid for over 90 day (Minton et al., 2009).

Though, Beck et al. (2015) noticed NPL as a loan that is past-due for more than 90 days. They further stressed that NPL could be a loan that is doubtful to be repaid without recourse to recovery actions such as the sale of obligor’s held collateral security, if any.

D’Hulster, Salamao-Garcia, and Letelier (2014) proposed that a most accepted definition of NPLs is when obligation related to loans and advances become over 90 days past-due, when the banks reflect the borrower is doubtful to pay and when other sort of obligation is past-due by more than 90 days. These are actually consistence with the IMF Financial Soundness Indicators that put NPLs as situations of non-performing past-due of principal and/or interest over 90 days. Going by these definitions of different researchers it can then be concluded that NPLs which are sometimes referred to as the NPAs or impaired loans are entirely those categories of bank loans that have been left unpaid in terms of interest and/or principal amount of a loan above 90 days. However, this excludes loans that have been realized through recovery efforts such as sales of obligors’ securities as well as those that have been restructured.

According to Zeng (2012) NPLs is “financial pollution” which if present in a financial system of a country can be risky to its economy and social welfare of its citizens. This means that banking system is predictable to maintain clean loan books with
little or no NPLs but in reality banks do not have an absolute clean loan books. However, the level of NPLs should not be significant or else they will infect the banking system and negatively affect economies and well-being of citizens. Consequently, NPLs can lead to ineffectiveness in the banking sector.

Barseghyan (2010) preserved that the existence of NPLs and combined with a delay in government bailouts can lead to insistent decline in aggregate economic activity. It should be that governments well-known about to rescues the bank through bailouts but typically at the expense of tax payers’ funds. However, this should not be stimulated excluding where it becomes unconditionally necessary because governments are likely through their apex banks to deliver close banking supervision of all banks. This should not be limited to simple banks periodic and unprepared examinations but also through regulatory functions such as sufficient prudential guidelines and transparent reporting procedures and sanctions in contradiction of any deviation by the lending banks.

In additional, NPLs are not only expressions of low or non-quality of loans but also as measure of qualitative level of the whole loan portfolio of banks (Filip, 2013). Ahmad and Bashir (2013) conserved that the growth of NPLs is linked to ineffectiveness and failures of the banks, as well as financial crises in both developed and developing countries.

The lending banks are responsible for all NPLs because statutorily they are debtors to all economic units that make deposits with them. It is predictable that the
banks will be well-organized in the management of their assets to the extent that loans are not permissible to deteriorate in term of their qualities.

2.3 Theoretical Studies

2.3.1 Financial Accelerator Theory

This theory was established by Bernanke and Gertler (1989) and Bernanke, Gertler, and Gilchrist (1998) argues that credit markets are procyclical and those information asymmetries between lenders and borrowers as well as the balance sheet effect work to amplify and propagate credit market shocks to the economy. This theory seeks to clarify how lending and borrowing activities of organizations are largely affected by small economic shocks. The theory also designates that due to economic shocks, borrowers may not have the aptitude to borrow and there is a probability of them avoiding refunding their loans or external finance.

As a result the financial accelerator works its way through the macroeconomic by means of changes in a proxy of economy wide financial strength—aggregate net worth or cash flow. Generally, in the real world, this aggregate variable is pro-cyclical: for case, in a recession, the financial accelerator effect “is approximately proportional to the size of the decline in GDP, since the variation in cash flow and the value of collateral would be expected to be roughly proportional to the decline in output” (Bernanke and Gertler, 1989, 1990; Bernanke et al., 1999).
According to Škarica (2014), the inflation might pass through nominal interest rates as lenders adjust rates to maintain their real returns or simply to pass on increases in policy rates resulting from monetary policy actions to combat inflation, thus reducing borrowers’ loan-servicing capacity. The financial accelerator theory therefore affects default through the inflation and GDP.

2.3.2 Macroeconomic Variable

There are many studies that have been conducted so far in determinants of NPLs. Their results have shown that, NPLs are determined by macroeconomic variable such as inflation and gross domestic product.

i. Inflation

Inflation affects borrowers’ debt servicing capacity over different channels and its influence on NPL can be positive or negative (Fofack, 2005; Pasha and Khemraj, 2009; Nkusu, 2011). The explaining provided by the previous literature for this relationship is that, higher inflation can create debt servicing easier through reducing the real value of outstanding loans particularly once the loan rates are fixed (banks do not modify rates in accordance to the inflation change to keep their real returns). However, it can also weaken some borrower’s ability to service debt by decreasing real income.

Furthermore, when loan rates are adjustable in accordance to the inflation variation, inflation is expected to reduce borrower’s loan servicing capacity as lenders
adjust rates to keep their real returns or simply to pass on increases in policy rates consequential from monetary policy actions to combat inflation.

ii. **Gross domestic product**

Gross domestic product (GDP) is an important macroeconomic variable which over the years has played a significant role in determining NPL. There is an inverse relationship between GDP and the level of NPLs reported by commercial banks (Louzis et al., 2012; Castro, 2013; Abid et al., 2014; Makri et al., 2014). The explanation provided by the literature for this relationship is that, variations in business cycle impact the credit worthiness of borrowers in terms of repayment capacity. Hence, strong positive in real GDP usually explains into more income which recovers the debt servicing capacity of borrower which in turn contributes to lower NPLs. On the other hand, when there is a slowdown in the economy (low or negative GDP), the economic activities in general are declining and the volume of cash held for either businesses or households are decreasing. These situations contribute in weakening the ability of borrowers to repay the loans, which lead to increase the possibility of delays their financial obligations and thus banks’ exposure to credit risk increase. In this regard, Hou (2006) distinguished that, each NPL in the financial sector is viewed as an obverse mirror image of an indisposed unprofitable enterprise.
2.3.3 Global Financial Crisis

NPLs reflect the stability of the banking system and largely the financial system since historically, a built-up level of NPLs has often been found to be associated with banking crisis (Fofack, 2005). This relationship is established in the East Asian banking and financial crisis of 1997, which severely affected economic growth in Thailand, Indonesia, Malaysia and Korea, when more than 300 percent increase in NPLs level preceded the crisis (Mishkin, 1999). Reinhart and Rogoff (2010) further link financial crisis with sovereign debt crisis as was the case in Greece. Barseghyan (2010) also argued that the huge level of NPLs in Japan accounts in part towards the prolonged slowdown in that economy for over a decade till 2003. However, the global financial market instability of 2008 was triggered by mortgage defaults, which started from the United States of America (USA) mortgage market. The severity of the later spread to different countries of the world then depended on each country’s cross-border financial exposure and link to the USA (Leaven and Valencia, 2010).

The quantity or percentage of NPAs is frequently related with bank failures and financial crises in both developing and developed countries (Caprio and Klingebiel, 2002). For example, in Indonesia where over 60 banks collapsed through the financial crisis, the NPA existed about 75% of total asset portfolios (Caprio and Klingebiel, 2002).

On the other hand, that deferred bailouts of the banking and/or financial sector during a financial crisis usually lead to lengthy economic downturns (e.g., Barseghyan, 2010; Cukierman, 2013). That is, the occurrence of large NPLs on banks’ balance sheets
might cause a long-term decline in the real economy. As well-known, asset price bubbles in the late 1980s and following the equity market crash and shocks to the banking sector in Japan have had thoughtful effects on the real economy of Japan (Barros et al., 2009). Moreover, Feldkircher (2014) shows that credit growth prior to a crisis on average results in an increase in the cumulative loss in real output.

Further worsening of NPLs level accompanies financial crisis (Louzis et al., 2012). But some researchers are of the opinion that the beginning of a financial crisis can be highlighted by a rise in NPLs level (Reinhart and Rogoff, 2010). NPLs in any economy, is one of the drivers of banking crises. Banks can create money through credit expansion to the system and also make significant portion of their earnings through loan creation (Vodova, 2011).

2.4 Empirical Studies

The following section presents the empirical evidence on the determinants of NPLs with a particular focus on those studies that have been conducted more recently, as far as they are the best indicators of the current situation.

2.4.1 Inflation and Non-performing Loan

Several studies have examined NPL’s determinants and concluded that the inflations play an important role in this matter. For example, Gabeshi (2017) analyze the link between the macroeconomic developments and the banking credit risk in Albania
over the period 2005-2014 using Ordinary Lease Square (OLS) method found that increase in inflation will increase the NPL. Abid et al. (2014) in a study of the macroeconomic and bank-specific determinants of household’s NPLs in Tunisia used a quarterly dynamic panel data of 16 banks from 2003Q1-2012Q4 with 768 banks-quarter observations, the result revealed a positive relationship between inflation and NPLs.

Furthermore, Klein (2013) are investigates the NPLs in Central, Eastern and South Eastern Europe (CESEE) in the period of 1998–2011, indicates that there are positive relationship between inflation and NPL. Then, Mileris (2012) used a panel data of 22 EU countries to investigate the effect of inflation on loan portfolio credit risk from 2008 to 2010, also found a positive relationship between inflation and NPLs.

However there is also evidence the inflation has negative relationship with NPL. Similarly, Hajja, Ali and Iqbal (2017) studied using Generalized Method of Moments (GMM) and vector autoregression (VAR) method analysis the relationship between macroeconomic variable and NPL of nineteen commercial bank in Malaysia. They found that, inflation have a negative relationship between NPL. Also, Roziela et al. (2013), study using Generalized Least Square (GLS) of panel data to examine the implications of macroeconomic indicators on the NPLs for twelve countries in Asian Pacific region from period 2000-2008. The results indicate inflation is negatively affecting NPL in the short run. And the researcher assumes that the positive coefficient for inflation will capture the effect of a less volatile price regime only in the long run.
2.4.2 Gross domestic product and Non-performing loan

GDP is an important determinant of NPLs and has been used by several researchers in their models. For example, Gabeshi (2017) analyze the link between the macroeconomic developments and the banking credit risk in Albania over the period 2005-2014, found that increase in GDP will decrease the NPL ratio. Also, study by Sari, Priyarsono, and Anggraeni (2017) examine factors influencing NPL of BPD in the period of 2012-2015 by using fixed effect model for time series data to test macroeconomic variables. There found that GDP growth has a negative impact on NPL.

Similarly, Idris and Nayan (2016), used panel data of 12 Organization of the Petroleum Exporting Countries (OPEC) for 2000-2014 investigate the relationship between NPL and macroeconomic variable. They found that, the negative impact on real GDP (constant 2005 US$) on NPLs. Ghosh (2015) in a study of 50 US States and the District of Colombia spanning 1984-2013 found a significant inverse relationship between GDP and NPLs.

Moreover, Makri et al. (2014) in a similar study of 14 Eurozone countries from 2000 to 2008 using exclusive aggregate data of bank, they suggested that an annual percentage growth rate of GDP denoted significant negative relationship to NPLs and public debt as percentage of GDP was found to be positively and significantly related to NPLs. Castro (2013) used the same GMM estimator to investigate the relationship between GDP and NPLs amongst Greece, Ireland, Portugal, Spain and Italy (GIPSI) over
the period of 1997q1-2011q3. This study indicated that NPLs are significantly increased by a decrease in GDP growth.

Furthermore, Messai and Jouini (2013) analyzed the determinants of NPLs on a sample of 85 banks in three countries (Italy, Greece, and Spain) for the period of 2004-2008, using the fixed effect method of panel data. They found the problem loans varied negatively with the growth rate of GDP. Also, Louzis et al. (2012) who used GMM estimator in investigating the effect of GDP on NPLs of nine largest Greek banks from 2003Q1-2009Q3. The study found an inverse relationship between GDP and NPLs.

However, there is also evidence the GDP have positive relationship with NPL. According the study by Hajja et al. (2017) using GMM and VAR method on a dynamic panel data and time series analysis for 19 commercial bank in Malaysia for macroeconomic variable. They find that GDP growth, lending interest rate and money supply has positive relationship with NPL. According to Wairimu and Gitundu (2017), using a linear regression model to examined the macroeconomic determinants of NPLs in Kenya by time series data for periods 1998 to 2015. The results indicated GDP growth rate, are not statistically significant to NPLs.

2.4.3 Global Financial Crisis and Non-performing loan

There are several previous studied the relationship between global financial crisis and NPL. For example, Kaminsky and Reinhart (1999) further find that a large increase in the NPL ratio serves as a reliable predictor of financial crises. Klein (2013) uses SVAR
estimation and reports a negative impact of increases in NPL ratios on credit, growth and employment in emerging Europe in the aftermath of the 2008-09 financial crisis.

Indeed, some other researchers have find out that the financial/banking crisis in East Asia and Sub-Saharan African countries were followed by high NPLs (Collins and Wanjau, 2011; Vatansever and Hepsen, 2013; Rono et al., 2014; Latif et al., 2014).

2.5  Concluding Remarks

In short, this chapter provided the definition and concept of NPL and the existing of literature that discusses in depth about the previous research studies. This section is discussing based on the keywords that relate to the studies which are about the relationship between NPL and macroeconomic variables.
CHAPTER THREE

METHODOLOGY

3.1 Introduction

The main objective of this study is to examine the hypothesis whether macroeconomic variables has significant effect to NPL. Section 3.2 describes data collection and sample selection. In section 3.3 discusses the measurement of variables. While, section 3.4 describes the theoretical framework of dependent and also independent variable used. In section 3.5 describes the econometric model to be tested. Sections 3.6 explain development of hypothesis. Then, in section 3.7 explain the method of panel data and advantages of using this method. In section 3.8 justify empirical method used and lastly section 3.9 provides a conclusion of the chapter.

3.2 Data Collection and Sample Selection

This study used the quantitative research. Quantitative research is research that use of mass numbers, obtained from data collection, explanations of the data, as well as the emergence of the results. There are several types of data always used in research liked cross sectional, time series and also pooled data (Cameron and Trivedi, 2013). The secondary data are collected for some aimed otherwise the problem in hand (Malhotra, 1999). Secondary data are very practical for the researcher to solve the problem statement and may explain the data more meaningful (Sekaran, 2003). This study based on secondary data that collected from World Development Indicators (World Bank, 2017),
Central bank of each ASEAN countries (2017), International Monetary Fund (IMF, 2017), Trading Economic (2017) and Data Stream (2017). The following table shows the data collection of this study in Table 3.1.

Table 3.1:  
*Table Data Description*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition of Variables</th>
<th>Source of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPL</td>
<td>Bank Non-Performing Loans To Total Gross Loans</td>
<td>World Bank (2017); Central Bank (2017); IMF (2017); Trading Economics (2017)</td>
</tr>
<tr>
<td>CPI</td>
<td>Inflation (Consumer Price Index)</td>
<td>World Bank (2017); IMF (2017)</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
<td>World Bank (2017)</td>
</tr>
</tbody>
</table>

The data used for this study consist of 6 countries in ASEAN countries namely Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam. The data collected starting from year 2005 until 2015 as presents in table 3.2.

Table 3.2:  
*Sampling of the Study*

<table>
<thead>
<tr>
<th>Name of Countries</th>
<th>Range of Year</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>2005-2015</td>
<td>11</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2005-2015</td>
<td>11</td>
</tr>
<tr>
<td>Philippines</td>
<td>2005-2015</td>
<td>11</td>
</tr>
</tbody>
</table>
3.3 Measurement of variables

3.3.1 Dependent Variable

*Non-Performing Loan*

In banking the term NPL or NPAs has been definite by numerous researchers to mean any loan that its interest and/or principal consumes be left unpaid for over 90 days. Reviews found that there are many researches have been covered for different countries. There are empirical literatures that solely focus on one country, such as Nigeria (Nezianya and Izuchukwu, 2014), Greece (Louzis et al., 2012), Malaysia (Lean and Smyth, 2011), France (Pouvelle, 2012) and others. Adding on, there are also researchers who used a few countries data as their research observations, such as CESEE countries (Škarica, 2014; Klein, 2013; Jakubík and Reiningger, 2013). This study used Bank non-performing loans to total gross loans (%).

3.3.2 Independent Variable

i. *Inflation*
This study used consumer price index (CPI) as proxy for inflation. In previous studies, inflation affects borrower’s debt servicing capacity through different channels and its impact on NPL can be positive or negative. On one hand, it reduces the loan’s real value which makes it easier to repay it and it even reduces the unemployment (Phillips’ curve). Then the other hand, it reduces the real income which makes debt servicing more difficult (Nkusu, 2011). Gabeshi (2017); Klein (2013); Greenidge and Grosvenor (2009); and Fofack (2005) found positive correlation between NPL and high inflation. In consequence, inflation will give the impact whole economic activity including depositor, borrower and also the banks. Therefore, a positive relationship between inflation and NPLs is expected in this study.

ii. **Gross Domestic Product**

This study used real GDP (US$ currency). The negative relationship between NPL and economic growth is common in the NPL literature (Nkusu, 2011; Jakubík and Reininger, 2013; Idris and Nayan, 2016; Gabeshi, 2017; Sari et al. 2017). The explanation provided by the literature for this relationship is that strong positive in real GDP usually translates into more income which improves the debt servicing capacity of borrower which in turn contributes to lower NPLs. This means that the rise of GDP or industrial production should reduce NPLs and vice versa. The same effect on NPL ratio can be expected with the total volume indices of construction work since they are directly associated with economic conditions. Therefore, a negative relationship between GDP and NPLs is expected in this study.
iii. **Global Financial Crisis**

Bank failure has a relationship with financial crisis due to poor loan monitoring since bank engaged mostly in lending activity. As highlighted by Athanasoglou et al. (2014) the recent global financial crisis shows the importance of the pro-cyclicality of the financial sector. The pro-cyclicality has transformed banks from mitigation mechanisms to amplify changes in economic activity that potentially affecting financial stability and economic growth. The positive relationship between NPL and global financial crisis is common in the NPL literature (Collins and Wanjau, 2011; Vatansever and Hepsen, 2013; Rono et al., 2014; Latif et al., 2014).

To perceive the potential impact of global financial crisis on NPL, this study adds 2008 and 2009 crisis dummy (DCRISIS) to see whether the recent global financial crisis influence the way ASEAN countries banks to control the NPL. Year 2008 and 2009 dummy global financial crisis is expected to have a positive relationship with NPL.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measurement</th>
<th>Definition</th>
<th>Previous Studied</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPL</td>
<td>Loan that its interest and/or principal consumes be left unpaid for over 90 days</td>
<td>Bank Non-Performing Loans to Total Gross Loans (%)</td>
<td>Louzis et al., (2012); Škarica (2014); Klein (2013); Nezianya and Izuchukwu (2014)</td>
<td>Positive</td>
</tr>
<tr>
<td>Inflation Consumer price index</td>
<td>Consumer price index (constant year 2010=100)</td>
<td>Fofack (2005); Greenidge and Grosvenor (2009); Klein (2013); Gabeshi (2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Domestic Product US$ currency are transform into Log form because it made the estimated elasticity.</td>
<td>Real GDP by US$ currency</td>
<td>Nkusu(2011); Jakubík and Reining (2013); Idris and Nayan (2016); Gabeshi, 2017; Sari et al., (2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Financial crisis Year 2008 and 2009 as a dummy for global financial crisis</td>
<td>Financial crisis in year 2008 and 2009</td>
<td>Collins and Wanjau, (2011); Vatansever and Hepsen, (2013); Rono et al., 2014; Latif et al.,(2014);</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.4 Theoretical framework

This study is use secondary data that taken from the empirical study. The variable into two categories namely:

a. Independent variable consists of 3 kinds of variable:
   
   i. Inflation (CPI)
   
   ii. Gross Domestic Product (GDP)
iii. Global Financial Crisis (DCRISIS)

b. Dependent variable consists of Non-Performing Loan.

Figure 3.1:
Theoretical Framework

3.5 Econometric Model

The regression model aims to examine and predict how the relationship between independent variables and dependent variable. The econometric model is show below:

\[ Y = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + \beta_3 x_{it} + \epsilon_{it} \]

\[ NPL_{it} = \beta_0 + \beta_1 CPI_{it} + \beta_2 LnGDP_{it} + \delta_3 DCRISIS_{it} + \epsilon_{it} \]
Where:

- **NPL**: Non Performing loan
- **$\beta_0$**: Constant
- **$\beta_1, \beta_2, \delta_3$**: Coefficient of the Parameters
- **CPI**: Inflation
- **GDP**: Gross Domestic Product
- **DCRISIS**: Global Financial Crisis (dummy)
- **$\epsilon$**: Error Term
- **i**: Cross-sectional Unit
- **t**: Time Period
- **Ln**: Natural Log

### 3.6 Hypothesis Development

This study is going to examine the relationship between inflation, gross domestic product and global financial crisis with NPL in selected ASEAN countries.

- **H$_1$**: There is a significant relationship between inflation and non-performing loan
- **H$_2$**: There is a significant relationship between gross domestic products and non-performing loan.
H₃: There is a significant relationship between global financial crisis and non-performing loan.

3.7 Panel data

The data used in this study involves sixty six balanced panel data in six different countries in ASEAN. Panel data is referred as cross sectional and time series. Moreover, there are combination between time series data and cross section in panel data. In addition, with differs type of fundamental variation by panel data the researches can learned different from other studies (Hsiao, 2014). In this study used balance panel data which has the same numbers time series in the unit of cross sectional. The advantages of using panel data can raise the sample of size; it suitable for the dynamic changes and furthermore it can remain allows studying the complex behavior (Gujarati, 2008).

3.8 Empirical Method

This study will be analyzed based on the several methods using the E-views program version 9 SV and STATA program version 12 SE to test the relationships between macroeconomic variables and NPL liked inflation, GDP and global financial crisis. The analysis will divide into 6 parts, namely:

i. Descriptive statistic

ii. Correlation
iii. Panel Ordinary Lease Square (POLS)

iv. Fixed effect model

v. Generalized Method of Moments

vi. Granger Causality

3.8.1 Descriptive Statistic

The descriptive statistics consist of a process of changing a large of raw data into a table with the frequency distribution and as well percentages which are important part of the data (Denscombe, 1998). The descriptive statistics are used to describe and summarize data in a study (Trochim, 2000). Moreover, descriptive statistics also discover and measure the cause and impact the relationships among variables (Cooper and Schindler, 2000).

3.8.2 Correlation

It is often essential to examine the correlation between two or more fiscal variables. There are several ways to observe how sets of data are correlated. Two of the most useful means are scattered plots and correlation analysis.
In statistical terms, dependence is correlation between two casual variables. Correlation refers to any relations involving dependence. Correlations are valuable because they canister predictive relationship.

### 3.8.3 Panel Ordinary Least Square (POLS)

This study, regression analysis applies Panel Ordinary Least Square (POLS) estimation. The Ordinary Least Square method is more suitable since it reduces normality problem in models. POLS are a method of standard linear regression with the focuses of minimizes the distinction between the observed responses in some arbitrary dataset and the responses predicted by the linear approximation of the data. The POLS is most common statistical method use for the application of vary disciplines for the regression analysis (Hair, 2010). The regressions provide the result predictable of dependent variable and independent variables (DeCoster, 2004). The equation for POLS show below:

\[ Y_{i,t} = \alpha + \beta X_{i,t} + \epsilon_{i,t}; \ i = 1,2, ..., N; \ t = 1,2, ..., T \]

### 3.8.4 Fixed Effect Model (FE)

Fixed effects (FE) are a burst model to be used for studies that concentrate on a set of \( N \) banks and an inference done is restricted to the bank behavior. The intention of the fixed effect and the first differences estimation is to eliminate unobserved effect. The effect was assumed to be associated with some of independent variables.
Every bank has its own features. These features are might and might not affect the predictor variables. Hence the fixed effect regression may consider the issue. Fixed effect assumes that all time-constant characteristic is unique to all countries. It also assumes that the time-constant cannot be related with other countries features. In this model all the time-constant differences between countries are controlled by omitted time-constant characteristic. Therefore, the estimated coefficient for the fixed effect model is unbiased.

There are numerous limitations in fixed effect. One of the limitation is the regressions cannot estimate the time constant covariates effect because all the effect are cancelled out by the within transformation. This weakness reflects that panel data cannot identify the causal effect of a time-constant covariate. Further, fixed effect model need some variation in \( x \). Without this variation, the effect could not be estimate and the standard error will be large.

### 3.8.5 Generalized Method of Moments

This study also used the Generalized Method of Moments (GMM) estimators. Arellano and Bond (1991), Arellano and Bover (1995) and Holtz-Eakin et al (1998) has developed the GMM estimator for dynamic panel data model, which firstly proposed by Anderson and Hsiao (1982).

The GMM estimator used pre-set variables as an instrument, as well as the lagged values of the levels for endogenous to controls the endogeneity. According to Gupta et
al., (2005), the strength of the instrument and the existence of serial correlation in the residual will cause the uniformity of the estimator; can be tested once the equation is estimated.

The GMM-SYS and GMM-DIF can be estimated by one-step or two-step procedures. The one-step estimators assume quite restrictive hypotheses of homoscedasticity and non-correlation over time. The results are consistent and robust standard errors adjusting for both hypotheses.

The two-step is efficient under more general conditions, but delivers too small standard errors, especially with a limited sample. Thus, Arrelano and Bond (1991) and Blundell and Bond (1998, 1999) recommend using the one-step robust results for inference, and the two-step regression diagnostics to confirm the validity of the model (Clijsters and Peters, 2005).

The advantages of utilizing dynamic model are to control for both the unobserved panel-level fixed effects as well as the panel's time persistence. Moreover, utilizing dynamic panel-data model allows better understand the dynamics of adjustment (Baltagi, 2008). The other advantages are: (i) GMM allow differentiating between exogenous and endogenous explanatory variables. That is, GMM allows dealing with potential endogeneity issues (Bouvatier et al., 2014). (ii) GMM estimator allows the precision in choosing the optimal lag length of the dependent variable and in other explanatory variables as well. (iii) GMM estimator deals with collinearity or multicollinearity
properly, as the estimator drops the variables that are highly correlated to each other and causing collinearity.

3.8.6 Granger Causality

Then the stationary test of the variables has been carried out, Granger (1969) causality test is used to analyze the causality direction of NPL and its determinants (inflation rate, GDP, and global financial crisis (dummy)). Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger, 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of Yt add no information to explanation of movements of Xt beyond that provided by lagged values of Xt itself (Green, 2003). The fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable.

In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H₀) that test in this case is that the X variable does not Granger cause variable Y, and variable Y does not Granger cause variable X.
3.9 Concluding Remarks

In conclusion, this chapter provides a clear explanation of the stages in the settlement problems that are discussed in this study, answer the questions and achieve the objectives of this research.
CHAPTER FOUR

EMPIRICAL FINDING AND DISCUSSION

4.1 Introduction

This chapter provides an answer to the problems and questions that presented in chapter 1. In this section presents the empirical results of the relationship between NPL and macroeconomic variable which is consists of descriptive analysis, correlation matrix, results of the study based on panel regression analysis for static model and dynamic model, also result of granger causality and then concluding remarks for this section.

4.2 Descriptive Statistics

Table 4.1 presents summary of descriptive statistics for the dependent variable and independent variables that used in this study. It is also including information about mean, standard deviation, median, minimum and maximum.

Table 4.1:
Descriptive Statistics

<table>
<thead>
<tr>
<th>Details</th>
<th>Mean</th>
<th>Median</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPL</td>
<td>3.580136</td>
<td>2.6820</td>
<td>14.4</td>
<td>0.757</td>
<td>2.61471</td>
</tr>
<tr>
<td>CPI</td>
<td>101.0796</td>
<td>100.00</td>
<td>144.9061</td>
<td>59.9258</td>
<td>16.9615</td>
</tr>
<tr>
<td>LNGDP</td>
<td>26.2372</td>
<td>26.2799</td>
<td>27.5453</td>
<td>24.7774</td>
<td>0.6143</td>
</tr>
<tr>
<td>DCRISIS</td>
<td>0.1818</td>
<td>0.0000</td>
<td>1</td>
<td>0</td>
<td>0.3887</td>
</tr>
</tbody>
</table>

Note: NPL: Non-performing loan, CPI: Inflation, LNGDP: Gross Domestic Product (US$ Currency), DCRISIS: Global Financial Crisis (dummy)
In Table 4.1 above, the descriptive statistic is presented on the dependent variable for this study is NPL and the independent variables are inflation, GDP and also DCRISIS. In addition, variable of GDP are transform into log form because the transformation into log made the estimated elasticity. The table 4.1 above shows that the mean of NPL, inflation, GDP and DCRISIS is 3.580136, 101.0796, 26.2372 and 0.1818 respectively. The higher mean is obtained in inflation and the lowest mean is the DCRISIS. Standard deviation indicates the variability and diversity of the data. A low standard deviation shows the data are close to mean whereas high standard deviation shows that the data are spread out over a large range of values. The inflation shows high standard deviation of 16.9615 and DCRISIS has the lowest one at 0.3887. The maximum value of NPL data is 14.4 and the minimum value of NPL data is 0.757. For inflation, the maximum value data is 144.9061 and the minimum value of inflation is 59.928. Moreover, the maximum value of GDP data is 27.5453 and the minimum value of GDP is 24.7774.

4.3 Correlation

Pearson correlation was used to identify the relationship between two variables. The results of this correlation as present in Table 4.2.

<table>
<thead>
<tr>
<th>Correlation Probability</th>
<th>NPL</th>
<th>CPI</th>
<th>LNGDP</th>
<th>DCRISIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPL</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In Table 4.2 shows the Pearson correlation coefficients. The correlation function is to measure the strength of relationships between the variables for this study. Furthermore, if the correlation coefficients between independent variables are more than 0.80, it might lead to multicollinearity problem between the variables (Gujarati, 2003). However, the interpretation of a correlation coefficient are depends on the purposes of the study. Thus, in table 4.2 shows that all correlation coefficients in this study are less than 0.80 meaning that the correlation are in small and medium range. Thus, this analysis supports that there is no multicollinearity in this study. Moreover, the table indicates that the correlation coefficient between NPL and inflation is negative (r= -0.4293) and significant (p-value=0.0003) at 1% level. Similarly, the correlation coefficient between the NPL and GDP is negative (r= -0.2841) and significant (p-value=0.0208) at 5% level. This shows that change in NPL would be followed by changing in inflation and GDP in opposite direction. However, the correlation coefficient between NPL and DCRISIS is not significant.

<table>
<thead>
<tr>
<th></th>
<th>CPI</th>
<th>LNGDP</th>
<th>DCRISIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPI</td>
<td>-0.4293***</td>
<td>1.0000</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>0.0003</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>LNGDP</td>
<td>-0.2841**</td>
<td>0.442***</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>0.0208</td>
<td>0.0002</td>
<td>-------</td>
</tr>
<tr>
<td>DCRISIS</td>
<td>-0.0239</td>
<td>-0.1776</td>
<td>-0.09736</td>
</tr>
<tr>
<td></td>
<td>0.8489</td>
<td>0.1537</td>
<td>0.4368</td>
</tr>
</tbody>
</table>

*Note: The *, ** and *** are 10%, 5% and 1% level of significant.
4.4 Analysis of Static Model – POLS, Random Effect and Fixed Effect

This sub-section aims to discuss the analysis of static model comprising POLS, RE and FE regression. The result of these regressions is shown in Table 5-1.

4.4.1 Panel Ordinary Lease Square

Table 4.3 records the result of POLS it shows that the NPL is influenced by inflation in the opposite direction at 1 percent level of significant, except the GDP and DCRISIS which is not significant to NPL. In another word, when 1 percent increase in inflation led to almost 6.1 percent decline in the NPLs. In addition, the value of the coefficient of determination ($R^2$) for this model indicates that all independent variables were able to explain the variance of dependent variables in an amount of 20.62%.

4.4.2 Random Effect

Subsequent is the Random Effect (RE) analysis is showed in Column 3 of Table 4.3. It is demonstrated the NPL is affected by GDP in the different directions at 1 percent level of significant, except the inflation and DCRISIS which is not significant to NPL. When, the direction of GDP to NPL is opposite with the value of elasticity is 4.5435 percent. According to this analysis, the GDP are the strongest variables among the four in the influence of NPLs.
4.4.3 Fixed effect

Lastly, Column 4 in Table 4.3 represents the analysis of Fixed Effect (FE). According to this analysis, in contrast with the previous two analysis, DCRISIS appear to have negative relation on NPL at 10 percent level of significant, with the correlation of -0.8519. Similar as RE, GDP have negative relation on NPL at 1 percent level of significant. Thus, only the inflation has a positive relation on NPL at 1 percent level of significant. If 1 percent increase in inflation directed to 0.1327 percent increase in NPL. Even though, only inflation affects NPL positively, but the sensitivity of inflation on the NPL is the strongest than other variables.

4.4.4 Langrange Multipler (LM) and Hausman test

The LM and Hausman test is the test for determining the static model of NPL. LM test is proposed to determine the appropriate method of RE than POLS for NPL model. While Hausman test is determined the appropriateness of FE than RE of NPL model.

An LM regression result indicates the value is 0.0002 which is significant at 1 percent. It is described that RE methods is suitable to this model. Subsequently, the study Hausman test and regression results found that the value of the Hausman test is 0.0000, which is significant at 1 percent. This study decides the FE is suitable than RE. This supports the economic theory namely the FE is better than RE, since there is variation in time between the long term and short term. Therefore, the NPL regression results expected to be influences by time than countries.
Table 4.3: Regression result of static model

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STATIC MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POLS</td>
</tr>
<tr>
<td>CPI</td>
<td>-0.0611*** (0.0197) [-3.10] 0.003</td>
</tr>
<tr>
<td>LNGDP</td>
<td>-0.5111 (0.5384) [-0.95] 0.346</td>
</tr>
<tr>
<td>DCRISIS</td>
<td>-0.7132 (0.7757) [-0.92] 0.361</td>
</tr>
<tr>
<td>Constant</td>
<td>23.291* (13.393) [1.74] 0.087</td>
</tr>
</tbody>
</table>

LM Test 0.0002***

Hausman test 0.0000***

R² 0.2062

N 66 66 66

T 11 11 11

Note: The value in the () are standard error and the value [ ] are the t-stat, respectively. The *, ** and *** are 10%, 5% and 1% level of significant
4.5 Analysis of Dynamic Model - GMM-Diff & GMM-System

This sub-section aims to discuss the analysis of dynamic model comprising GMM-Difference and GMM-System estimator. The result of regression is shown in Table 4.4.

4.5.1 GMM-Difference

Regarding the Column 2 and 3 in Table 4.4 shows the result of GMM-Difference estimator one step and two steps. As a summary, the GMM-Difference two-step is better than GMM-Difference one-step. The explanation of the results is discussed in the next sub-section.

i. GMM-Difference one step

Regarding the Column 2 in Table 4.4, GMM-Difference one step showed only two variables are positive and statistically significant to NPL, namely, lag (1) NPL (0.62%) and inflation (0.03%). All these variables are significant at 1% level of significant. However, the others variable is statistically important but in negative direction which is GDP (-229.30%) and DCRISIS (-0.2604) to NPL at 1% and 10% level of significant. Briefly, according to the value of coefficient of each variable, this analysis shows the NPL is strongly affected by inflation compare to the other variables.

ii. GMM-Difference two step
Contradict to the GMM-Difference two-step estimator result when all the variables are statistically significant to NPL. All variables are significant at 1 percent, except DCRISIS that is significant at 5 percent. The coefficient of lag (1) NPL is 0.55%, inflation is 0.062 percent, GDP is -427.86 percent, and DCRISIS is -0.5642. Similar as earlier analysis, this analysis also showed the NPL is strongly affected by inflation compare to the other variables, according to the value of coefficient.

4.5.2 GMM-System

Then, GMM-System one-step and two-step is conducted in this study. Thus, Column 4 and 5 in the Table 4.4 represents the result of the analysis. The discussion of the results is discussed in the next sub-section.

i. **GMM-System one step**

Clearly seen that from the GMM-System one step, the variables namely DCRISIS are affecting NPL in opposite direction to the theory. From the table, the coefficient of DCRISIS is -0.2001 at 10 percent level of significant, meaning that DCRISIS have negative relationship to NPL.

Whereas, lag (1) NPL, inflation and GDP influence NPL according to the theory. From the table, the coefficient value of lag (1) NPL is 0.6822, describe that, when 1 percent increase in lag (1) NPL will increase NPL by 0.6822%. Although, 1 percent increase in inflation led to 0.0090 percent rise in NPL, showed by the coefficient value,
Meanwhile, GDP have negative relation on NPL at 1 percent level of significant, with the correlation of -0.7065, it mean 1 percent increase in GDP caused 70.65 percent decrease in NPL.

ii. **GMM-System two step**

Distinguished, when the GMM-system two-step is carried out, it is found that lag (1) NPL and inflation are statistically significant to NPL at 1 percent level of significance. Meanwhile, GDP and DCRISIS are statistically significant to NPL at 5% and 10% level of significance respectively. Based on the table, the coefficient value of all variables are 0.5495 (lag (1) NPL), 0.0621 (inflation), -4.2303 (GDP), and -0.5599 (DCRISIS). It is clearly seen that variables namely DCRISIS affecting NPL in contrasts to the theory.

4.6 **Diagnostic Results**

The Table 4.5 represents two diagnostic result of the correctness of the instrument used in the GMM estimator for the dynamic model of NPL that has been modeled.

The first is test of identifying restrictions under the null hypothesis of the validity of the instrument is tested using a Sargan test (Arellano and Bond, 1991; Blundell and Bond, 1998). The chi-squared under the null is tested under asymptotically distributed. The Sargan test of over-identifying permits the instruments used in the first differenced GMM or in the GMM system. Table 4.5 shows the both Sargan test of GMM-difference
and GMM-System is statistically insignificant means that fail to reject the null hypothesis. Consequently, this is indicates that there is no serious problem with the validity of the instrument variables and the instrument used in the GMM-SYS estimation and previous do pass the test as well as consistent with the presence of measurement errors (Blundell and Bond, 1998).

The next test is the asymptotically standard normal distribution values AR (1) and AR(2) describes as tests of first and second order serial correlation in the first-differenced residuals. Essentially, Table 4.5 records the first-order autocorrelation AR (1) failed to rejects null hypothesis for both GMM difference and GMM system. Whereas, the second-order autocorrelation also failed to reject the null hypothesis, indicates the absence of autocorrelation. Furthermore, the validity of the first GMM difference and the GMM system is supported by the AR (1) and AR (2) test. As mentioned earlier, the absence of serial correlation in the error terms relates to the consistency of GMM system estimators. The obtainable estimations obviously seem to be consistent. The differenced residual is confirmed by non-existence of serial correlation and by significant negative first-order serial correlation and no second-order serial correlation.

Briefly, the fitting of GMM estimator estimated for dynamic model of NPL are is confirmed by the Sargan test and autocorrelation test. First-differencing presents AR (1) serial correlation after the time-varying component of the error term in levels is serially uncorrelated (Arellano and Bond, 1991; Blundell and Bond, 1998). Consequently, GMM estimator is reliable only when second-order correlation is insignificant even though first-
order correlation is significant. Once more, the first and second order serial correlations tests are all satisfied.

Table 4.4:
Regression result of Dynamic Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>GMM- DIFF</th>
<th>GMM- SYS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Onestep</td>
<td>Twostep</td>
</tr>
<tr>
<td>NPL (-1)</td>
<td>0.6199***</td>
<td>0.5451***</td>
</tr>
<tr>
<td></td>
<td>(0.04384)</td>
<td>(0.0720)</td>
</tr>
<tr>
<td></td>
<td>[14.14]</td>
<td>[7.57]</td>
</tr>
<tr>
<td>CPI</td>
<td>0.0300***</td>
<td>0.06245***</td>
</tr>
<tr>
<td></td>
<td>(0.0100)</td>
<td>(0.0157)</td>
</tr>
<tr>
<td></td>
<td>[2.99]</td>
<td>[3.97]</td>
</tr>
<tr>
<td>lnGDP</td>
<td>-2.2930***</td>
<td>-4.2786***</td>
</tr>
<tr>
<td></td>
<td>(0.6989)</td>
<td>(1.1774)</td>
</tr>
<tr>
<td></td>
<td>[-3.28]</td>
<td>[-3.63]</td>
</tr>
<tr>
<td>DCrisis</td>
<td>-0.2604*</td>
<td>-0.5642**</td>
</tr>
<tr>
<td></td>
<td>(0.1471)</td>
<td>(0.2509)</td>
</tr>
<tr>
<td></td>
<td>[-1.77]</td>
<td>[-2.25]</td>
</tr>
<tr>
<td>Constant</td>
<td>58.1029***</td>
<td>107.3116**</td>
</tr>
<tr>
<td></td>
<td>(17.6408)</td>
<td>(30.0923)</td>
</tr>
<tr>
<td></td>
<td>[3.29]</td>
<td>[3.57]</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.014</td>
</tr>
</tbody>
</table>

Note: The value in the () are standard error and the value [ ] are the t-stat, respectively. The *, ** and *** are 10%, 5% and 1% level of significant.
Table 4.5: Continue

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dynamic Model Panel Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GMM- DIFF</td>
</tr>
<tr>
<td></td>
<td>One step</td>
</tr>
<tr>
<td>Sargan test</td>
<td>0.9415</td>
</tr>
<tr>
<td>AR (1)</td>
<td>0.1066</td>
</tr>
<tr>
<td>AR (2)</td>
<td>0.9600</td>
</tr>
<tr>
<td>N</td>
<td>66</td>
</tr>
<tr>
<td>n</td>
<td>6</td>
</tr>
<tr>
<td>T</td>
<td>11</td>
</tr>
</tbody>
</table>

4.7 Granger Causality

The last step of this analysis is to test the direction of the causal relationship among the variables. Therefore, a pairwise Granger causality test is used to estimate the causal relationship among the variables. The test result of the Granger causality is presented in Table 4.6.

Table 4.6: Result Pairwise Granger Causality Test

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>F-Statistic</th>
<th>Prob.</th>
<th>Level of Significance</th>
<th>Sign</th>
<th>Causality</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCRISIS does Granger Cause INFLATION</td>
<td>10.5477</td>
<td>0.0002</td>
<td>1%</td>
<td></td>
<td>Two Way Causality</td>
</tr>
<tr>
<td>INFLATION does Granger Cause DCRISIS</td>
<td>6.55074</td>
<td>0.0030</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCRISIS does Granger Cause LNGDP</td>
<td>9.77137</td>
<td>0.0003</td>
<td>1%</td>
<td>(Bidirectional Causality)</td>
<td></td>
</tr>
<tr>
<td>LNGDP does Granger Cause DCRISIS</td>
<td>11.1592</td>
<td>0.0001</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFLATION does Granger Cause NPL</td>
<td>4.46863</td>
<td>0.0165</td>
<td>5%</td>
<td>One Way Causality (unidirectional Causality)</td>
<td></td>
</tr>
<tr>
<td>NPL does Granger Cause LNGDP</td>
<td>2.97110</td>
<td>0.0605</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPL does Granger Cause DCRISIS</td>
<td>3.34192</td>
<td>0.0436</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFLATION does Granger Cause LNGDP</td>
<td>3.88158</td>
<td>0.0272</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From Table 4.6 showed the results of causality analysis; indicate that there exists bidirectional causality between DCRISIS and Inflation, and DCRISIS and GDP at 1 percent level of significance. Moreover, there is also having unidirectional causality between Inflation and NPL, NPL and GDP, NPL and DCRISIS, and Inflation and GDP at 5 and 10 percent level of significance. Therefore, there exists no causality among remaining variables.

4.8 Discussion Finding

4.8.1 Inflation and Non-Performing Loan

The regression analysis for dynamic model shows that the impact inflation towards NPL is significance at 1 percent level of significance. The positive coefficient
estimate of inflation (0.0621) indicates a strong relationship between inflation and NPL. That means an increase in inflation rate; lead an increasing in NPL. This result was consistent with the findings of Fofack (2005), Pasha and Khemraj (2009); Louzis et al. (2012); and Azeem et al. (2012).

4.8.2 Gross Domestic Product and Non-Performing Loan

The coefficient estimate of GDP shown a negative and statistically significant relationship through NPL of ASEAN countries at 1 percent level of significance (p-value of 0.00). The magnitude of the coefficient estimate (-4.2303) indicates a strong inverse relationship between GDP and NPL. This infers that, an increase in the GDP, surely lead to a decrease in the probability that loans turn into default. This is due to the circumstance that, strong positive increasing in GDP usually transforms into additional income which recovers the debt servicing capacity of debtor (households and businesses). This result was in consistent with the findings of Salas and Saurina (2002); Nkusu (2011); Louzis et al. (2012); Azeem et al. (2012); Jakubík and Reinerger (2013); Idris and Nayan (2016); Sari et al (2017); and Gabeshi, (2017).

4.8.3 Global Financial Crisis and Non-Performing Loan

The regression analysis shows that the impact global financial crisis towards NPL is significance at 1 percent level of significance. The negative coefficient (-0.5599) estimate of dummy variable represent the global financial crisis indicates a strong inverse relationship with NPL. That means, when global financial crisis in year 2008-2009, the
NPL are decrease. This result was inconsistent with the findings of Collins and Wanjau, (2011); Vatansever and Hepsen (2013); Rono et al. (2014); and Latif et al. (2014).

This is because, global financial crisis 2008-2009 are happening in United States and spread to whole world especially Europe, the issue of NPLs has gained increasing because of the quick increased defaulting of sub-prime mortgage loans. Furthermore, that the spillover effects of the US subprime mortgage crisis on the Asian financial and real economic activity have been quite limited, and that the growing forecasts of Asian economies will continue robust. Asian financial institutions’ exposure to subprime-related products was limited due to three factors: (i) they were lagging behind global financial institutions in incorporating highly complex financial innovations into their business models; (ii) many of them were cautious in investing in high-risk, high-return instruments; and (iii) Central bank have strengthened prudential supervision and regulation and risk management practices in their respective financial sectors. In addition, Asian banks and non-bank financial institutions are basically comprehensive, with well-capitalized balance sheets, low NPL ratios (less than 5%), small exposure to real estate, and limited off-balance activities.

Table 4.7: Summary of Hypothesis Testing

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Hypothesis</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>To investigate the relationship between inflation and the non-performing loan in ASEAN Countries.</td>
<td>There is a significant relationship between inflation and non-performing loan.</td>
<td>Supported the theory</td>
</tr>
</tbody>
</table>
To determine the impact of gross domestic product on non-performing loan in ASEAN Countries. | There is a significant relationship between gross domestic products and non-performing loan. | Supported the theory |
---|---|---|
To examine whether global financial crisis (2008-2009) gives impact on non-performing loan in ASEAN countries. | There is a significant relationship between global financial crisis and non-performing loan. | Supported the theory |

### 4.9 Concluding Remarks

This chapter presents the results and findings of this study. Moreover, early of this chapter discusses the summary descriptive analysis of all variables and follow by explains in correlation. This chapter also reported the regression analysis for static model and dynamic Model (GMM model) and granger causality. Additionally, indicate the discussions of result for this study from the regression analysis. Lastly, this chapter shows the summary results of hypothesis in this study.
5.1 Introduction

This chapter consists of the whole presentation of this study from previous chapter. Section 5.2 presents the summary of findings in this study. While, in section 5.3 discusses on implications of the study. Section 5.4 identifies the limitation in this study. Lastly, in section 5.5 consists of conclusion with recommendation for the future research.

5.2 Summary of findings

In this study investigate the relationship of macroeconomic variable towards NPL in ASEAN countries. The data was collected from 6 countries which are developing countries in the world and the data was collected from the year 2005 to 2015. The sample 6 countries are Malaysia, Indonesia, Singapore, Thailand, Vietnam and Philippines. The main focus was to determine whether macroeconomic variable affect the NPL in ASEAN countries. The study finds that inflation, GDP and global financial crisis have relationships with the NPL in ASEAN countries.

The result for inflation is consistent with the studies by Fofack (2005); Pasha and Khemraj (2009); Azeem et al. (2012); Louzis et al. (2012); and Gabishsi (2017), which they conclude that inflation has positive relationship with NPL and significant. Moreover, the result also consistent with the financial accelerator theory (1989/1998), where
inflation will affect the default of loan. Furthermore, the regression coefficient shows that 1% increase in inflation will increase the NPL by 0.0621. So, if the NPLs decrease then the volume of inflation will decrease. Thus, higher inflation can create debt servicing easier through reducing the real value of outstanding loans particularly once the loan rates are fixed. However, it can also weaken some borrower’s ability to service debt by decreasing real income.

The result for GDP in consistent with the studies by Nkusu (2011); Azeem et al. (2012); Louzis et al. (2012); Jakubík and Reinnerg (2013); Idris and Nayan (2016); Sari et al. (2017); and Gabeshi (2017) which they conclude that GDP has negative relationships with NPL and also significant. Moreover, the result indicates the regression coefficient shows the direction of GDP to NPL is opposite with the value of elasticity is 4.2303. So, when the numbers of GDP increase then surely led to a decrease in the probability that loans turn into default. Basically, the strong positive increasing in GDP usually transforms into additional income which recovers the debt servicing capacity of debtor (households and businesses).

The result for global financial crisis is inconsistent with the studies by Collins and Wanjau (2011); Vatansever and Hepsen (2013); Rono et al., 2014; and Latif et al. (2014) which they conclude that global financial crisis have positive relationship with NPL. In this study, the result show that there are negative relationship and significant between global financial crisis and NPL in ASEAN countries. That means, when global financial crisis in year 2008-2009, the NPL are decrease. Thus, it because the spillover effects of the US subprime mortgage crisis on the Asian financial and real economic activity have
been quite limited, and that the growing forecasts of Asian economies will continue strong. In addition, ASEAN banks and non-bank financial institutions are basically comprehensive, with well-capitalized balance sheets, low NPL ratios (less than 5%), small exposure to real estate, and limited off-balance activities.

5.3 Implications of study

There is valuable information and implication provides for policymakers to look insight from this study. Policymaker should focus and reengineering the institutions together with these indicators could reduce the probability of NPLs in bank of ASEAN countries. Specially, commercial banks need to consider the performance of the real economy when extending loans given the reality that NPLs are expected to be lower during the periods of economic growth. Moreover, Central Banks are noticeably tightens up their lending standards, foremost to having better quality loans on their balance sheet over time. Central bank also should introduce policies that can have controlling effects on inflation.

For the government side, it calls the national treasury to certify fiscal prudence in spending with the need to apply the effective fiscal policy that will promote economic growth. This will go long way in contributing to measures geared towards lowering loan defaults and ultimately lowering the NPLs.
In addition, bank also should take part to reduce the NPL in their bank. The bank must strictly know their customers before granting loans to them, in fact adhering strictly to the 5C’s (capital, collateral, conditions, characteristic, and capability) of credit in modern banking practice. Banks can consider collateral as major factor for assessing loan application in all conditions and hence, providing appropriate focus for factors such as repayment capacity of the client, the feasibility of the project and the experience of the management of the company in credit approval process could improve the quality of their loan portfolios.

5.4 Limitations

There are several limitations in this study. The limitation is on the data collection. The data has collected from each ASEAN countries and each bank’s annual report from year 2005 to 2015; it is difficult to get full data from every bank for every country. This is because some of central bank for ASEAN countries is not provide the data for NPL and others variable.

Secondly, the limitation in this study is limited for financial institutions and only focuses in banking sector. Then, the limitation is due to the time constrained for this study, is covered only period from 2005 until 2015. Generally, get a more comprehensive conducted then the better results can be obtains.
5.5 **Recommendations and Future Research**

There are several recommendations for future research. Firstly, it would be interesting to study the relationships between macroeconomic variables and NPL in emerging countries and developed countries. It might be different or same impact between emerging countries and developing countries.

Secondly, the researcher can extend length of the period to get a better result. Besides, the researcher can expand their study not only focuses in financial institutions. They will cover the non-financial institutions.

In additional, the researcher also can use other method such as panel Vector Auto Regression and use another macroeconomic variable such as unemployment to study the relationship between macroeconomic variable and NPL in ASEAN countries. Moreover in the future the researcher can study the effect of Asian financial crisis (1999) in NPL of ASEAN countries.

5.6 **Conclusion**

In this study conclude that inflation, GDP and global financial crisis significantly affect NPLs. The results indicate a statistically positive relationship between inflation and NPLs. These findings are parallel to Fofack (2005); Abid et al. (2014); and Gabeshi (2017). Moreover, GDP is statistically significant inverse relationship towards NPLs. This finding is consistent with the findings of Idris and Nayan (2016); Gabeshi (2017).
However, global financial crisis is indicated a statistically negative relationship towards NPL, this finding are not parallel to previous studies from Vatansever and Hepsen (2013); and Latif et al. (2014).

In the area of policy implications, there should focus and reengineering the institutions together with these indicators could reduce the probability of NPLs in bank of ASEAN countries. Specially, commercial banks need to consider the performance of the real economy when extending loans given the reality that NPLs are expected to be lower during the periods of economic growth. Moreover, Central Banks are noticeably should tighten up their lending standards, remarkable to having better quality loans on their balance sheet over time. Central bank also must introduce policies that can control effects on inflation.
REFERENCES


### APPENDIX 1

**REVIEW OF RELATED LITERATURE**

<table>
<thead>
<tr>
<th>No</th>
<th>Author (Year)</th>
<th>Country/ Data Frequency</th>
<th>Variable used</th>
<th>Model/ Method of Estimation</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gabeshi (2017)</td>
<td>Albania/ Quantitative/ Time series</td>
<td>NPL, GDP, Inflation and exchange rate (Euro/Lek)</td>
<td>OLS</td>
<td>The result show that increase in inflation, exchange rate (Eur/Lek), will increase the NPL ratio and an increase in GDP will decrease the NPL ratio.</td>
</tr>
<tr>
<td>2</td>
<td>Hajja, et al. (2017)</td>
<td>Malaysia/ Quantitative/ Time series</td>
<td>NPL, GDP growth, lending interest rate, inflation and money supply</td>
<td>GMM and vector auto regression (VAR)</td>
<td>The result shows that GDP growth, lending interest rate and money supply have positive relationship with NPL. Meanwhile for inflation there is negative relationship between NPL.</td>
</tr>
<tr>
<td>3</td>
<td>Idris and Nayan (2016)</td>
<td>Organization of the Petroleum Exporting Countries (OPEC)/ Quantitative/ Panel Data</td>
<td>NPL, oil price volatility, environmental risk, real GDP, inflation, lending interest rate and unemployment rate</td>
<td>Fixed Effect</td>
<td>The results indicated a statistically significant inverse relationship between oil price volatility, GDP and NPLs whereas the relationship is statistically positive between environmental risks, unemployment and NPLs. Meanwhile for inflation and lending interest rate are not significant.</td>
</tr>
<tr>
<td>4</td>
<td>Ghosh (2015)</td>
<td>US States / Quantitative/ Time series</td>
<td>NPL, Real GDP, state housing</td>
<td>Fixed effects and GMM</td>
<td>The findings show that higher state real GDP and real</td>
</tr>
<tr>
<td></td>
<td>Authors</td>
<td>Location/Model</td>
<td>Equation &amp; Variables</td>
<td>Method</td>
<td>Findings</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>----------------</td>
<td>----------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>5</td>
<td>Abid et al (2014)</td>
<td>Tunisia/Quantitative/Time series</td>
<td>DV: NPL IV: GDP, inflation, interest rates</td>
<td>GMM</td>
<td>The findings show that macroeconomic variables, precisely the real GDP growth rate, inflation rate and the real lending rate have an effect on the level of NPLs.</td>
</tr>
<tr>
<td>6</td>
<td>Makri et al. (2014)</td>
<td>Eurozone countries/Quantitative/Panel Data</td>
<td>DV: NPL IV: growth GDP, public debt of gross domestic product, unemployment</td>
<td>GMM</td>
<td>The findings reveal strong correlations between NPL and various macroeconomic (public debt, unemployment, growth rate of GDP)</td>
</tr>
<tr>
<td>7</td>
<td>Castro (2013)</td>
<td>Greece, Ireland, Portugal, Spain and Italy (GIPSI)/Quantitative/Panel data</td>
<td>DV: NPL (credit risk) IV: GDP growth, unemployment rate, share price, interest rate, credit growth, real exchange rate, financial crisis</td>
<td>GMM</td>
<td>The findings show that the credit risk increases when GDP growth and the share price indices decrease and rises when the unemployment rate, interest rate, and credit growth increase; it is also positively affected by an appreciation of the real exchange rate; moreover, a substantial increase in the credit risk during the recent financial crisis</td>
</tr>
<tr>
<td>Period</td>
<td>Author(s)</td>
<td>Region</td>
<td>Methodology</td>
<td>DV: NPL</td>
<td>IV:</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>--------</td>
<td>-------------</td>
<td>---------</td>
<td>-----</td>
</tr>
<tr>
<td>8</td>
<td>Messai and Jouini (2013)</td>
<td>Italy, Greece, and Spain</td>
<td>Quantitative/ Panel data</td>
<td>NPL</td>
<td>GDP growth, unemployment rate and real interest rate</td>
</tr>
<tr>
<td>9</td>
<td>Klein (2013)</td>
<td>Central, Eastern and South Eastern Europe (CESEE)</td>
<td>Quantitative/ Panel Data</td>
<td>NPL</td>
<td>credit the private sector to-GDP ratio, real GDP growth, unemployment rate, inflation rate</td>
</tr>
<tr>
<td>10</td>
<td>Roziela et al. (2013)</td>
<td>Asian Pacific region</td>
<td>Quantitative/ Panel Data</td>
<td>NPL</td>
<td>interest rate, inflation and economic growth (GDP)</td>
</tr>
</tbody>
</table>
## APPENDIX 2

### DESCRIPTIVE STATISTIC

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>npl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N = 66</td>
</tr>
<tr>
<td>overall</td>
<td>3.580136</td>
<td>2.621471</td>
<td>.757</td>
<td>14.4</td>
<td></td>
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<tr>
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<td>1.306226</td>
<td>1.601455</td>
<td>4.958909</td>
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<td>n = 6</td>
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<tr>
<td></td>
<td>2.329889</td>
<td>.5062273</td>
<td>13.02123</td>
<td>11</td>
<td>T = 11</td>
</tr>
<tr>
<td>cpi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N = 66</td>
</tr>
<tr>
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<td>101.0796</td>
<td>16.96154</td>
<td>59.92583</td>
<td>144.9061</td>
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<tr>
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<td>99.35118</td>
<td>104.213</td>
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<td>n = 6</td>
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<tr>
<td></td>
<td>16.8909</td>
<td>56.79252</td>
<td>141.7728</td>
<td>11</td>
<td>T = 11</td>
</tr>
<tr>
<td>lngdp</td>
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<td></td>
<td></td>
<td></td>
<td>N = 66</td>
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<tr>
<td>overall</td>
<td>26.2372</td>
<td>.614342</td>
<td>24.77736</td>
<td>27.54532</td>
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<tr>
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<td>25.46919</td>
<td>27.15594</td>
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<tr>
<td></td>
<td>.334942</td>
<td>25.46006</td>
<td>26.75708</td>
<td>11</td>
<td>T = 11</td>
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<td>dcrisis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N = 66</td>
</tr>
<tr>
<td>overall</td>
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<td>.3886502</td>
<td>0</td>
<td>1</td>
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<tr>
<td>between</td>
<td>3.04e-17</td>
<td>.1818182</td>
<td>.1818182</td>
<td></td>
<td>n = 6</td>
</tr>
<tr>
<td></td>
<td>.3886502</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>T = 11</td>
</tr>
</tbody>
</table>
APPENDIX 3

RESULT: PANEL ORDINARY LEASE SQUARE

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>Number of obs = 66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>92.092923</td>
<td>3</td>
<td>30.697641</td>
<td>F(  3,    62) = 5.37</td>
</tr>
<tr>
<td>Residual</td>
<td>354.594362</td>
<td>62</td>
<td>5.7192639</td>
<td>Prob &gt; F = 0.0024</td>
</tr>
<tr>
<td>Total</td>
<td>446.687285</td>
<td>65</td>
<td>6.87211207</td>
<td>R-squared = 0.2062</td>
</tr>
</tbody>
</table>

| npl | Coef. | Std. Err. | t    | P>|t| | [95% Conf. Interval] |
|-----|-------|-----------|-----|-----|---------------------|
| cpi | -0.0610672 | 0.0197215 | -3.10 | 0.003 | -0.1004898 to -0.0216445 |
| lngdp | -0.5110564 | 0.5383959 | -0.95 | 0.346 | -1.587294 to 0.5651816 |
| dcrisis | -0.7131984 | 0.7757363 | -0.92 | 0.361 | -2.263873 to 0.8374764 |
| cons | 23.29115 | 13.39302 | 1.74 | 0.087 | -3.481117 to 50.06341 |
### APPENDIX 4

**RESULT: RANDOM EFFECT**

Random-effects GLS regression

| Coef.   | Std. Err. | z     | P>|z|  | [95% Conf. Interval] |
|---------|-----------|-------|------|----------------------|
| npl     | 0.0137957 | 0.0227179 | 0.61 | 0.544    | -0.0307305    .0583219 |
| cpi     |          |        |      |          | -4.543519   1.023266    -4.44   0.000    -6.549085   -2.537954 |
| lngdp   |          |        |      |          | -0.7534932   .6051549    -1.25   0.213    -1.939575    .4325886 |
| dcrisis |          |        |      |          | 121.5319   25.08645    4.84   0.000     72.36338    170.7005 |

| sigma_u | 1.1709538 |
| sigma_e | 1.3253233 |

rho | 0.43839569  (fraction of variance due to u_i)
APPENDIX 5

RESULT: FIXED EFFECT

<table>
<thead>
<tr>
<th>Fixed-effects (within) regression</th>
<th>Number of obs = 66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group variable: country</td>
<td>Number of groups = 6</td>
</tr>
</tbody>
</table>

R-sq: within = 0.7163
between = 0.0333
overall = 0.0256

Obs per group: min = 11
avg = 11.0
max = 11

F(3, 57) = 47.96
Prob > F = 0.0000

corr(u_i, Xb) = -0.9308

| npl | Coef.  | Std. Err. | t    | P>|t|  | [95% Conf. Interval] |
|-----|--------|-----------|------|-----|----------------------|
| cpi | 0.1327 | 0.02218   | 5.98 | 0.000 | 0.0883001 - 0.1771171 |
| lngdp | -11.172 | 1.1184 | -9.99 | 0.000 | -13.41177 - 8.932605 |
| dcrisis | -0.8519 | 0.4302 | -1.98 | 0.053 | -1.713442 - 0.009665 |
| _cons | 283.45 | 27.3604 | 10.36 | 0.000 | 228.6596 - 338.236 |

sigma_u | 6.7526
sigma_e | 1.3253
rho | 0.9629
(fraction of variance due to u_i)

F test that all u_i = 0: F(5, 57) = 28.98
Prob > F = 0.0000
APPENDIX 6

RESULT: LM AND HAUSMAN TEST

Lagrangian Multiplier Test

\[ npl[\text{country},t] = Xb + u[\text{country}] + e[\text{country},t] \]

Estimated results:

<table>
<thead>
<tr>
<th>Var     sd = sqrt(Var)</th>
</tr>
</thead>
<tbody>
<tr>
<td>---------+-----------------------------</td>
</tr>
<tr>
<td>npl</td>
</tr>
<tr>
<td>e</td>
</tr>
<tr>
<td>u</td>
</tr>
</tbody>
</table>

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

\[ \text{chibar2}(01) = 12.31 \]

\[ \text{Prob} > \text{chibar2} = 0.0002 \]

Hausman Test

<table>
<thead>
<tr>
<th>------ Coefficients ------</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
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<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>cpi</td>
</tr>
<tr>
<td>lngdp</td>
</tr>
<tr>
<td>dcrisis</td>
</tr>
</tbody>
</table>

\[ \text{chi2}(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) \]

\[ = 215.33 \]

\[ \text{Prob} > \text{chi2} = 0.0000 \]

\( (V_b-V_B \text{ is not positive definite}) \)
APPENDIX 7

RESULT: GRANGER CAUSALITY

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFLATION does not Granger Cause NPL</td>
<td>54</td>
<td>4.46863</td>
<td>0.0165</td>
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<td>NPL does not Granger Cause INFLATION</td>
<td>2.16571</td>
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<tr>
<td>LNGDP does not Granger Cause NPL</td>
<td>54</td>
<td>1.53953</td>
<td>0.2247</td>
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<tr>
<td>NPL does not Granger Cause LNGDP</td>
<td>2.97110</td>
<td>0.0605</td>
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</tr>
<tr>
<td>DCRISIS does not Granger Cause NPL</td>
<td>54</td>
<td>0.94261</td>
<td>0.3966</td>
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<tr>
<td>NPL does not Granger Cause DCRISIS</td>
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<td>0.0436</td>
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<tr>
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<td>0.8218</td>
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<tr>
<td>INFLATION does not Granger Cause LNGDP</td>
<td>3.88158</td>
<td>0.0272</td>
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<tr>
<td>DCRISIS does not Granger Cause INFLATION</td>
<td>54</td>
<td>10.5477</td>
<td>0.0002</td>
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<tr>
<td>INFLATION does not Granger Cause DCRISIS</td>
<td>6.55074</td>
<td>0.0030</td>
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<tr>
<td>DCRISIS does not Granger Cause LNGDP</td>
<td>54</td>
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<td>LNGDP does not Granger Cause DCRISIS</td>
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<td>0.0001</td>
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</tr>
</tbody>
</table>