# THE IMPACT OF CAPITAL FLOW ON GROWTH AND PROBABILITY OF RECESSION

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## DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is **17,406** words.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| CEE | Central and Eastern European |
| CKA | Cumulative Capital Flow |
| CKA_NGDP | Cumulative Capital Flow as a share of nominal GDP |
| DLRGDP | Log Real Gross Domestic Product |
| EU | European Union |
| FDI | Foreign Direct Investment |
| FEM | Fixed Effect Model |
| GDP | Gross Domestic Product |
| IFS | International Financial Statistics |
| IMF | International Monetary Fund |
| INST | Institutional Quality |
| KA | Capital Account |
| LEXR | Real Effective Exchange Rate |
| LM | Lagrange Multiplier |
| M2_NGDP | M2 as a share of nominal GDP |
| NGDP | Nominal GDP |
| OLS | Ordinary Least Square |
| REM | Random Effect Model |
| RER | Real Exchange Rate |
| RESID | Residual |
| RUS | U.S. Interest Rate |
| TFP | Total Factor Productivity |

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# PREFACE

This research project is submitted in partial fulfillment of the requirement for the degree of Bachelor of Economics (HONS) Financial Economics in University Tunku Abdul Rahman (UTAR). This research paper is conducted under the supervision of Dr. Wong Chin Yoong. This study provides an extensive explanation of our topic to enable us to move towards our project's goals.

The topic for this research is "The impact of capital flow on growth and probability of recession." Our study mainly consists of two parts where we first study the impact of capital flow on growth and we want to see how or though what ways can capital flow affect growth through different channels. We took into account the roles of our four interactive variables which are institutional quality, exchange rate, financial market and the US interest rate. We want to see how capital flow can affect the growth of the economy when taking into account the roles of these interactive variables. We then see how this can bring us a possible recession in the near future.

Initially, this study started with the brief introduction about our topic and followed by the reviewing of the journals from past researchers. Then, we adopt Eviews 9 as an effective tool to compute our data with the supporting of relevant frameworks or models to prove the robustness of our result. Lastly, we ended our study with the overall results, implications, recommendations and limitations.

## Abstract

The purpose of this study is to investigate the relationship between capital flow and economic growth and through what channels does capital flow influence the growth. Meanwhile, we also aim to forecast the probability of the recession. This study consists of data from 30 sample countries from 2007 to 2011, using quarterly data. There are four interactive variables in total which includes the interaction between capital flow and institutional quality, exchange rate, financial market, and U.S interest rate. We applied pooled OLS, Fixed Effect Model (FEM), Random Effect Model (REM) to compare and analyze the significance of the variables on growth. While Probit and Logit model were used to predict for the probability of the recession. In overall, we found out that there is positive relationship between capital flows and growth once important factors are controlled. In other words, cumulative net capital inflow does cause growth. Cumulative capital flow is found to raise the probability of recession. However, there are adverse impacts on the probability of recession are seen to be diminishing with better institutional quality and stronger and more stable exchange rate. Lastly, this study can be useful information for the government and investors to anticipate on the future economic conditions.

# Chapter 1: Research Overview

## 1.0 Introduction

This chapter highlights the research background, problem statements, research objectives, research questions, hypotheses of the study and significance of study. The layouts for the following chapters are also included together with the conclusion for this chapter.

## 1.1 Research Background

Let's recall what happened during the Asian Financial Crisis in 1997 to 1998. Before the Asian Financial Crisis, Asian countries such as Thailand, Malaysia, Indonesia, Singapore, Hong Kong, Indonesia and South Korea have the most magnificent economic growth rate. However, this came to an end when Asian Financial Crisis struck.

During those days, large capital inflow is related to the credit boom. The capital inflow to Asian countries is large because a big portion of the capital inflows was due to the borrowing from bank which means that it was an inflow of bank credit but not a direct investment except for the case of China. Most of the capital inflow in China was mainly in the form of foreign investment instead of borrowings from bank. These countries funded their investments by borrowing funds in U.S. dollar. They imported massive amount of capital equipment and raw material for their production of domestic goods from overseas. Due to the growing import, the Asian countries has experienced current account deficit. For instance, Indonesia has a current account deficit of 3.5 %, Thailand was 8.1% and Malaysia with 5.9 %.

These were the countries that experienced a larger capital deficit. On the other hand, other Asian countries such as China, Singapore and Taiwan experienced current account surpluses. Singapore has a current account surplus of 16%, China with relatively small surplus averaging 1% and Taiwan with 4.5% (Corsetti, Pesenti & Roubini, 1999).

With increasing current account deficit in the countries which are already suffering current account deficit, it becomes harder for the respective countries' governments to peg their currencies against the U.S. dollar. If these countries fail to peg their currencies, their currency will depreciate which subsequently increases the borrowing cost and rate of debt default. This is what happened to Thailand as their currency devalued in relative to U.S. dollars. They were unable to pay back their debts. The situation has worsen with the speculative attacks on Thai Baht (Hill, n.d.). The event happened in Thailand has then developed into banking and balance of payment crisis. Investors and creditors start to withdraw their investments and funds from the country and the crisis spread. Subsequently, Malaysia, Indonesia, South Korea, Philippines also experienced large depreciation in their currency. Whereas countries that has current account surplus earlier like Singapore, China and Taiwan only experienced a small depreciation in their currency.

Eventually, slowdown of capital flow or capital reversal happened and growth decline promptly. Banks were pressured, investments fell sharply and some countries even get into deep recessions (Carson & Clark, 2013). Countries with current account surplus are unlikely to experience capital reversal and vice versa.

On the other hand, we noted the impact of capital inflow on growth in Central and Eastern European (CEE) countries. CEE countries including the Czech Republic, Hungary, Poland, Romania, Slovenia, and other seven countries have gained a huge amount of capital inflow after joining the EU. The purpose of capital inflows to CEE countries is known as catching-up process which is aimed to support CEE countries financially in order to improve their economic condition. As we know, capital inflows has a positive relationship with growth. Countries are able to promote growth when there are more capital inflow.

The Impact of Capital Flow on Growth and Probability of Recession.

The structure of capital inflow into CEE countries is divided in three major sectors which are banking sector, real estate & construction, and manufacturing & business services (Bogumil, 2014). The capital inflow to these sectors have their respective purposes. To finance mortgages and consumption credit, capital inflow to the banking sector is able to achieve this goal. By offering more loans to the public, it will increase the consumption and stimulate growth. Putting capital into real estate and construction sector, the housing investment increased because there were more capital that supported the construction process. Similarly, a developed and potential profitable housing investment attracts more capital inflow to the countries. To strengthen the countries' export capacities, capital inflow is needed in manufacturing and business sector as it is able to increase the equipment and machines used to produce goods and services. When outputs are produced, it indicates that outputs are able to meet the demand in the market, at the same time it also encourages export output to other countries and earn more income.

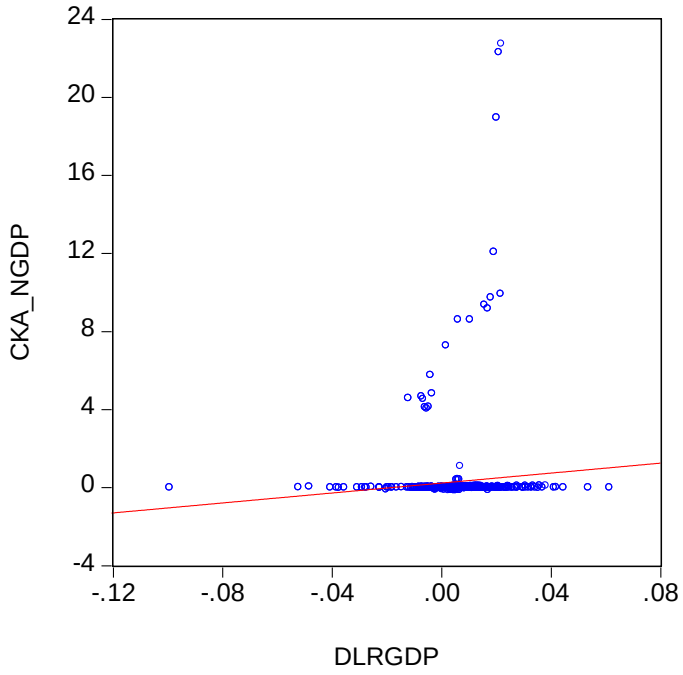
With the help from the EU by financing CEE countries, it seems to be an effective and smooth plan in helping CEE countries to improve their economic condition. However this may not be a good sign if there is capital reversal. For instance, when countries consistently receiving capital from other countries, the capital recipient countries will face troubles since capital inflows are their main source of funds to improve their economic condition if there is a sudden stop. In this case, high domestic consumption through borrowing, high reliant on export and capital inflows and low government savings are the symptoms of entering into financial crisis (World Bank, 2014). When countries solely rely on the capital inflows contributed by other countries, the capital recipient countries will be hurt if there are capital reversal.

People used to think that more capital inflow will promote growth but what occurs in the event mentioned above is that the sudden pull out of capital flow caused the whole regime to enter into recession. Thus, this brings the question does capital flow promote growth and bring in recession.

The Impact of Capital Flow on Growth and Probability of Recession.

We have studied the relationship of capital flow and growth on 30 countries including 15 developed countries and 15 developing countries using quarterly data starting from January 2007 to December 2011.

Figure 1.1: Relationship of Capital Flow and Growth




Source: International Financial Statistics and World Bank Indicator.

The scatter plot above explain the relationship of capital flow and growth in both developed and developing countries (see figure 1.1). It implies a positive relationship of capital flow and growth since the regression line is upward sloping shown by the red line in Figure 1.1. Positive gradient of the regression lines signifies that as the capital flow in both developed and developing countries increases, so does growth. On the other hand, as the capital flow in both developed and developing countries decreases, the economic growth in both developed and developing countries also decreases. Since both capital flow and growth are positively correlated, we used the effect of capital flow on growth to predict the probability in occurrence of recession. Besides, we also included additional four interactive variables which

are institutional quality, exchange rate, financial market and U.S. interest rate to study how they affect capital flow respectively.

## 1.2 Problem Statement

Capital flows has been seen as one of the important factors which contributed to the economic growth. We can see that from the events in the 1990s, several countries have experienced financial crises when there was an increased international capital flows (International Monetary Fund [IMF], 2001). This has caused us doubts on the ability of capital flows to stimulate long-run growth in developing economies. Therefore, when the market situation gets volatile and unpredictable, we tend to have the fear of facing a potential recession. In this study, we try to research the interaction between capital flow and growth while seeing how or through what ways capital flow affects the probability of recession. In other words, we study how capital flows could affect growth and to see if the effects of it would cause us to enter into a recession. We want to see how or through what ways capital flow could affect the probability of recession. We did this by taking into account the role of the institutional quality, exchange rate, financial market and the US interest rate that influences the changes in the capital flow thus seeing how these variables could potentially change how capital flow affects growth.

## 1.3 Research Objectives

### 1.3.1 General Objective

To investigate the impact of capital flow on economic growth and probability of recession using sample range from 2007 till 2011.

### 1.3.2 Specific Objectives

1. To study the impact of capital flow towards economic growth.
2. To examine the interactive relationship between capital account and institutional quality.
3. To examine the interactive relationship between capital account and exchange rate.
4. To examine the interactive relationship between capital account and financial market.
5. To examine the interactive relationship between capital account and U.S. interest rate.

## 1.4 Research Questions

1. What is the impact of capital flow on economic growth?
2. Through what channels the impact of capital flow on growth is moderated or propagated?

## 1.5 Hypothesis of the Study

1. We hypothesize that capital inflow would promote growth while capital outflow would drag down growth rates.
2. Capital flow would have a stronger impact on growth if institutional quality is better.
3. Capital flow would have a stronger impact on growth if the exchange rate is stronger and better.
4. Capital flow would have a stronger impact on growth if there is a better financial market.
5. Capital flow would have an adverse impact on growth if there is a higher US interest rate.

6. Through the channels of institutional quality, exchange rate, financial market and US interest rate, capital flow would have a stronger impact on the probability of recession.

## 1.6 Significance of the Study

This research covered the studies on two main investigations which comprises the influence of international capital flows on economic growth and the other variables that can significantly affect capital flows by taking 30 developed and developing countries equally within 2007 and 2011.

In the previous studies, most of the literature were **inconclusive** for the causality relationship between capital flows and economic growth. Bailliu (2000) proposed that capital flows will cause adverse impact on the countries which found to be weak in banking industry. The reason behind the fact is due to the slow development progress in financial sector as well as the inappropriate policies imposed by government that leads to moral hazard problem. Yet, Garita (2009) has proved that one of the components of capital inflows, which is foreign direct investment (FDI) yielded positive impact on total factor productivity (TFP) regardless in advanced or emerging countries. In other words, the inflows of FDI have indirectly stimulated the growth through the increase in TFP.

When it comes to the aspect of crises, Aizenman, Jinjarak and Park (2011) pointed out that among the three main capital flows, FDI is the only prominent capital inflows which ensures the robustness and positive result in growth. Whereas the relationship between portfolio equity and growth seems insignificant and volatile, but for short term debt, it seems to be negatively correlated with growth. The author also highlighted that the negative impact will be even severe for those countries with poor institutional system. Hartwell (2012) also mentioned that although with the higher degree of liberalization will mitigate the negative outcome derived from financial crises, the institutional quality acts as the most important

role in order to minimize the effect. Nevertheless, the past studies were associated with the relevant case and facts but without extensive explanation on how to resolve the issues.

Instead, our research project clarified both the relationship between capital flow and growth as well as the probability of recession. Throughout the research, we can know exactly whether capital flow plays a crucial role as an influencing factor towards growth and under what circumstances the effects of the capital flow on growth can be amplified or minimized. As capital flow itself consists of different components, it is important to identify whether the capital inflow positively or negatively stimulate the economic growth and thus further investigate whether the capital flow can cause higher probability of recession. We anticipate or forecast whether the crisis is going to happen again in these recent years by taking into account the capital flow to measure the economic growth. As we found that capital inflows may not necessarily enhance growth, we can check how significant it is for an economy, meanwhile we can get to know whether it will trigger recession. In order to predict more precisely, we cover the time series which include the presence of global financial crisis that occurred within 2007 and 2011 to get a rough idea on the changes in economic progress before and after the crisis occurred in different countries.

Besides, our research also identified how and through what channels the capital flow can influence growth. The capital flow itself can definitely affect the economic growth till certain extent, but our research further examined the possible impacts of capital flow on growth by considering the interaction of capital flow with other variables. The variables included in our research are institutional quality, exchange rate, financial market, and U.S interest rate respectively. For instance, the capital flow can enhance growth when capital flow interacts with better institutional quality, on the other hand cause an adverse impact on growth when capital flow interacts with weak institutional quality. By taking into account the four interactive variables, we can obtain more information regarding the effect of capital flow on growth through different channels. We will probably know the criteria or characteristics that must be fulfilled by a country in order to attract the capital inflows, and at the same time we also get to know the reasons of capital flow benefits or harms that particular country.

Lastly, our research can provide signals for the policy-makers, financial institutions and investors to deal with issues promptly as they have better understanding on the impact of capital flow on growth and the probability of recession. With the useful information, government can establish appropriate policies whereas financial institutions can give advice on how to improve the economic growth and minimize the risks from recession. For instance, government can strengthen the law and relevant policies, banking sectors can better allocate the funds into productive investment, investors can diversify their risks wisely and so forth.

Furthermore, the emerging countries which have insufficient capacity to absorb huge amount of capital inflow can find alternative ways to spur their economic growth rather than highly dependent on advanced countries in order to be less affected by the contagious effect of recession.

## 1.7 Chapter Layout

The flow of this research were laid accordingly. Chapter 1 provides an overview for the framework of the research, following by Chapter 2 which summarize the review on the past studies and theoretical models that were linked with the research. Next is Chapter 3 which presented the dataset and methodology that were used. Then, Chapter 4 revealed the empirical result attached with the interpretation in details. Lastly, Chapter 5 draws a conclusion as the ending of the whole research project.

## 1.8 Conclusion

The research background and brief history of the growth and capital flow have been discussed. Problem statements, research objectives, research questions and significance of this study were well addressed. Hypotheses were mentioned before significance of this study.

# Chapter 2: Literature Review

## 2.0 Introduction

In this chapter, we review a number of previous studies from different authors which are relevant to our variables to absorb more knowledge in order to ensure the subsequent research run smoothly. The variables which we have selected in our study include capital flow, and the interaction of capital flow with institutional quality, exchange rates, financial market and U.S interest rate.

## 2.1 Review of Theoretical Model

In the late 1980's, there was much discussion that capital account should be opened up to allow the capital to flow across countries in order to generate growth and productivity in a country. Capital openness affects the growth of a country such that an inflow of capital flow would spur growth while outflow of capital would discourage growth. The Lucas Paradox says that "capital does not flow from areas of concentration to areas of scarcity, despite the theoretical possibility of higher returns" (Shell, n.d.). When we assume that there is free trade and competitive market, holding all other factors constant, capital is supposed to flow to countries that are poorer until the capital-labour ratios are equalised (Lucas, 1990). According to a standard neoclassical theory as said by Okada (2012), a production function will have a decreasing return to scale which would theoretically cause the capital to flow from richer countries to poorer countries. However, the truth is, the capital actually flows the other way around, where the flow to developed countries is actually greater (Okada, 2013). In this

modern day and age, we want to see how capital flow can affect the growth of a country in comparison to the economic theories.

## 2.2 Review of Literature

### 2.2.1 Capital flow and growth

Generally, there is no fixed effect of capital flows on economic growth. According to common textbook economic theory, it is said that capital inflows should promote growth as capital flows towards economies with better investment opportunities that has better source of technological spillovers. However, as time went by, we can see that there is a robust association between growth and capital flow. Capital flows can yield both positive and negative effect on economic growth. Prasad, Rajan and Subramanian (2007) and Gourinchas and Jeanne (2013) show that there is a positive and significant relationship between the growth and capital flow. Net capital inflow is significant to productivity growths. Gourinchas and Jeanne (2013) further explained that capital should flow into developing countries which have Total Factor Productivity that is equivalent to the world frontier but should flow out of countries with low Total factor productivity. Thus, international capital markets should allocate their resources to the countries that are more productive than the rest of the world. They followed up saying that countries that receives more capital flows grows faster. Previous studies have shown that FDI is the most contributed factors to economic growth among other types of capital flows. By referring to Choong, Baharumshah, Yusop and Habibullah (2010), foreign direct investment (FDI) is positively correlated with economic growth.

Developed countries will obtain more benefits from capital inflows compared to developing countries. According to Soto (2003), private capital flows regardless of domestic or foreign can definitely spur economic growth for developed nations which possess with good characteristics in different aspects. Mello (1997) and Borensztein, Gregorio, Lee (1998)

pointed out that a positive outcome can be generated as long as the countries have the ability to capture the huge amount of capital inflows. As for poor and low savings economies, recent empirical findings show that there is a significant negative effects of capital flows on growth (Gente, Ledesma & Nourry, 2015).

Ultimately, the relationship between capital flow and growth can only show a clearer picture when factoring in other variables that influences the capital flow. These other factors include the institutional quality, exchange rate, financial market and the U.S. interest rate. By looking at these factors, we can see how these interactive variables affect the capital flow which in turn has effect on the growth.

### 2.2.2 Institutional Quality

There have been numerous researches on the institutional quality that affects capital flows which in turn affects growth. Okada (2013) says that that a country with good institutional quality will have international capital inflows whereas a country with poor institutional quality will have lesser or even a hindrance of international capital inflows. It is expected when a country with good capital flow would be more financially open thus have an increase in international capital inflows. This surge of capital inflow will then generate growth in the country. This is confirmed by Tornell and Velasco (as cited by Okada, 2013) saying that better institutions prompt capital flows. The proxy for institutional quality can be political institutions, economic and legal (Fratzscher, 2012; Shell, n.d.).

When facing crisis, institutional quality plays a big role towards the flow of capital flow. According to Fratzscher (2012) it is said that countries with good institutions and strong macroeconomic basis may be less likely to face sharp capital flow reversals during the crisis. This means that during crisis periods where growth is substantially low, the adverse effects of capital flow reversals will be lesser. It then went on explaining that better institutions and fundamentals may be important as an insulant against negative external shock hence having

smaller capital outflows. The small capital outflows may not substantially hurt the growth of a strong institution. They may even have net capital inflows due to the flight-to-safety phenomenon (Fratzscher, 2012). This shows that better institutions have rather stable growth rates as compared to weaker institutions where changes of capital flows might cause volatility in growth.

### 2.2.3 Exchange Rate

Exchange rate is a rate that is used for trading with other countries' currency. Countries are selling their local currency and buying the opponent countries' currency when international trade takes place. Real exchange rate (RER) is selected as our variable measurement since being compared to nominal exchange rate, monitoring RER is more practical when evaluating the impact of exchange rates on international trade. RER is defined as the ratio of the price level abroad and the domestic price level by converting the foreign price level into domestic currency value through the current nominal exchange rate (Czech National Bank, n.d.). Rodrik (2008) mentioned that high RER encourages economic growth. In other words, when the exchange rate appreciates, the growth rate also increases. Countries with rapid growth are related with high RER. Therefore there is a positive relationship between exchange rate and growth.

Flexibility of exchange rate plays a significant role in influencing the movement of capital flow which in turn affects growth. Under flexible exchange rate regime, an increase of the nominal exchange rate results in real appreciation of the exchange rate. According to Magud and Vesperoni (2015), flexibility of exchange rate cannot fully protect the economy from a capital reversal. A more flexible exchange rate may help to attract more capital inflow into the countries and boost the economic growth. However a more rigid exchange rate regime could gain the most from reserve requirements. A country with more reserves represents a better ability in financing country debts and expenses. With the aim of stimulating economic growth, countries who applied a more rigid exchange rate can provide a low debt background and protect them from the crash of a rapid decline of capital outflow. In the other words,

countries are able to enjoy an increase of economic growth that was brought on by capital flow if fixed exchange regimes are used.

Public and private capital inflows are related with RER appreciation (Combes, Kinda & Plane, 2011). Investors tend to be more active in putting capital into countries that have higher RER. It is because of the belief of higher RER, higher productive capacity. Higher productive capacity indicates that the resources such as land and labors are fully utilized to produce goods and services. Economic problems such as unemployment and inflation are able to decrease more when resources are fully used in countries. These are the elements that investors seek for higher return since the country is performing well. A better country's image is presented to the whole world and people started to invest the country. Therefore, when capital flows into countries with higher RER, economic growth increases.

### 2.2.4 Financial Market

Our research uses M2 as a share of nominal GDP of develop and developing country itself as a measurement for financial market. Based on previous research, the authors found out that there is a positive relationship between financial market and capital market which would then affect the economic growth (Agbloyor, Abor, Adjasi & Yawson, 2014). Negative influence on capital flow can be converted to positive one in countries with strong financial market. This means that economic growth can be fostered by the capital flow if there is strong financial market. Whereas capital flow are unable to improve the economic growth in the absence of strong domestic financial market.

Consistent with this, Alfaro, Chanda, Ozcan and Sayek (2006) have also conducted a research on the role of financial markets in promoting capital flow such as foreign direct investment which then foster economic growth. Alfaro et al. (2004) initially linked local financial market to production of intermediate good by entrepreneurs. Entrepreneurs must produce intermediate goods to operate a firm in intermediate good sectors in order to generate foreign

direct investment. However, high capital is required to start a firm and thus entrepreneurs with limit credit are only able to start their own firm if the local financial market are developed enough. As a consequence, local financial markets generate linkages between foreign and domestic firms which then cause FDI spillovers and afterward increase the aggregate growth.

Choong et al. (2010) investigate how the three types of capital flow which are foreign direct investment, portfolio investment and foreign debt affect growth using stock market as a channel. Stock market is also considered as financial market. By investigating 51 countries (19 developed countries and 32 developing countries), Choong et al. (2010) found that portfolio investment and foreign debt flow have negative impact on economic growth whereas foreign direct investment has positive impact. However, the negative impact caused by portfolio investment and foreign debt flow can be converted to positive if the stock market are development reached a threshold level. Therefore, well-developed stock market is important for countries to obtain positive capital flow.

Hsu and Wu (n.d.) re-evaluate the role of financial market on capital flow (FDI). In contrast with Agbloyor et al. (2014), Alfaro et al. (2006) and Choong et al. (2010) that proved financial market does affect capital flow which then foster growth, Hsu and Wu (n.d.) on the other hand found that countries with well-developed financial market are not essential to gain advantage from capital flow to foster growth. They have taken into account the problems caused by weak instrument and also avoiding endogeneity problem.

### 2.2.5 U.S. Interest Rate

In response to the hike of U.S. interest rate which was after nearly a decade since the last increase was done by the Federal Reserve, quite a number of articles and researches was done in order to examine the level of impact done towards different types of economy markets. The center point of research was focused more towards emerging market economies as they

are more sensitive towards external shocks compared to advanced market economies. According to Arteta, Kose, Ohnsorge and Stocker 2015, capital flows to emerging market economies tends to be dampened by the rise of long-term interest rate in major economies and the effect will be enhanced in the short-term because of market volatility. Policy makers uses conventional monetary policy to increase or decrease interest rates through open market operations. However, raising U.S. interest rate can have the reverse effect of raising the attractiveness of a nation as a destination for foreign investment (Liu & Spiegel, 2015). When a nation failed to attract foreign investment, it will eventually affect its own economic growth in the long-run. According to Cuipa (2016), an increase in interest rate in major developed-market central banks would cause emerging markets to face a prolonged period of capital outflows and also an increase in financing cost. Adding to the debt accumulated after the global financial crisis, a higher U.S. interest rate and a stronger dollar will likely to cause capital continue to flow out from emerging market economies.

## 2.3 Hypothesis Development

After studying the literature review, we have a clearer picture on how all the variables act and how capital flow affects growth through its interactive variables. From there we have come up with the hypothesis to show the relationship of the variables. When looking at our main research, we can see that capital inflow would promote growth while capital outflow would have a negative effect on growth. Therefore, we hypothesize that capital flow has a positive relationship with growth where an increase in capital inflow would increase growth. As for institutional quality, better institutional qualities are able to promote growth through capital inflow, thus it has a positive relationship with capital flow. Stronger exchange rates show a pull in capital flow which would promote growth. This shows that there is a positive relationship between exchange rates and capital flow where it will increase growth. Financial markets that are strong are able to bring in capital flow showing a positive relationship to spur up growth of the economy. Last but not least, U.S Interest rates that acts as a global determinant has an adverse relationship on capital flow on the economic growth showing a negative relationship between the U.S interest rates and capital flows that affects growth.

## 2.4 Conclusion

In conclusion, we have found that through our literature review, we can expect that all our variables have strong impacts on growth. We will then verify our expected signs with the actual output after performing our data analysis. With that being said, in our next chapter we aim to design and structure our research in order to get a clearer picture to run our empirical testing.

# Chapter 3: Methodology

## 3.0 Introduction

In this chapter, we will exhibit the methodology used to conduct this study. The main objective is to portray what we have done in this study in an orderly and organized manner for easy understanding. Our necessary data were collected through various sources and processed through various testing methods using Eviews 9. Here, we will discuss our 1) Research design, 2) Data Collection method, 3) Data processing procedures and lastly our 4) Econometric model and econometric testing methods.

## 3.1 Research Design

This research uses solely quantitative data. In our study, we conducted causal research. There are two types of causation which are deterministic and probabilistic. Our research involves probabilistic causation as we study the probability the recession by examining the effect on capital flow on growth through the four interactive variables affecting capital flow which are institutional quality, exchange rate, financial market and U.S. interest rate. Growth is identified as our dependent variable, y, while capital flow is our independent variable, x. Institutional quality is quantified by the Government Effectiveness of the country whereas the Financial Market is quantified by taking the M2 over the GDP. We then have a total of 600 observations from the sample of 30 countries, of which 15 are developed countries and 15 developing countries, within 5 years period of 2007-2011 quarterly. The reason we chose the sample period of 2007-2011 is because of Global Financial Crisis that occurred within this timeframe. Global Financial Crisis is the largest crisis and it basically affects every country.

Hence, it has more impact on world economies compared to the rest of crises that only affects certain countries but not globally. We have used Eviews 9 to study the effect of the interactions of the four variables on capital flow and its effects on growth.

### 3.1.1 Baseline Model (Bivariate)

$$DLRGDP_{it} = \alpha_0 + \beta_1 CKA_{it} + \mu_{it} \quad (3.1)$$

Where $\alpha_0$ = intercept

$DLRGDP_{it}$ = Difference of Log Real Gross Domestic Product (Growth)
where i= number of countries and t= number of period

$CKA_{it}$ = Cumulative Capital Flow
where i= number of countries 30 and t= number of period

$\mu_{it}$ = error term with iid [0, $\sigma^2$]
where i= number of countries and t= number of period

In this research, we want to study the effect of capital flow on growth rate. Balance of payment is a combination of current account and capital account. Current account records transactions that involved capital inflows and capital outflows. Foreign direct investment, portfolio investment and selling and buying of bonds and securities also included in capital account. We used capital account as the measurement to observe the movement of capital flow clearly by comparing the difference amount of capital account. When there are capital inflow to countries, then there will be an increase in capital account, vice versa.

The purpose of using GDP as dependent variable is to observe the growth rate in the selected countries. Growth rate represents a country's economic performance and development by looking at their output produced and labor force in the country. The growth rate tends to increase when there is extra one unit of output produced in the market or extra one labor involved in the labor force. A higher growth rate indicates that countries are performing well in the aspect of economy and development. Countries with more stable economy and improvement over the time tend to engage in foreign investments. It applies to both situation

which are, more investors want to invest in the countries or investors from those countries want to invest in other countries to earn more return.

Capital account is able to affect the growth rate of countries in the aspect of the movement of capital inflows and capital outflows. When there is an increase in capital inflows, then it affects the growth rate positively. It is because when the foreign investment increases in recipient countries, it leads to more development, machinery, and labor are needed in the market, hence the output produced increases and results an increase in growth rate. Current account also plays a significant role to affect the capital account and growth indirectly. When there is depreciation of currency, it attracts more foreign capital flow into the countries, leading to increasing growth rate. However growth rate can also affect the capital account in the sense that high growth rate able to attract more foreign investments. Because high growth rate symbolizes a more developed the country and high economic stability in the market, more foreign investors are likely to invest in the countries with high growth rate.

Therefore, there might be bivariate relationship between capital flow and growth rate in Equation 3.1. Bivariate relationship defined as dependent variable able to affect the independent variables or vice versa. In other words, the relationship between these two variables can be explained in two ways, which the capital flow can affect the growth at the same time be affected by growth. This is also known as endogeneity problem. To overcome this problem, we modified the equation into an exogenous model. This means that in an exogenous model, only the independent variable can affect the dependent variable.

### 3.1.2 Endogeneity

In this research, we want to study the effects of capital flow on growth. Equation (3.1) shows how capital flow as the independent variable affects growth. However, we can see that from this model, we face an issue of endogeneity because capital flows can be driven by economic performance. This model is an endogenous model which means that the dependent variable

can affect the independent variables or vice versa. In other words, when studying this research, the capital flow can affect the growth at the same time be affected by growth. To solve the endogeneity problem, we first modified the equation into an exogenous model by regressing capital account (KA) on growth (GDP).

$$CKA_{it} = \alpha_0 + \beta_1 dGDP_{it} + \mu_{it}^{CKA} \quad (3.2)$$

Where $CKA_{it}$ = cumulative capital flow
where i= number of countries and t= number of period

$DLRGDP_{it}$= difference of log Real Gross Domestic Product
where i= number of countries and t= number of period

$\mu_{it}^{CKA}$ = all other variables affecting capital flow excluding growth
where i= number of countries and t= number of period

In order to solve this problem, we have modified Equation (3.1) into Equation (3.2) by setting GDP as the independent variable and capital flow as the dependent variable. Therefore, Equation (3.2) represents the effects of growth on capital flow. The error term, $\boldsymbol{\mu_{it}}$, in Equation (3.2) represents all other variables that affect capital flow. This 'all other variables' does not include the effects of growth on capital flow.

$$DLRGDP_{it} = \alpha_0 + \mu_{it}^{CKA} + \varepsilon_{it} \quad (3.3)$$

Where $DLRGDP_{it}$= Difference of Log Real Gross Domestic Product
where i= number of countries and t= number of period

$\mu_{it}^{CKA}$ = all other variables affecting capital flow excluding growth
where i= number of countries and t= number of period

$\varepsilon_{it}$ = error term with iid [0, $\sigma^2$]
where i = number of countries and t = number of period

Besides, we also derived Equation (3.3) to explain the relationship between the growth and capital flow via the four interactive variables. For instance, how capital flow influence growth through interest rate and etc.

Next, we derived Equation (3.4) by taking this error term and substituted it into the first equation, Equation (3.1). By doing this, we have secured the equation as an exogenous model where the growth can no longer affect the capital flow. This equation is now a one way exogenous model where all other variables affect Capital Flow which is represented by $\boldsymbol{\mu_{it}}$ can affect the growth. This brings us back to our main objective to study how the interactive relationship between capital flow and 1) institutional quality, 2) exchange rate, 3) financial market and 4) U.S. interest rate, and how it all affects the growth.

### 3.1.3 Multivariate Model

Equation 3.4 is to examine the interactive relationship between the Capital Flow and the four interactive variables which are institutional quality, exchange rate, financial market and U.S interest rate. The interactive relationship of the variables would affect the flow of capital which in turn would influence the growth.

$$DLRGDP_{it} = \alpha_0 + \beta_1 \mu_{it}^{CkA} + \beta_2 INST_{it} + \beta_3 LEXR_{it} + \beta_4 M2\_NGDP_{it} + \beta_5 RUS_{it} + \varepsilon_{it} \quad (3.4)$$

Where

$\alpha_0$ = intercept

Dependent Variable:

$DLRGDP_{it}$ = Difference of log Real Gross Domestic Product (Growth)

where i= number of countries and t= number of period

$\mu_{it}^{CKA}$ = Other factors affecting Cumulative Capital Flow (CKA)

where i= number of countries and t= number of period

INST = Institutional Quality

LEXR = Real Effective Exchange Rate

M2_NGDP= Financial Market

RUS = U.S. Interest Rate

$\varepsilon_{it}$ = error term with iid [0, $\sigma^2$]
where i= number of countries and t= number of period

From this, we defined our dependent variable, Y, as the difference of the quarter to quarter of log real Gross Domestic Product. This is to ensure that we eliminate the seasonal effects of the selected countries. As for our independent variable, capital flow was defined as the cumulative capital flow of each country. This is to see the accumulated effect of the capital flow.

The interactive variables which are institutional quality, exchange rate, financial market and U.S. interest rate have an interaction relationship with capital flow. Institutional quality is a qualitative variable, thus we have used the government effectiveness estimate to define it in a quantitative way. This estimate is a standard normal distribution value ranging from -2.5 to 2.5, whereby a negative value would mean a weaker institutional quality vice versa. On the other hand, we have taken the real effective exchange rate and log the value in order to see the percentage changes that would take place.

When studying the financial market as our third interactive variable, we have defined the financial market as the broad money of money market, M2, divided by the nominal gross domestic product, M2_NGDP. This is to study how the strength of the financial market of a country could affect their capital flows. Lastly, looking at our U.S. interest rate, we want to see how the interest rate of the United States acts as a global determinant that could affect the growth of emerging and developed markets through the flow of capital.

### 3.1.4 Probability of Recession

We attempt to link our 30 sample countries to investigate the likelihood of recession that may occur by taking the difference of the quarter to quarter log real gross domestic product (DLRGDP) and capital flows (CKA) into account, we created dummy variable to identify the presence of recession. In case there is two consecutive negative sign from first quarter to the second quarter it means there is recession which represented by 1, 0 if otherwise. In fact, the purpose of testing the probability of recession is to know whether the capital inflow is concerned with the recession. If it does, it can contribute to the policy makers whereby they can adjust their policies to avoid the surge of capital flows. But if it does not raise any hints on the recession it can, at least provide an extra knowledge to educate the public that capital flows do not have influence on the recession.

## 3.2 Data Collection Method

Our study focuses on secondary data which utilized panel data that derived from the database known as International Financial Statistics (IFS) and from World Bank.

### 3.2.1 Data Sources

Our sample consists of quarterly data on Gross Domestic Product, Capital Account, Institutional Quality, Real Effective Exchange Rate, Financial Market and U.S. Interest Rate for our selected developed and developing countries over the period from first quarter of year 2007 to fourth quarter of year 2011. We used government effectiveness as a proxy for institutional quality, Broad Money (M2) as a share of nominal GDP as a proxy for financial market, 3-months of Treasury bills as the proxy of U.S. Interest Rates.

### 3.2.2 Secondary Data

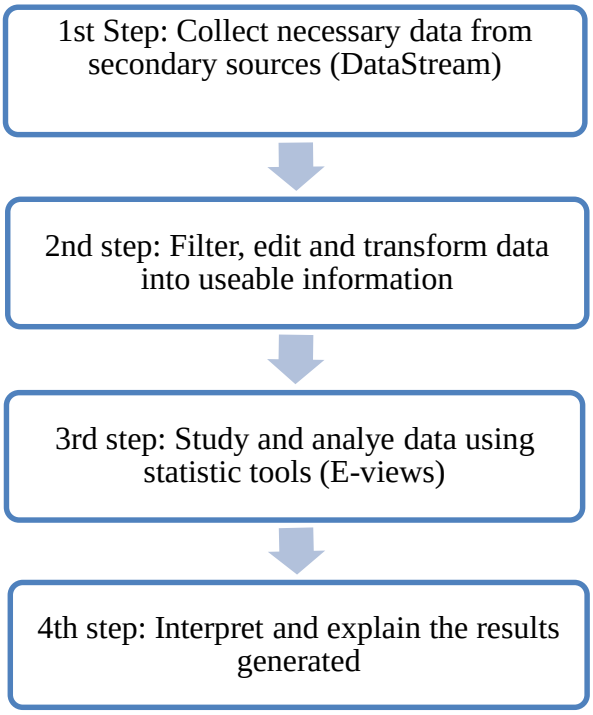
Basically, our studies adopts panel data which comprises of the combination of 15 developed countries and 15 developing countries within the period of 2007 to 2011. Our regression equations are separated into two in which the first one setting the economic growth as the dependent variable and capital flows as the independent variable. Whereas another one are setting capital flows as dependent variable, the remaining four independent variables are institutional quality, exchange rate, financial market and the U.S. interest rate.

Table 3.1: Summary of Variables and Data Sources

| Variables | Indicator name | Unit measurement | Source of data |
|---|---|---|---|
| Real Gross Domestic Product | LRGDP | National currency | World Bank Indicator |
| Capital Account | KA | U.S. Dollar | International Financial Statistics |
| Government Effectiveness | INST | Estimate of Governance | World Bank Indicator |
| Real Effective Exchange Rate | LEXR | National currency per U.S. Dollar | International Financial Statistics |
| Financial Market | M2/NGDP | National currency | International Financial Statistics |
| U.S. Interest Rate | RUS | % per annum | International Financial Statistics |

### 3.2.3 Data Processing

Figure 3.1: Steps in Data Processing




We started our research with the process of finding relevant data. Our data for Capital Account, Real Effective Exchange Rate, M2 and U.S Interest Rate are extracted from International Financial Statistic. Whereas the data for Gross Domestic Product and Government Effectiveness are extracted from World Bank Indicator. After the extraction of data, we proceed to convert the unit measurements of data using Microsoft Excel to ensure that the conformity of the unit measurement. In order to run our empirical tests, we modified our data using Eviews 9. At first, we log Real Gross Domestic Product (LRGDP) in order to be able to find the difference from quarter to quarter, we also changed the Real Effective Exchange Rate into percentage by logging the data. Besides that, we did the effect of cumulative on Capital Flow using Microsoft Excel and we named it as CKA. By the help of Eviews 9, we managed to modify our data into useable variables for testing, for example, M2_NGDP is represented by Financial Market. Lastly, in order to test the probability of recession, we created dummy variables by differencing LRGDP from quarter to quarter using Microsoft Excel, for example, fourth quarter of 2008 minus fourth quarter of 2007.

## 3.3 The Estimators

### 3.3.1 Pooled OLS

In this study, we have used a panel data which includes the combination of cross-sectional data and the time-series data. This means that we study a sample across 30 countries along the time period of 5 years. We therefore ran our data using the Pooled OLS method. We ran multiple regression models with each of our variables to come up with our best fit model. The best fit model would be the model with the most significant variables.

We first ran the basic model regression of cumulative capital flow as a share of nominal Gross Domestic Product (CKA_NGDP) against the Difference of log real Gross Domestic Product (DLRGDP). We then expended our regression by adding in other variables like the interactive variables and comparing our significance as we go along. This is to test the reliability of our main basic equation. In other words, it is to say that more testing and changes we made to our model would only explain back the basis of our research, which is to study the impact of capital flow on growth.

However, if our model shows large standard errors or small T-Statistics, this could mean that the Pooled-OLS method for panel data may not be the best fit model. This acts as a warning sign that the groups may not all be homogeneous, thus further data regression methods like the Fixed Effect Model (FEM) or the Random Effect Model (REM) may be more suited for this data. The equation of Pooled OLS is shown below. Equation 3.5 below shows you the econometrics model for Pooled OLS.

$$DLRGDP_{it} = \alpha_0 + x'_{it}\beta + u_{it} \quad (3.5)$$

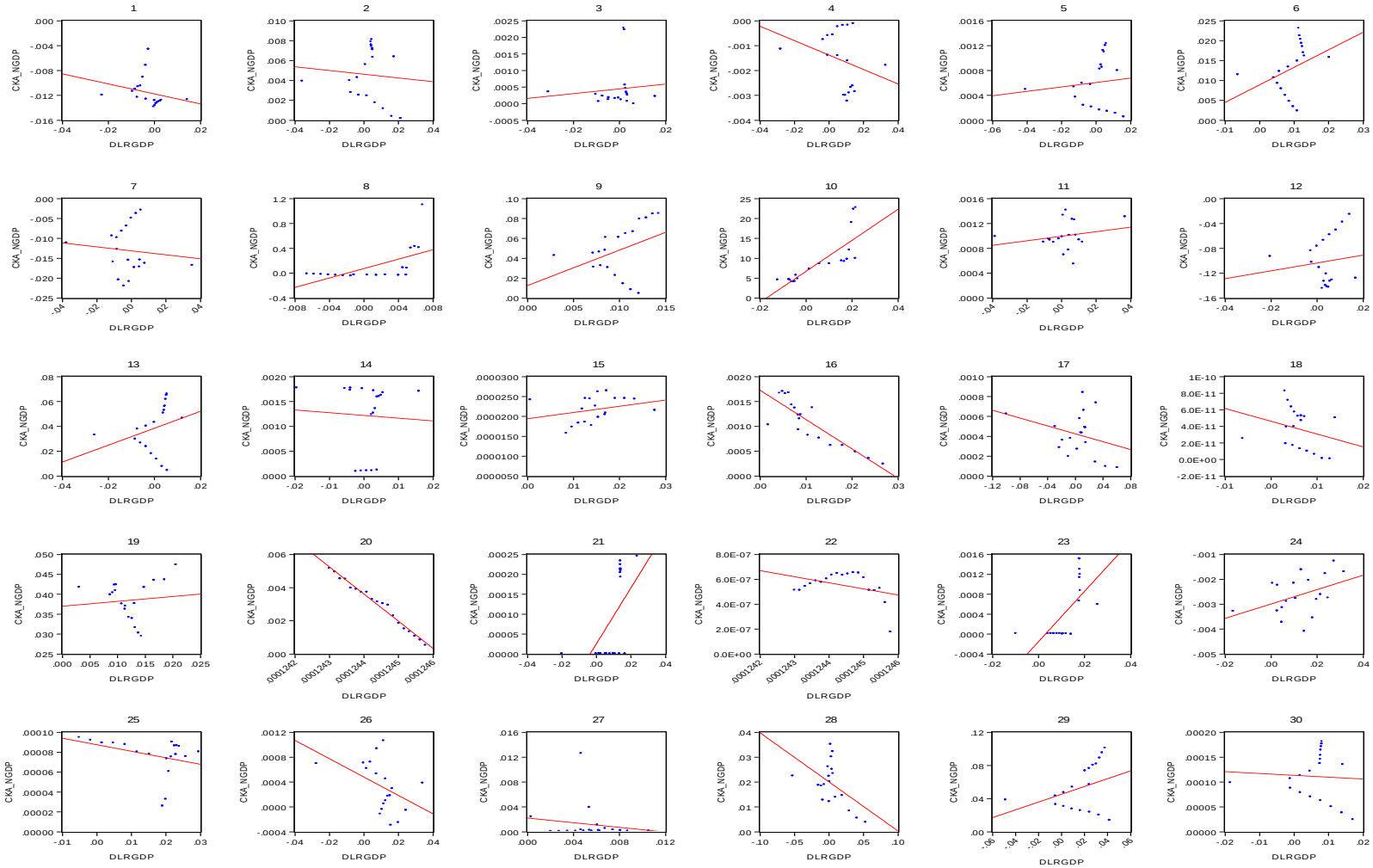
Where $\alpha_0$ = intercept

$DLRGDP_{it}$ = Difference of Log Real Gross Domestic Product
where i= number of countries and t= number of period

$x'_{it}$ = K x 1 independent variables
where i= number of countries and t= number of period

$u_{it}$ = error term with iid [0, $\sigma^2$]
where i= number of countries and t= number of period

Figure 3.2: Relationship between Cumulative Capital Flow and Economic Growth




Source: International Financial Statistics and World Bank Indicator.

Table 3.2: List of countries

| DEVELOPED COUNTRIES | DEVELOPING COUNTRIES |
|---|---|
| 1. Bahamas | 1. Albania |
| 2. Czech republic | 2. Armenia |
| 3. Denmark | 3. Belize |
| 4. Hong Kong | 4. Bolivia |
| 5. Hungary | 5. Brazil |
| 6. Israel | 6. Chile |
| 7. Japan | 7. Indonesia |
| 8. New Zealand | 8. Kazakhstan |
| 9. Poland | 9. Kyrgyz republic |
| 10. Seychelles | 10. Lebanon |
| 11. Sweden | 11. Malaysia |
| 12. Switzerland | 12. Pakistan |
| 13. United kingdom | 13. Romania |
| 14. United states | 14. Solomon island |
| 15. Uruguay | 15. South Africa |

Source: United Nations New York (2014).

The graphs in Figure 3.2 above show the relationship between cumulative capital flows and difference between log of growth rate and Table 3.2 shows the list of countries and designated numbers respectively. We observe there are endogeneity across country in pooled ordinary least square (OLS). Therefore, we try to break them up and look at the individual graph. By looking at the regression line from Country 1 to Country 30, we can conclude that there are differences between developed and developing countries. Upward sloping of the regression line indicates positive relationship between capital flow and growth whereas downward sloping regression line indicates negative relationship between capital flow and growth. From the observation, developed countries mostly show positive relationship which means that an increase in capital flow leads to increase in the countries' growth or decrease in capital flow leads to decrease in the countries' growth. On the other hand, developing

countries generally show negative relationship between capital flow and countries' growth where increase in capital flow will lead to decrease in countries' growth and vice versa.

### 3.3.2 Fixed Effect Model

The Fixed-Effect Model (FEM) is a statistical model that assumes that since it is said that an individual effect is time invariant and considered a part of the intercept, individual effect is allowed to be correlated with other regressors. In other words, we can say that we can impose the time independent effects for each variable that are possibly correlated with the regressors.

FEM measures the differences in intercepts for each groups. We use FEM in order to control the unobserved heterogeneity to be constant over time and correlated with independent variables.

Because our first Pooled-OLS model may not be the best fit model, we would run the FEM testing to see if FEM would be more accurate than Pooled-OLS. We took the best model from the Pooled-OLS and derived our FEM using Eviews 9. This is because we want to assume that the heterogeneity effects are kept constant. The equation for FEM is shown below. Equation 3.6 below shows the econometrics model for FEM

$$DLRGDP_{it} = \alpha_i + x'_{it}\beta + u_{it} \quad (3.6)$$

Where $DLRGDP_{it}$= Difference of Log Real Gross Domestic Product
where i= number of countries and t= number of period

$\alpha_i$ = individual specific effects
where i= number of countries

$x'_{it}$ = dummies included in the regressors
where i= number of countries and t= number of period

$\beta$ = K x 1 vectors

$u_{it}$ = error term with iid [0, $\sigma^2$]
where i= number of countries and t= number of period

### 3.3.3 Random Effect Model

Random Effect Model (REM) also known as random intercept, partial pooling model. This model is different from fixed effect model in respective of how researcher treat their explanatory variables. If the explanatory variables or the panel data are assumes to have no fixed effect then Random Effect Model is used. Estimation of error variance specific to group can be made using REM. Assumption has to be made that individual effects are not correlated with any regressors, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables. Under Random Effect Model, estimation of mean of a distribution of true effect sizes are taken into account, but not the effect of one true effect.

One of the advantage of Random Effect Model is that researchers can include time invariant variables, such as gender whereas these variables will be absorbed by the intercept under Fixed Effect Model. To test whether Pooled OLS or REM is preferred,

Lagrange Multiplier Test will be conducted. If the null hypothesis is not rejected, the Pooled OLS regression is favored. If the null hypothesis is rejected, then REM is chosen. The decision whether to reject or not rejecting a null hypothesis is based on the P- value of the variables. Null hypothesis will be rejected if the P-value is less than the α-value, hence Random Effect Model is favored and vice versa.

The Random Effect Model assumes that there is no fixed effect that caused the data constant across the period $t_0$ to $t_1$ and this excluded the omitting variables bias. The equation for REM is shown below. Equation 3.7 below shows the econometrics model for FEM

$$DLRGDP_{it} = \theta + x'_{it}\beta + \alpha_i + u_{it} \quad (3.7)$$

Where $DLRGDP_{it}$= Difference of Log Real Gross Domestic Product
where i= number of countries and t= number of period

$\theta$ = nonrandom scalar intercept

$\alpha_i$ = individual specific effects
where i= number of countries

$x'_{it}$ = dummies included in the regressors
where i= number of countries and t= number of period

$\beta$ = K x 1 vectors

$u_{it}$ = error term with iid [0, $\sigma^2$]
where i = number of countries and t= number of period

### 3.3.4 Model Comparison

We generated three testing which are Likelihood Ratio Testing, LM Test and Hausman Test after conducted the pooled OLS Testing. We used the results generated by the Pooled OLS Testing to perform these testing.

**Likelihood Ratio Testing**

The purpose we conduct this testing is to find estimates two models and compares them by comparing the log likelihoods of the two models and tests them to see if this difference would be statistically significant. If the difference is seen to be statistically significant, the less restrictive model which is the one with the more variable is said to have a better fit than the more restrictive model. In this test, we made comparison between the two models which are the Pooled-OLS model and the FEM model to notice the better fit model compared than the others. The testing method is writing hypotheses where null hypothesis is there is no fixed effect and the alternative hypothesis is there is a fixed effect. When there is no fixed effect, indicating that pooled OLS is preferred; when there is a fixed effect, meaning that FEM is preferred. By having this test, we able to know whether Pooled OLS or FEM is a better model. If the P-Value is less than $\alpha$ of 0.05, then we reject $H_0$. Therefore, the FEM test is significantly fitter than the Pooled OLS model, thus we would chose to use the FEM model.

**Lagrange Multiplier test**

This test aims to estimate the consecutive two models by compared them using different tests to see whether it is statistically significant. The LM test is useful for testing for autocorrelation, but also suitable for models with or without lagged dependent variables. If the result is statistically significant, it implies that the model which contains more variables is relatively suitable than the model that contains less

variables. In order to know the result exactly, we test it by apply Pooled-OLS model and the random effect model (REM). We can make decision that which model is better between pooled OLS and REM. We wrote two hypotheses where null hypothesis is there is no random effect and the alternative hypothesis is there is random effect. When there is no random effect, meaning that Pooled OLS is preferred. REM is preferred when there is a random effect. If the P-Value is less than α of 0.05, then we reject $H_0$. Therefore, the REM test is significantly fitter than the Pooled OLS model, thus we would chose to use the REM model.

**Hausman test**

This test is used to estimate and compared the consecutive two models to see which model is relatively statistically significant. If the result is statistically significant, it implies that the model which contain more variables is relatively suitable than another one that contain less variables. Then the two models will be Fixed Effect Model (FEM) and Random Effect Model (REM) respectively. From the beginning, we assume random effect model to be preferred under null hypothesis ($H_0$) or in other words there is no systematic effect occur, whereas fixed effect model would be preferred under alternative hypothesis ($H_1$), or there is systematic effect occur. If the P-value is found to be less than significant level (α) which is 5%, we will reject $H_0$. In contrast, if P-value is more than α, we do not reject $H_0$. When $H_0$ is being rejected, it carries the meaning in which FEM is preferred due to its higher consistency. When we do not reject $H_0$, it means that REM is more preferred because of its higher efficiency. Nevertheless, our study found that P-value less than α, so we reject $H_0$. Therefore, FEM is more significant and fitter than REM model.

### 3.3.5 Probit and Logit model

In this section, Probit and Logit model are applied to test for the probability of recession. The main reason of we chose these two models rather than others is because of these two models can be as useful as linear model which enable measurable scale such as ratio and interval to fit in, at the same time they can be used when the variables are in terms of nominal scale. For instance, the optional question such as male or female, and yes or no. As such the Probit and Logit model can be suitable model to describe both linear and non-linear function. Hence, we are using the Probit and Logit model to indicate the probability of recession by provide optional terms in which the presence of recession is represented by 1, whereas the absence of recession is represented by 0.

The equation for Probit model:

$$P_i = E(Y = 1|X_i) = \frac{1}{1+e^{-(\alpha_0+\beta_1 INST+ \beta_2 LEXR+ \beta_3 M2\_NGDP+ \beta_4 RUS)}} \quad (3.8)$$

Where $P_i$ = probability of recession

where i = number of countries

Y = 0 if there is no recession

1 if there is recession

The equation for Logit model:

$$Prob(Y_i - 1) = F(\frac{\alpha_0+\beta_1 INST+\beta_2 LEXR+\beta_3 M2\_NGDP+\beta_4 RUS}{\sigma}) \quad (3.9)$$

Where $P_i$ = probability of recession

where i = number of countries

Y = 0 if there is no recession

1 if there is recession

F = standard normal cumulative density function (c.d.f)

## 3.4 Conclusion

We conclude our chapter of methodology with all these and proceeded with our empirical testing on our data in chapter 4. In the next chapter, we will have a look at how we run our testing based on this chapter and see the generated output and results.

# Chapter 4: Data Analysis

## 4.0 Introduction

In this chapter, our study highlights the fixed effect model (FEM), random effect model (REM), Logit model and Probit model that will be generated. Our study has fully utilized the sources from Eviews 9 to ensure the result is statistically significant.

## 4.1 Test Results

### 4.1.1 Endogeneity

Endogeneity existed when an explanatory variable is correlated with the error term. An explanatory variable is used to explain the changes of dependent variable. When the explanatory variable is correlated with error term, autoregession with autocorrelated errors and omitting variables will be occurred. As mentioned earlier, endogeneity is found in our research since the capital flow and growth can affect each other at the same time. In order to overcome this problem, firstly we regressed difference log real growth rate on cumulative capital flow. Table 4.0 shows the test result of capital flow on growth.

The Impact of Capital Flow on Growth and Probability of Recession.

Table 4.0: The Relationship between Cumulative Capital Flow and Growth.

Y=cumulative capital flow

| | |
|---|---|
| C | 0.2379*** |
| | (0.0910) |
| DLRGDP | 12.7530** |
| | (6.4908) |
| R-squared | 0.0068 |
| Adjusted R-squared | 0.0050 |
| F-statistic | 3.8604 |
| Prob(F-statistic) | 0.0499 |
| Durbin Watson stat | 0.0414 |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

The purpose we have this result is to solve the endogeneity problem. From Table 4.0, we found that growth rate is significant to affect the capital flow at 5% of significant level. Similarly with expectation, the growth affects the cumulative capital flow positively. It means stronger growth will lead to more capital flow in the countries. Stronger growth rate can be defined as the development and improvement of a country. The more developed and improvement in the country attracts more investors to make investment in the country without any consideration. It is because the performance of the country is a strong evidence to investors for the return and stability of the country. After confirming the relationship between capital flow and growth, we proceeded to the next step which is to use the residual from Table 4.0 and make a regression that sets growth as the dependent variable. Table 4.1 is used to observe the relationship between the residual of capital flow against growth. The residual of capital flow is said to be all other variables that affect capital flow which does not include growth.

The Impact of Capital Flow on Growth and Probability of Recession.

Table 4.1: Residual of Capital Flow against Growth.

Y=DLRGDP

| | |
|---|---|
| C | 0.0060*** |
| | (0.0005) |
| RESID_CKA | -8.11E-14 |
| | (0.0003) |
| R-squared | 0.0000 |
| Adjusted R-squared | -0.0018 |
| F-statistic | 0.0000 |
| Prob(F-statistic) | 1.0000 |
| Durbin Watson stat | 0.5745 |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

By doing this, we have secured the equation to eliminate endogeneity problem. We have ensured that our cumulative capital account is not affected by growth. Thus this equation is now an exogenous model where cumulative capital account affects growth. This is then our main study which is to study the effects of capital flow on growth through the interactions of institutional quality, exchange rate, financial market and U.S. interest rate.

However, our results show that we did not manage to solve the endogeneity problem because the residual is insignificant. The most probable reason to this result would be due to our sample period. Our sample period is from year 2007 till year 2011, exactly during the period of Global Financial Crisis. During crisis, capital flow across countries no longer based on growth potential because every countries' economies was affected. When there is no crisis and economies are operating under normal conditions, the economic growth affects the movements of capital flow. When growth of a country seem to be strong and accelerating, more capital inflow will likely to occur due to high returns. This conclude that growth influenced by capital flow is less

likely to occur during crises periods. Hence, it explain our insignificance result on Table 4.1.

### 4.1.2 Pooled OLS

We have conducted our Pooled OLS testing on our panel data. Table 4.2 shows the regression output from our testing. We did various testing on different combination of models. First model being the basic model which is the relationship between capital flow and DLRGDP. We then studied the changes when a variable is added into the equation. In Model 2, we have added in institutional quality, Model 3 including exchange rate, model 4 with the financial market and lastly Model 5 with the U.S. interest rate.

Table 4.2: Cumulative Capital Flow and Interactive Variables regressed against Growth.

Y=DLRGDP

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| C | 0.0059 | 0.0078 | 0.0080 | 0.0077 | 0.0059 |
| | (0.0005) | (0.0006) | (0.0011) | (0.0011) | (0.0011) |
| CKA_NGDP | 0.0005** | 0.0004 | 0.0004 | 0.0004 | 0.0005* |
| | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| INST | | -0.0030*** | -0.0031*** | -0.0028*** | -0.0027*** |
| | | (0.0005) | (0.0006) | (0.0006) | (0.0006) |
| LEXR | | | -0.0001 | 0.0000 | 0.0001 |
| | | | (0.0002) | (0.0003) | (0.0003) |
| M2_NGDP | | | | -0.0000* | -0.0000* |
| | | | | (0.0000) | (0.0000) |
| RUS | | | | | 0.0017*** |
| | | | | | (0.0003) |
| R-squared | 0.0068 | 0.0559 | 0.0560 | 0.0614 | 0.1010 |
| Adjusted R-squared | 0.0050 | 0.0525 | 0.0510 | 0.0548 | 0.0930 |
| F-statistic | 3.8604 | 16.7705 | 11.1927 | 9.2472 | 12.6721 |
| Prob(F-statistic) | 0.0499 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Durbin Watson stat | 0.5777 | 0.6085 | 0.6085 | 0.6126 | 0.6269 |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

Based on table 4.2, we are including a total of 5 models to test for the degree of significance on growth. We add in our variables accordingly where the first model only displays the relationship between cumulative capital flow and growth, then followed by the second model which add in one more variable, institutional quality. Next, we include exchange rate into the third model, while the fourth model include the financial market and lastly U.S. interest rate being added into the fifth model. From the output, we observed that the coefficient of the capital account is significant in only model 1 and model 5 with 5% and 10% significant level respectively. The model 1 is significant because the capital flows is definitely affect the growth in certain extent. When come to the model 5, there is significant result after U.S. interest

rate is being added. Apparently, the U.S. interest rate is an important determinant that must be counted in to examine the influence on growth.

Capital flow yielded insignificant result on growth after being combined with other variables in model 2, 3 and 4. Our result shows the institutional quality when interacting with cumulative capital account is negatively correlated with the growth which is inconsistent with our journal reviews. On the other hand, the exchange rate is found to be insignificant to affect the growth, regardless of individual effect or after being combined in model 3. Based on the journal reviews, the exchange rate when interacting with the capital flows is positively correlated which can stimulate the growth, however, our result shows it is ambiguous which can be either positive or negative correlated with the growth. Besides, financial market also found to be insignificant to affect the growth if tested on a sole basis, but after added into model 4, the result become significant in 10% significant level, but due to the figure is almost near to zero, it is less convincing to prove it significance on growth. Through the journal reviews, it stated that the financial market is positively correlated with capital flows which can raise positive outcome on growth, but in fact it is not consistent with our result. Our result revealed negative relationship between the financial market and the growth.

Last but not least, the U.S. interest rate can robustly affect the growth as the result shown it is significant in 1 % significant level. After being added into model 5, it can improve the result from insignificant become significant in 10% significant level. Indeed, our result does not consistent with the journal reviews. Based on the review, U.S. interest rate is negatively correlated with the capital flows which then delivered adverse impact on growth. However, our result shows that the U.S. interest rate is positively correlated with the growth. We carried out table 4.3 to show how capital flows can influence growth through different channels.

Table 4.3: Multiplication of Capital Flow and Interactive Variables respectively regressed against Growth.

Y=DLRGDP

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| C | 0.0059 | 0.0059 | 0.0060 | 0.0062 | 0.0062 |
| | (0.0005) | (0.0005) | (0.0005) | (0.0005) | (0.0005) |
| CKA_NGDP | 0.0005** | -0.0008 | -0.0051 | -0.0079 | 0.0030 |
| | (0.0003) | (0.0008) | (0.0043) | (0.0045) | (0.0066) |
| CKA_NGDP*INST | | 0.0048 | 0.0041 | 0.0043 | 0.0013 |
| | | (0.0029) | (0.0030) | (0.0030) | (0.0033) |
| CKA_NGDP*LEXR | | | 0.0018 | 0.0025 | -0.0014 |
| | | | (0.0018) | (0.0018) | (0.0025) |
| CKA_NGDP*M2_NGDP | | | | 0.0006 | 0.0006** |
| | | | | (0.0003) | (0.0003) |
| CKA_NGDP*RUS | | | | | -0.0013** |
| | | | | | (0.0006) |
| R-squared | 0.0068 | 0.0114 | 0.0133 | 0.0216 | 0.0301 |
| Adjusted R-squared | 0.0050 | 0.0079 | 0.0081 | 0.0147 | 0.0215 |
| F-statistic | 3.8604 | 3.2777 | 2.5446 | 3.1207 | 3.5005 |
| Prob(F-statistic) | 0.0499 | 0.0384 | 0.0553 | 0.0148 | 0.0040 |
| Durbin Watson stat | 0.5777 | 0.5817 | 0.5840 | 0.5906 | 0.5944 |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

The coefficient for capital account is being inconsistent throughout Model 1 to Model 5. Model 5 shows the best result compared to the rest of the models, the additional variable of U.S. interest rate interact with capital flow manage to improve the coefficient of capital flow itself. In model 5, capital flow now has a positive relationship with growth showing that an increase in capital flow would actually spur growth. However, when cumulative capital flow interacts with the U.S. interest rate, it shows that there is a negative relationship with capital flow and growth. Besides, institutional quality interacts with capital flow has the lowest coefficient in Model 5

compared to the rest of the models. Whereas exchange rate interacts with capital flow shows inconsistent coefficients. It turned negative from being initially positive.

Besides looking into which variables influences growth the most, we carried out tests to investigate through which channel can influence capital flows. Apparently, institutional quality, exchange rate and financial market offsets the positive relationship between capital flow and growth as shown in Model 2 to Model 4. This means that these three variables does not give significant impact on capital flow that can affect growth itself. These contradicting results compared to what we have reviewed from other researchers' findings can be due to the insignificance of the variables or the incomplete or missing information. On the other hand, Model 5 shows better results compared to the rest of the models. The relationship between capital flow and growth is positively related, which means an increase in capital flow will eventually cause an increase in the percentage of growth. Model 5 shows that the financial market and the U.S. interest rate are in fact important factors that affects the capital flow on growth.

Our testing for this section ended with Model 5 included additional channel of U.S. interest rate and it managed to prove that capital account does have negative relationship with growth through U.S. interest rate and financial market. This result managed to prove the findings we have gained from review of journals, which will be an increase in U.S. interest rate would cause the capital flow to have an adverse effect on growth, showing negative relationship. A country that has strong financial market manage to attract foreign investors to invest in that country, causing more capital inflow and hence boost the economic growth. However, for financial market, although it shows positive coefficient, but the relationship is weak. Which means our results cannot fully prove that financial market can affect growth through the interaction with capital account.

Even though Model 5 managed to improve Model 1 to Model 4, it still does not give a robust result to our research questions. Hence, we regress FEM and REM models to

help us to determine which regression is the best to show the relationship between growth and capital account along with the interactive variables.

### 4.1.3 Pooled, REM, FEM

Referring back to Table 4.1, the capital flow has a positive impact on economic growth without considering other channel. Somehow, once we consider all different interaction such as such as institutional quality, exchange rate, financial market and U.S. interest rate, the capital flow appears to be insignificant. Seeing that the capital flow on the economic growth itself is non-significant variable. We suspect that Pooled OLS is not sufficient to capture the effect of capital flow on economic growth. Thus, we proceed to Random Effect Model (REM) and Fixed Effect Model (FEM) testing.

Table 4.4: Test results for Pooled, REM and FEM without Interactive Relationship.

Y=DLRGDP

| | POOLED | REM | FEM |
|---|---|---|---|
| C | 0.0059 | 0.0056*** | 0.0309** |
| | (0.0011) | (0.0020) | (0.0145) |
| CKA_NGDP | 0.0005* | 0.0012*** | 0.0022*** |
| | (0.0003) | (0.0004) | (0.0005) |
| INST | -0.0027*** | -0.0026** | -0.0061 |
| | (0.0006) | (0.0011) | (0.0076) |
| LEXR | 0.0001 | 0.0001 | -0.0085* |
| | (0.0003) | (0.0005) | (0.0051) |
| M2_NGDP | -0.0000* | -0.0000 | -0.0000 |
| | (0.0000) | (0.0000) | (0.0000) |
| RUS | 0.0017*** | 0.0017*** | 0.0016*** |
| | (0.0003) | (0.0003) | (0.0003) |
| R-squared | 0.1010 | 0.0788 | 0.2611 |
| Adjusted R-squared | 0.0930 | 0.0707 | 0.2141 |
| F-statistic | 12.6721 | 9.6554 | 5.5589 |
| Prob(F-statistic) | 0.0000 | 0.0000 | 0.0000 |
| Durbin Watson stat | 0.6269 | 0.7133 | 0.7499 |
| | stats | stats | Stats |
| Likelihood test: | | | |
| Cross-section F | | | 3.9959*** |
| Cross-sectional Chi-square | | | 111.7555*** |
| Langrange Multiplier test: | | | |
| Breusch-Pagan | 824.8289 | | |
| Hausman test: | | | |
| Cross-section random | | 11.6691** | |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

Higher coefficient means the particular variable has stronger effect on capital flow. For capital flow, FEM shows the highest coefficient compared to REM and Pooled OLS. It is seen that different countries has heterogeneity and therefore each country has differences in their capital flow. In FEM, it is assumed all countries have the same characteristics and thus eliminating off heterogeneity. Therefore, FEM shows the highest coefficient for cumulative capital flow.

REM captures the variation across countries. For institutional quality, exchange rate and U.S. interest rate, REM shows the highest coefficient. Different countries have different degree of institutional quality. Countries with better institutional quality can increase capital flow and enhance growth and vice versa. Institutional quality could improve over time. Hence, REM has the highest coefficient. Besides, improvement of exchange rate over the year bringing more capital flow which then promote growth. That is why exchange REM shows the highest coefficient for exchange rate. Whereas coefficient for financial market is -0.0000 in Pooled OLS, REM and FEM signifies that financial market has no impact on capital flow at all. Apparently, financial market does not influence much. Although it is significant but it is pointless as a variable.

We then did another set of testing based on the results generated in table 4.3. This is where we want to study the effect of cumulative capital flow on growth through the interaction variables. Table 4.5 shows that we have derived out the random effect model and fixed effect model. Our purpose of doing so is to get the fittest model when studying the effects of capital flow on growth.

Table 4.5: Test results for Pooled, REM and FEM with interactive relationship.

Y=DLRGDP

| | POOLED | REM | FEM |
|---|---|---|---|
| C | 0.0062 | 0.0060*** | 0.0055*** |
| | (0.0005) | (0.0010) | (0.0007) |
| CKA_NGDP | 0.0030 | 0.0054 | 0.0101 |
| | (0.0066) | (0.0065) | (0.0074) |
| CKA_NGDP*INST | 0.0013 | 0.0022 | -0.0006 |
| | (0.0033) | (0.0035) | (0.0054) |
| CKA_NGDP*LEXR | -0.0014 | -0.0023 | -0.0032 |
| | (0.0025) | (0.0024) | (0.0025) |
| CKA_NGDP*M2_NGDP | 0.0006** | 0.0003 | -0.0002 |
| | (0.0003) | (0.0004) | (0.0006) |
| CKA_NGDP*RUS | -0.0013** | -0.0012** | -0.0009 |
| | (0.0006) | (0.0006) | (0.0006) |
| R-squared | 0.0301 | 0.0276 | 0.2167 |
| Adjusted R-squared | 0.0215 | 0.0190 | 0.1669 |
| F-statistic | 3.5005 | 3.2057 | 4.3538 |
| Prob(F-statistic) | 0.0040 | 0.0073 | 0.0000 |
| Durbin Watson stat | 0.5944 | 0.6950 | 0.7355 |
| | stats | stats | Stats |
| Likelihood test: | | | |
| Cross-section F | | | 4.3955*** |
| Cross-sectional Chi-square | | | 121.8134*** |
| | | | |
| Langrange Multiplier test: | | | |
| Breusch-Pagan | 956.2522 | | |
| | | | |
| Hausman test: | | | |
| Cross-section random | | 7.4637 | |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

As we can see from the table above, cumulative capital flow as a share of nominal gross domestic product (CKA_NGDP) has the highest coefficient in FEM. For institutional quality, exchange rate and financial market as a share of NGDP, REM show the highest coefficient. In contrast with Table 4.4, FEM shows the highest coefficient for interest rate.

To determine the best regression between Pooled OLS, FEM and REM, we ran three empirical testing which are the Likelihood test, Lagrange Multiplier test and Hausman test. We ran these three testing based on the output produced in in Table 4.4 because we felt that table 4.4 has given us better results with more variables that are significant as compared to the results in table 4.5. From here we can see that the interaction between the variables and capital flow does not tell us much on how it affects growth in Table 4.5. This could be because there may be insufficient information that we have added into our research or the limited time period that has acted as a limitation to our research. Therefore, we have proceeded with using the results from table 4.4.

For Likelihood test, the null hypothesis will be there is no fixed effect where pooled regression is preferred. Whereas the alternative hypothesis will be there is fixed effect where FEM is preferred. We will reject the null hypothesis if the p-value is less than the significance level(s). We conclude that Fixed Effect Model is preferred because there is sufficient evidence to prove that there is fixed effect in the model 1% significance level. We move to the Lagrange Multiplier test to determine the best regression between pooled and REM.

For Lagrange Multiplier test, we set our null hypothesis as there is no random effect where pooled regression is preferred. Whereas alternative hypothesis will be there is random effect where Random Effect Model is preferred. We will reject the null hypothesis when the test statistic is more or less than the critical values. We concluded that Pooled regression is preferred due to there is no enough evidence to show that there is random effect in the model at 10% significance level. We then

proceed to the Hausman test to determine the best regression between Random Effect Model and Fixed Effect Model.

For Hausman test, we set our null hypothesis as there is no systematic effect where Random Effect Model is preferred. Whereas the alternative hypothesis will be set as there is a systematic effect where Fixed Effect Model is preferred. We will reject the null hypothesis when p-value is less than the significance level(s). We conclude that Fixed Effect Model is preferred due to there are sufficient evidence to prove that there is a systematic effect in the model at 5% significance level.

As a conclusion, we have decided that the Fixed Effect Model from table 4.4 gives us the best fit model.

### 4.1.4 Probit Model

In this section, we examine the impact of capital flow on growth to predict the probability of recession. In order to do this, we have conducted the Probit model on our data. We first found the difference of the quarter to quarter of the log of real GDP (DLRGDP). We then identified recession as two consecutive quarters of DLRGDP that have negative value. A dummy variable of recession was created where it will be equal to 0 if there is no recession, or equal to 1 if recession is present.

After doing so, we regressed this dummy variable of recession as the dependent variable against the cumulative capital flow in model 1. We then added in the other variables and computer different models that would show different interactions on the probability of recession. Table 5 below shows the Probit model regression output.

Dummy variables is represented by Y whereas cumulative capital account as a share of nominal GDP (CKA_NGDP) is represented by X. For the subsequent models which are model 2, model 3, model 4 and model 5, we remain the Y as dummy variables but changing the component of X. The purpose of keep changing the X is to test the accuracy and how significant it is to explain the probability of recession from capital flows. In model 2, we add-in a new variable which is institutional quality and it is represented by X to become (CKA_NGDP *INST). Then, when continue to model 3, X will be changed to (CKA_NGDP *LEXR) by adding in log of exchange rate. Next, followed by (CKA_NGDP *M2_NGDP) which represented by X in model 4 after add-in the financial market as a share of nominal GDP. Lastly, we switched the component of X to real U.S. interest rate to become (CKA_NGDP *RUS) in model. By using this way, we can give proper explanations by revising the output generated from Eviews 9. If the result shows positive sign, it means that the variable is more likely to trigger recession. In contrast, the negative sign from the result carries the meaning that the variable is less likely to trigger recession.

The Impact of Capital Flow on Growth and Probability of Recession.

Table 4.6: Results of Probit Models.

Y=Dummy recession

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| C | -1.0322 | -1.0799 | -1.0421 | -1.0435 | -1.0583 |
| | (0.0667) | (0.0693) | (0.0671) | (0.0680) | (0.0677) |
| CKA_NGDP | 0.0107 | 0.5838*** | 0.9141* | 0.0550 | -0.3260 |
| | (0.0323) | (0.1690) | (0.5027) | (0.0566) | (0.2252) |
| CKA_NGDP*INST | | -3.2152** | | | |
| | | (1.1072) | | | |
| CKA_NGDP*LEXR | | | -0.3630* | | |
| | | | (0.2024) | | |
| CKA_NGDP*M2_NGDP | | | | -0.0264 | |
| | | | | (0.0278) | |
| CKA_NGDP*RUS | | | | | 1.7647 |
| | | | | | (1.1542) |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

Table above shows how the probability of recession can be seen when the cumulative capital flow affects growth. From the table we can see that the probability of recession can be told when there is an interaction of institutional quality and exchange rate against growth. However, on its own, cumulative capital flow does not significantly show the probability of recession and neither do the interaction of financial market and the U.S. interest rate with the capital account.

The institutional quality interaction with cumulative capital flow shows the most significant at 5% significance level. On the other hand, the interaction of exchange rate on cumulative capital flow shows it is significant at 10% significance level. This means that when institutional quality reacts with cumulative capital flow, it can tell us the probability of recession, thus telling us how it affects growth. Whereas for the

exchange rate, it shows that the interaction with cumulative capital flow will also significantly tell us the probability of recession.

Model 1 shows that cumulative capital flow on its own does not affect growth. That is why we look at Model 2 where we have added in one interactive variable which is the institutional quality to see how cumulative capital flow affects growth when factoring in the institutional quality. In Model 2, we can see that cumulative capital flow does significantly affect growth. This goes hand in hand with what was previously discussed that the cumulative capital flow does have effect on growth. The more capital flows in, it actually builds up the fragility of the economy in the sense that if there was the risk that capital could suddenly reverse and flow out, it would cause a negative impact on growth. Therefore, we can see that Model 2 shows how there is a positive relationship with the probability of recession because this risk of sudden capital flow reversal could actually increase the probability of recession. However, in Model 2, we have to also see the effects of the institutional quality on cumulative capital flow that affects growth. It shows that the coefficient value is -3.2152. This value has a negative relationship with growth. From here we can see that when cumulative capital flow interacts with the institutional quality, it is actually able to offset the positive value of the probability of cumulative capital flow causing recession. To better explain this, refer to equation 4.2.

$$Dummy\ Recession = -1.0322 + 0.5838\ CKA\_NGDP - 3.2152\ CKA\_NGDP \times INST \quad (4.2)$$

$$Dummy\ Recession = -1.0799 + (0.5838 - 3.2152\ INST)\ CKA\_NGDP \quad (4.3)$$

The above equations shows how the negative value of institutional quality can offset the positive value of the coefficient of cumulative capital flow. When this happens, the probability of recession would actually have a negative relationship with cumulative capital flow. This means that changes in the cumulative capital flow as discussed above would not cause the probability of recession when factoring in the institutional quality. As capital constantly flows into a country that has better institutions, it would not cause fragility in the market because better institutions are

able to withstand the risk of capital flow reversals. Thus, the sudden reversal of capital flow would not increase the probability of recession in a country with better institutions.

Model 3 shows how the cumulative capital flow affects the probability of recession when factoring in the exchange rate. We can see that in this model, cumulative capital flow has a positive relationship with the probability of recession. This is significant and proven that cumulative capital flow when interacting with exchange rate can affect growth. The flow in of capital with the risk of sudden reversals would increase the fragility of the economy causing the increase in the probability of recession. When looking at the coefficient of the exchange rate interaction variable, there is a negative value. This means that there is a negative relationship between the cumulative capital flow and probability of recession when there is an interaction with exchange rate. The exchange rate here is seen as the volatility of exchange rate. A country with a more volatile exchange rate would actually increase the probability of recession through its cumulative capital flow but a more stable exchange rate is able to decrease the probability of exchange rates through its cumulative capital flow. Volatility of exchange rate, being insecure and unpredictable, is not able to bring in capital inflow. Investors have little confidence in countries with very volatile exchange rates. A country with a more stable exchange rate would not have a huge effect of sudden capital flow reversal on the economy. People still have confidence when there are better exchange rates. Thus, the results show that a country with a more stable exchange rate can retain its cumulative capital flow to withstand the effects of capital flow reversals, if any, thus reducing the probability of recession. When the exchange rate is more stable, it is less likely that the probability of recession would occur due to the capital flow reversals. Therefore, when the quality of exchange rate gets better, the lower the chances of the probability of recession of occurring through the changes of cumulative capital flows.

Model 4 and 5 shows that the financial market and the U.S. interest rate are not significant in how the capital flow affects the probability of recession. This could be

because there may be some other factors that is affecting the data or maybe an insufficient data to explain how financial market affects the probability of recession.

### 4.1.5 Logit Model

For robustness and to confirm our results in the Probit model, we ran the logit model on our data. Similar to the Probit model, we used the same data using different variation of models, adding the variables as we go along. Table below shows the regression output that was generated for the different models.

Table 4.7: Results on Logit models.

Y=Dummy recession

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| C | -1.7261 | -1.8167 | -1.7508 | -1.7462 | -1.7778 |
| | (0.1216) | (0.1281) | (0.1233) | (0.1241) | (0.1246) |
| CKA_NGDP | 0.0171 | 0.9980*** | 1.8456** | 0.0944 | -0.5717 |
| | (0.0545) | (0.2769) | (0.9081) | (0.0959) | (0.3974) |
| CKA_NGDP*INST | | -5.5026*** | | | |
| | | (1.8300) | | | |
| CKA_NGDP*LEXR | | | -0.7362** | | |
| | | | (0.3692) | | |
| CKA_NGDP*M2_NGDP | | | | -0.0469 | |
| | | | | (0.0481) | |
| CKA_NGDP*RUS | | | | | 3.1221 |
| | | | | | (2.0036) |

*Note:* Standard errors are provided in parenthesis, *** $\rho < 0.01$, ** $\rho < 0.05$, * $\rho < 0.1$.

From this table we can see how the probability of recession is affected by the variables. The result of this Logit model is very much similar to the results of the Probit model. In fact, the only difference that can be seen when comparing with Probit model is that the results seems to have improved. The interaction between the institutional quality and exchange rate with the cumulative capital flow still significantly affects the probability of recession. This means that we can see the probability of recession when studying the interactive relationship of exchange rate and institutional quality with capital flow. The significance level has improved in the sense that it has increased to be more significant. When looking at the interactive relationship of exchange rate, we can see that it lowered from 10% significance to 5% significance level. Whereas the interactive relationship of institutional quality has the same significance at 1% significance level compared to the Probit model. The coefficient values got bigger in magnitude showing stronger and better relationships between the variables.

Therefore, from the results above, we can see that the probability of recession can be told from the interaction relationship of exchange rate and institutional quality with the capital flow.

## 4.2 Conclusion

As a conclusion, this chapter basically covers the testing of the Pooled OLS, REM, and FEM testing on the individual effect of capital flow on growth and also with the interaction with the other variables. We then studied the probability on recession when capital flow affects growth through different channels.

# Chapter 5: Discussion, Conclusion and Implications

## 5.0 Introduction

In this last chapter, we analyze and review our results generated and provide a brief summary on what we have learnt. A comprehensive discussion is done on our major findings before covering the limitations and recommendations on how to improve our research. Thus, we conclude our research project.

## 5.1 Summary of Statistical Analyses

We first started our research by the solving the basic endogeneity problem that exists in our baseline mode. Since we have discovered the endogeneity problem exists in our research, we attempt to solve it by initially regressing the difference of log real gross domestic product on cumulative capital flow which is shown in table 4.0. After that, we take the residual from table 4.0 and make a regression which sets the growth as the dependent variable to determine the relationship between residual of capital flow and growth because we know that the residual shows all other factors that affects capital flows excluding growth. This is shown by table 4.1 which allows the endogeneity problem to be eliminated.

Next, we proceed to the Pooled OLS where we did two sets of testing; first seeing the individual effect of all variables on the growth and secondly taking the interaction of the variables (institutional quality, exchange rate, financial market, U.S interest rate) with capital flow regressing it against growth. This is to identify which one raises

significant impact on growth. This is shown by table 4.2 and 4.3. Among the 4 variables, there is only exchange rate found to be insignificant against the capital flows. And more importantly, although the interactive of financial market with cumulative capital flow is significant, it is too weak to prove its effectiveness. After the cumulative capital flow interacts with the variables in each model, we discovered that the additional of variables in each model can slightly improve the result.

As our result is not sufficiently robust, we continued to carry out REM and FEM in order to choose the regression which is the best describe on the relationship between cumulative capital flow and growth. We evaluate this by observed the coefficients from Pooled OLS, REM and FEM in table 4.4 where the higher the coefficient, the stronger the effect of particular variable with capital flow on growth. Without the interactive relationship, FEM has highest coefficient on capital flows which assumed all countries shared the same characteristics, whereas REM shows the highest coefficient on institutional quality, exchange rate and U.S. interest rate because these variables could be improved over time. Over here, financial market is not significant on capital flows at all.

The empirical testing of Likelihood test, Lagrange multiplier test and Hausman test are carried out based on the result from table 4.4 to determine the best regression among Pooled OLS, REM and FEM. For likelihood test, the FEM is preferred over the pooled regression at 1% significant level, followed by the Lagrange Multiplier test which preferred pooled regression over the REM at 10% significant level. Lastly, FEM is preferred over REM at 5% significant level in Hausman test. We therefore have chosen the FEM test from table 4.4 as the best fit model.

In order to enable us on predict the probability of recession, we proceeded to the result of Logit and Probit model which can be shown in table 4.6 and 4.7 respectively. From table 4.6, the interaction of institutional quality and exchange rate with the capital account can anticipate the probability of recession except for capital flow itself as well as the interaction of financial market and U.S interest rate with the capital

flow. Then we continued to Logit model to make the result improved which shown in table 4.7. From the result of table 4.7, it proved that the interactive relationship of institutional quality and exchange rate with the capital flow is significant in forecasting the probability of recession.

## 5.2 Discussions of major findings

From the individual testing of Pooled OLS of cumulative capital flow, institutional quality, exchange rate and U.S. interest rate from table 4.2, we see that institutional quality can influence growth on its own but became insignificant after being regressed with the other variables. According to past researchers, we are to expect that institutional quality would be positively correlated with the growth but instead our result shows they are negatively correlated. This could be because there are many ways to define an institutional quality such as through economic prospects, legal prospects or government prospects. In our research, we have assumed that institutional quality is defined by the government effectiveness. According to the World Bank, government effectiveness actually takes into account the quality of the public services offered, the civil servants quality and also the degree of the country's political pressure independence (World Bank, n.d.). This may not be the most accurate because there may be other factors that have to be taken into account when considering an institutional quality of a country, therefore, the results may not have come out as what we have expected.

The exchange rate however insignificantly affects growth whether being regressed on its own or with other variables. According to the journal reviews, the exchange rate is when interacting with the capital flows should be positively correlated to stimulate growth, however, our result shows it is ambiguous which can be either positive or negative correlated with the growth. This could be because the exchange rate could not directly affect growth. Exchange rate could affect growth indirectly through other sources. An increase in exchange rate should theoretically bring in capital flow

because investors are attracted by our stronger currency and can earn through forex exchange. On the other hand, a depreciation of exchange rate could also bring in capital flow to invest in our goods and services because it is much cheaper. Therefore, this would explain the ambiguous effects of the coefficient sign.

In table 4.3, we did a testing to see the relationship to see through our four interactive variable channels do capital flow affect growth. In this result, we had the same outcome that through the institutional quality and exchange rate are insignificant to affect growth through capital flows.

We found that through Table 4.2, the financial market apparently has little or no effect on the growth of the economy. Although significant, the very small coefficient value says that it has almost no effect on growth. According to our literature review, we have expected that a better financial market should affect capital flow to positively stimulate growth. This is consistent with our results from table 4.3 where we did an interactive relationship test of cumulative capital flow and financial market against growth. This outcome shows a positive and significant relationship. This means that the financial market is actually able to affect capital flow to increase growth of a country. We know that a stronger financial market will foster in growth by the capital flow but the absence of a strong financial market will be unable to spur economic growth. Investors would also prefer to invest in markets with stronger financial markets or better stock markets which would encourage FDI's.

Lastly, U.S. interest rate showed the best results as it robustly affects the growth. We hypothesized that U.S. interest rate is negatively correlated with the capital flows which then delivered impact on growth. This is consistent with our result from table 4.3 that shows that the U.S. interest rate has a negative and significant relationship on the impact of capital flow and growth. We have predicted that the rise in U.S. interest rates would actually cause a negative effect on growth through the capital flows because when the U.S. interest rates is high, the capital would flow out of the U.S. and into emerging markets. This would cause a sudden reversal of capital flows

because capital was previously being flowed into developed countries. But with this sudden reversal of capital flow, it would actually cause fragility in the emerging markets. This is bad for emerging markets and thus growth could be adversely affected.

The second part of this research is to see how we can expect the probability of recession by conducting the Logit and Probit model. From there we can see that we can predict that the probability of recession can only be significantly seen when capital flow interacts with the institutional quality and exchange rate. As discussed above, the probability of recession is less likely to occur when capital flow interacts with the institutional quality and the exchange rate. The changes in the capital flow are able to have lesser negative impact on the likelihood of a recession when there is a strong institutional quality and better exchange rate stability. A stronger institutional quality would be able to withstand the sudden stop or the capital flow reversal situation thus would be less likely to bring a country into recession. A less volatile and more stable exchange rate is able to improve a country's investment opportunities and bring in more investments thus is able to spur growth or offset any negative impacts of capital flow reversals therefore being less likely the probability of running into a recession.

In conclusion, we found that our study has been rather effective and efficient as to study the impact of capital flow on growth because we have found rather similar results to what we have expected and also to past researchers. All in all, we now know and understand how the capital flow affects growth through different channels and we have a clearer picture on how all these would affect our future as regards to our questions of facing a possible crisis. We are able to grasp how the capital flow would affect growth in our country in the coming years and if we face a possibility of a recession.

## 5.3 Policy Implications

Based on our result, although the institutional quality and financial market are found to be insignificant to affect the growth but they are crucial factors in affecting the probability of the recession. The weak institutional quality and instability of financial market can amplify the negative impacts from recession towards a country. Hence, the policy-makers should reinforce the macro-prudential policy which aims to **minimize the systematic risks** and **strengthen the financial system** to avoid from vulnerability. (Claessens, 2014). According to International Monetary Fund (IMF), macro-prudential policy act as a regulatory framework which has wide coverage of control over the financial system to ensure systematic procedure that can subsequently secure against financial vulnerability. The macro-prudential policy is differ from micro-prudential policy that aimed to get rid of insecurity of individual institutions, it emphasized on the overall welfare of the financial system.

According to Federal Reserve Bank of San Francisco (FRBSF), the main advantage of macro-prudential policy is to look into deep about the current status of financial system as a whole to recognize the possible threats before situation getting worse until affect the stability of the system (Williams, 2015). Besides, it aims to narrow down the risks of capital outflows that cause by financial distress through strengthening of credit provision. Although the implementation of this policy incurred high costs, it has been widely adopted by the countries, regardless of advanced or emerging countries mainly because it can effectively minimize the risk exposures from financial system and eventually enhance long-term economic growth.

On the other hand, **macroeconomic policies** such as **monetary and fiscal policies** can be used to better improve the exchange rate, financial market and the U.S. interest rate. Our result shows the exchange rate is insignificant to affect the growth but it can bring significant effect on the probability of recession. Hence it is important for the central bank in controlling the monetary policy to avoid from the risks triggered by exchange rate volatility. As the central bank act as a core of monetary policy, they

should attempt to loosen the **monetary policy** significantly during the crises happen, such as global financial crisis in 2008-2009 so that the lower degree of restriction can induce lower market rates for savings and credit. (Binici & Yörükoğlu, 2011). This action can be implemented through the holding of sizable foreign reserves or set up a plan to allow the access of contingent credit in order to prevent from an unexpected capital reversal from global capital markets.

In order to achieve financial stability, it is important for the central bank to eliminate the barriers in foreign exchange market and at the same time supply liquidity in terms of foreign exchange whenever there is a need. Besides, the required reserves ratio also should be cut down to deal with the problem of the increasing in long term liquidity shortage. (Binici & Yörükoğlu, 2011). As such, the emerging countries can be protected against severe recessions. Nevertheless, the implementation of this policy is time consumed and regarding the cost involved still under discussion.

Next, our result shows that the U.S. interest rate is significant in examining both the relationship with growth and the probability of recession. When U.S. interest rate increases, this will eventually narrow down the arbitrage differential in rate of return. Which means that there will be low rate of rerun from investment in emerging market economy. This will cause a decline in foreign investments. To counter this issue, the emerging market economy countries should increase their home interest rate in order to continue attracting foreign investors. We know that most of the emerging countries are fairly depending on the advanced countries on the aspect of economics, especially U.S. When the U.S. interest rate is high, it is most likely to cause the capital outflows from the emerging countries because investors always expect for higher return and thus they tend to invest in U.S. rather than the emerging countries. Thus, the policy-makers should equip themselves with sound macroeconomic policies in order to stabilize the financial system and have a higher growth through capital inflows. More specifically, national banks are mainly responsible on controlling the money supply and coordinate with other financial institutions to control the interest rate. Banking sector should prohibit from the unproductive investments because it can increase the volatility risks which subsequently harm to a nation if there is sudden stop from

capital flows. In addition, banking sector ought to eliminate moral hazards among themselves because this can induce crisis problem as a result of excess government bailouts. (McKinnon & Pill, 1997).

On the other hand, government can allocate their funds wisely through the implementation of **fiscal policies** whereby involved the adjustment in taxes and government spending. Then the government should always alert with the current economic condition, for example when there is high unemployment, the government should increase the spending and cut down the taxes. Thus, the stronger the macroeconomic policies can effectively ease the adverse effects from capital reversal, and perform a better capability in absorbing the foreign capital flows.

## 5.4 Limitations of the Study

We have found that in our research, there are a few insufficiencies that have prevented us from improving the outcome of our research. This is because we have certain limitations in our study that has bounded us to get better results. These limitations are discussed below.

### 5.4.1 Limited time coverage

Our study is limited to only 5 years which is within 2007 to 2011. The main reason is because there are some of the countries with incomplete dataset which restricted us from collecting more data. With longer time periods, it would allow us to prove the relationship between capital flows and growth whether they are positively or negatively correlated over time. This will give us a more accurate and robust

relationship. Besides, the longer time periods also enable us to predict the probability of recession by observed the changes of growth in previous years. Through the collection of data, we can track the incidents that happened in the past and forecast the future economic trend. However, due to limited time periods covered in our study, our result is less robust. Indeed, 5 years is considered as medium term, it is relatively less powerful than longer time periods for example 10 years because the wider range of time would allow us to collect and discover more relevant information on our study that make our result more significant.

### 5.4.2 Inadequate variables

Our primary objective is to know the impact of capital flows on economic growth. Meanwhile, we have developed another model to indicate the different channels of how capital flow is able to affect growth which are institutional quality, exchange rate, financial market, and U.S. interest rate respectively. Although these variables are independent, the capital flows can be affected by various external factors instead of restricted to these four variables. For instance, the technological progress can be one of the factors contributed to the foreign capital inflows. Hence, our model is slightly less persuasive if only extract the four determinants from a numerous factors.

### 5.4.3 Geographical Location

Countries chosen in the research are important as it may affect the result. Variety of countries can act as limitation to our study. We have Southeast Asian, South American, Europe, Central Asian, Southeastern Europe's Balkan Peninsula and South Asia countries in our research. Various countries involved in the research may be good in the sense that we included all possibilities however the risk of doing this is

the result may have outliers that lead to inaccurate results. Moreover, we only included one or two countries in a region. It may stop us to capture the significant effect of the region. In other words, if one or two countries are selected for a huge region, then the result is going to be biased since generalization is taken place. Furthermore, we categorized those countries into developed countries and developing countries based on the list of sources from United Nations New York. Several journals have defined their own categories of developed countries and developing countries. For example, Israel is listed in developed countries.

## 5.5 Recommendations for Future Research

### 5.5.1 Lengthen time period

As longer time period covered in the study can effectively make the result more robust, future researchers are advised to broaden the time range for any economic-related research. We should know that longer time period enable us to discover clues and predict something that may happen in future. We can figure it out by leading an example, which are 5 years (1997- 2002) and 10 years (1997-2007) respectively. In this case, we can only know there is Asian financial crisis that occurred in 1997-1998 within the 5 years period and the factors that are likely cause it to happen, but unable to forecast whether it will strike to the economic once again. In contrast, 10 years period can provide us information at the same time guide us on forecast the future economic trend. More specifically, Asian financial crisis happened in 1997-1998 followed by global financial crisis in 2007-2008, hence we can exactly know that the crises was cyclical, it probably will happen once for every 10 years.

### 5.5.2 Add more variables

From our empirical result, only two out of four interactive variables can significantly affect the capital which then influence the economic growth (GDP) which are institutional quality and exchange rate. The insignificance of the variable simply means that there are other variables that could affect capital flow which then influence the GDP. Rather than just including only four interactive variables to the research, future researchers are recommend to take into account more variables. This might improve the persuasiveness of the model and also the robustness of their results in the future. Moreover, this is also our contribution of the study where the future researcher can exclude financial market and U.S. interest rate as we already find out that this two variables is insignificant and further researches on the determinants of capital flow need to be conducted if they want to do research on the probability of recession.

## 5.6 Conclusion

This chapter provides a summary for the results generated and includes a comprehensive discussion of each independent variables base on the results generated. Furthermore, this chapter offers several implications. Lastly, this chapter addresses the limitations of this study following suggestion to overcome it in future research.

In conclusion, with this study being done, we now have a clearer picture on how the capital flow affects growth and through which channels can we see this happen. We also now know how this capital flow is able to foster in growth or even cause an adverse relationship to a recession when studying the probability of recession. This has enabled us to be able to see the signs and symptoms of a possible recession in the coming years and be more aware of our country's economic activities. All in all, we are extremely happy and proud of the outcomes of this research.

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# APPENDICES

## Appendix 4.0: Output for the Relationship between Cumulative Capital Flow and Growth.

Dependent Variable: CKA_NGDP

Method: Panel Least Squares

Date: 07/15/16 Time: 15:49

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.237881 | 0.090990 | 2.614350 | 0.0092 |
| DLRGDP | 12.75299 | 6.490802 | 1.964779 | 0.0499 |

| | | | |
|---|---|---|---|
| R-squared | 0.006751 | Mean dependent var | 0.314612 |
| Adjusted R-squared | 0.005002 | S.D. dependent var | 1.967024 |
| S.E. of regression | 1.962099 | Akaike info criterion | 4.189409 |
| Sum squared resid | 2186.704 | Schwarz criterion | 4.204657 |
| Log likelihood | -1191.982 | Hannan-Quinn criter. | 4.195358 |
| F-statistic | 3.860357 | Durbin-Watson stat | 0.041471 |
| Prob(F-statistic) | 0.049927 | | |

Appendix 4.1: Output for Residual of Capital Flow against Growth.

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/15/16 Time: 15:40

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.006017 | 0.000531 | 11.32524 | 0.0000 |
| RESID_ENDO | -8.11E-14 | 0.000271 | -2.99E-10 | 1.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.000000 | Mean dependent var | 0.006017 |
| Adjusted R-squared | -0.001761 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012684 | Akaike info criterion | -5.893485 |
| Sum squared resid | 0.091379 | Schwarz criterion | -5.878237 |
| Log likelihood | 1681.643 | Hannan-Quinn criter. | -5.887535 |
| F-statistic | 0.000000 | Durbin-Watson stat | 0.574505 |
| Prob(F-statistic) | 1.000000 | | |

Appendix 4.2.1: Output for Model 1

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:13

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005850 | 0.000536 | 10.91022 | 0.0000 |
| CKA_NGDP | 0.000529 | 0.000269 | 1.964779 | 0.0499 |

| | | | |
|---|---|---|---|
| R-squared | 0.006751 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.005002 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012641 | Akaike info criterion | -5.900258 |
| Sum squared resid | 0.090762 | Schwarz criterion | -5.885010 |
| Log likelihood | 1683.574 | Hannan-Quinn criter. | -5.894309 |
| F-statistic | 3.860357 | Durbin-Watson stat | 0.577736 |
| Prob(F-statistic) | 0.049927 | | |

Appendix 4.2.2: Output for Model 2

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:19

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.007762 | 0.000631 | 12.30750 | 0.0000 |
| CKA_NGDP | 0.000429 | 0.000264 | 1.626831 | 0.1043 |
| INST | -0.002971 | 0.000547 | -5.430189 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.055851 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.052521 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012335 | Akaike info criterion | -5.947447 |
| Sum squared resid | 0.086275 | Schwarz criterion | -5.924576 |
| Log likelihood | 1698.022 | Hannan-Quinn criter. | -5.938523 |
| F-statistic | 16.77046 | Durbin-Watson stat | 0.608533 |
| Prob(F-statistic) | 0.000000 | | |

Appendix 4.2.3: Output for Model 3

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:24

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.008022 | 0.001070 | 7.499074 | 0.0000 |
| CKA_NGDP | 0.000424 | 0.000264 | 1.604428 | 0.1092 |
| INST | -0.003056 | 0.000617 | -4.952381 | 0.0000 |
| LEXR | -7.48E-05 | 0.000248 | -0.301439 | 0.7632 |

| | | | |
|---|---|---|---|
| R-squared | 0.056003 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.050999 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012345 | Akaike info criterion | -5.944099 |
| Sum squared resid | 0.086261 | Schwarz criterion | -5.913603 |
| Log likelihood | 1698.068 | Hannan-Quinn criter. | -5.932201 |
| F-statistic | 11.19267 | Durbin-Watson stat | 0.608524 |
| Prob(F-statistic) | 0.000000 | | |

Appendix 4.2.4: Output for Model 4

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:27

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.007714 | 0.001081 | 7.135506 | 0.0000 |
| CKA_NGDP | 0.000421 | 0.000264 | 1.597710 | 0.1107 |
| INST | -0.002752 | 0.000638 | -4.310644 | 0.0000 |
| LEXR | 4.02E-05 | 0.000256 | 0.157314 | 0.8751 |
| M2_NGDP | -6.59E-06 | 3.64E-06 | -1.809936 | 0.0708 |

| | | | |
|---|---|---|---|
| R-squared | 0.061444 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.054800 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012320 | Akaike info criterion | -5.946372 |
| Sum squared resid | 0.085764 | Schwarz criterion | -5.908252 |
| Log likelihood | 1699.716 | Hannan-Quinn criter. | -5.931498 |
| F-statistic | 9.247222 | Durbin-Watson stat | 0.612646 |
| Prob(F-statistic) | 0.000000 | | |

Appendix 4.2.5: Output for Model 5

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:30

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005877 | 0.001121 | 5.240527 | 0.0000 |
| CKA_NGDP | 0.000491 | 0.000259 | 1.897240 | 0.0583 |
| INST | -0.002717 | 0.000625 | -4.344629 | 0.0000 |
| LEXR | 6.26E-05 | 0.000250 | 0.250064 | 0.8026 |
| M2_NGDP | -6.85E-06 | 3.57E-06 | -1.921513 | 0.0552 |
| RUS | 0.001661 | 0.000333 | 4.981221 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.100995 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.093025 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012069 | Akaike info criterion | -5.985916 |
| Sum squared resid | 0.082150 | Schwarz criterion | -5.940173 |
| Log likelihood | 1711.986 | Hannan-Quinn criter. | -5.968069 |
| F-statistic | 12.67208 | Durbin-Watson stat | 0.626933 |
| Prob(F-statistic) | 0.000000 | | |

Appendix 4.3.1: Output for Model 1

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:13

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005850 | 0.000536 | 10.91022 | 0.0000 |
| CKA_NGDP | 0.000529 | 0.000269 | 1.964779 | 0.0499 |

| | | | |
|---|---|---|---|
| R-squared | 0.006751 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.005002 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012641 | Akaike info criterion | -5.900258 |
| Sum squared resid | 0.090762 | Schwarz criterion | -5.885010 |
| Log likelihood | 1683.574 | Hannan-Quinn criter. | -5.894309 |
| F-statistic | 3.860357 | Durbin-Watson stat | 0.577736 |
| Prob(F-statistic) | 0.049927 | | |

Appendix 4.3.2: Output for Model 2

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:37

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005927 | 0.000537 | 11.02730 | 0.0000 |
| CKA_NGDP | -0.000756 | 0.000830 | -0.911642 | 0.3623 |
| CKA_NGDP*INST | 0.004800 | 0.002930 | 1.638182 | 0.1019 |

| | | | |
|---|---|---|---|
| R-squared | 0.011429 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.007942 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012622 | Akaike info criterion | -5.901471 |
| Sum squared resid | 0.090334 | Schwarz criterion | -5.878599 |
| Log likelihood | 1684.919 | Hannan-Quinn criter. | -5.892547 |
| F-statistic | 3.277720 | Durbin-Watson stat | 0.581746 |
| Prob(F-statistic) | 0.038430 | | |

Appendix 4.3.3: Output for Model 3

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:45

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005962 | 0.000538 | 11.07140 | 0.0000 |
| CKA_NGDP | -0.005141 | 0.004305 | -1.194206 | 0.2329 |
| CKA_NGDP*INST | 0.004143 | 0.002997 | 1.382360 | 0.1674 |
| CKA_NGDP*LEX R | 0.001822 | 0.001755 | 1.037965 | 0.2997 |

| | | | |
|---|---|---|---|
| R-squared | 0.013308 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.008078 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012621 | Akaike info criterion | -5.899864 |
| Sum squared resid | 0.090163 | Schwarz criterion | -5.869368 |
| Log likelihood | 1685.461 | Hannan-Quinn criter. | -5.887966 |
| F-statistic | 2.544569 | Durbin-Watson stat | 0.584015 |
| Prob(F-statistic) | 0.055306 | | |

Appendix 4.3.4: Output for Model 4

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:52

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.006173 | 0.000545 | 11.32078 | 0.0000 |
| CKA_NGDP | -0.007946 | 0.004477 | -1.774721 | 0.0765 |
| CKA_NGDP*INST | 0.004334 | 0.002988 | 1.450259 | 0.1475 |
| CKA_NGDP*LEXR | 0.002544 | 0.001780 | 1.429304 | 0.1535 |
| CKA_NGDP*M2_NGDP | 0.000567 | 0.000259 | 2.190401 | 0.0289 |

| | | | |
|---|---|---|---|
| R-squared | 0.021616 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.014689 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012579 | Akaike info criterion | -5.904811 |
| Sum squared resid | 0.089403 | Schwarz criterion | -5.866692 |
| Log likelihood | 1687.871 | Hannan-Quinn criter. | -5.889938 |
| F-statistic | 3.120696 | Durbin-Watson stat | 0.590588 |
| Prob(F-statistic) | 0.014810 | | |

Appendix 4.3.5: Output for Model 5

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:53

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.006171 | 0.000543 | 11.35759 | 0.0000 |
| CKA_NGDP | 0.002994 | 0.006646 | 0.450438 | 0.6526 |
| CKA_NGDP*INST | 0.001262 | 0.003284 | 0.384221 | 0.7010 |
| CKA_NGDP*LEXR | -0.001415 | 0.002515 | -0.562866 | 0.5738 |
| CKA_NGDP*M2_NGDP | 0.000617 | 0.000259 | 2.383475 | 0.0175 |
| CKA_NGDP*RUS | -0.001290 | 0.000581 | -2.221027 | 0.0267 |

| | | | |
|---|---|---|---|
| R-squared | 0.030099 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.021501 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012536 | Akaike info criterion | -5.910011 |
| Sum squared resid | 0.088628 | Schwarz criterion | -5.864267 |
| Log likelihood | 1690.353 | Hannan-Quinn criter. | -5.892163 |
| F-statistic | 3.500528 | Durbin-Watson stat | 0.594391 |
| Prob(F-statistic) | 0.003995 | | |

Appendix 4.4.1: Output for FEM

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 01:56

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.030901 | 0.014478 | 2.134322 | 0.0333 |
| CKA_NGDP | 0.002171 | 0.000466 | 4.659518 | 0.0000 |
| INST | -0.006101 | 0.007581 | -0.804727 | 0.4213 |
| LEXR | -0.008549 | 0.005143 | -1.662309 | 0.0970 |
| M2_NGDP | -1.04E-06 | 2.93E-05 | -0.035661 | 0.9716 |
| RUS | 0.001622 | 0.000328 | 4.940586 | 0.0000 |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.261053 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.214092 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.011234 | Akaike info criterion | -6.080224 |
| Sum squared resid | 0.067524 | Schwarz criterion | -5.813387 |
| Log likelihood | 1767.864 | Hannan-Quinn criter. | -5.976113 |
| F-statistic | 5.558921 | Durbin-Watson stat | 0.749866 |
| Prob(F-statistic) | 0.000000 | | |

## Appendix 4.4.2: Output for REM

Dependent Variable: DLRGDP

Method: Panel EGLS (Cross-section random effects)

Date: 07/18/16 Time: 01:57

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

Swamy and Arora estimator of component variances

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005575 | 0.001953 | 2.855087 | 0.0045 |
| CKA_NGDP | 0.001167 | 0.000350 | 3.337804 | 0.0009 |
| INST | -0.002636 | 0.001131 | -2.329669 | 0.0202 |
| LEXR | 5.84E-05 | 0.000456 | 0.127999 | 0.8982 |
| M2_NGDP | -6.85E-06 | 6.42E-06 | -1.067459 | 0.2862 |
| RUS | 0.001707 | 0.000311 | 5.489215 | 0.0000 |

| | Effects Specification | |
|---|---|---|
| | S.D. | Rho |
| Cross-section random | 0.004377 | 0.1318 |
| Idiosyncratic random | 0.011234 | 0.8682 |

| | Weighted Statistics | | |
|---|---|---|---|
| R-squared | 0.078848 | Mean dependent var | 0.003053 |
| Adjusted R-squared | 0.070682 | S.D. dependent var | 0.011733 |
| S.E. of regression | 0.011311 | Sum squared resid | 0.072152 |
| F-statistic | 9.655383 | Durbin-Watson stat | 0.713348 |
| Prob(F-statistic) | 0.000000 | | |

| | Unweighted Statistics | | |
|---|---|---|---|
| R-squared | 0.090053 | Mean dependent var | 0.006017 |
| Sum squared resid | 0.083150 | Durbin-Watson stat | 0.618998 |

## Appendix 4.4.3: Likelihood Test Output without Interactive Relationship

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 3.995946 | (29,535) | 0.0000 |
| Cross-section Chi-square | 111.755508 | 29 | 0.0000 |

Cross-section fixed effects test equation:

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/17/16 Time: 23:19

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005877 | 0.001121 | 5.240527 | 0.0000 |
| CKA_NGDP | 0.000491 | 0.000259 | 1.897240 | 0.0583 |
| INST | -0.002717 | 0.000625 | -4.344629 | 0.0000 |
| LEXR | 6.26E-05 | 0.000250 | 0.250064 | 0.8026 |
| M2_NGDP | -6.85E-06 | 3.57E-06 | -1.921513 | 0.0552 |
| RUS | 0.001661 | 0.000333 | 4.981221 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.100995 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.093025 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012069 | Akaike info criterion | -5.985916 |
| Sum squared resid | 0.082150 | Schwarz criterion | -5.940173 |
| Log likelihood | 1711.986 | Hannan-Quinn criter. | -5.968069 |
| F-statistic | 12.67208 | Durbin-Watson stat | 0.626933 |
| Prob(F-statistic) | 0.000000 | | |

Appendix 4.4.4: Langrange Multiplier Test Output without Interactive Relationship

Lagrange Multiplier Tests for Random Effects

Null hypotheses: No effects

Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

| | Test Hypothesis | | |
|---|---|---|---|
| | Cross-section | Time | Both |
| Breusch-Pagan | 61.25922 | 763.5697 | 824.8289 |
| | (0.0000) | (0.0000) | (0.0000) |
| Honda | 7.826827 | 27.63276 | 25.07372 |
| | (0.0000) | (0.0000) | (0.0000) |
| King-Wu | 7.826827 | 27.63276 | 26.54938 |
| | (0.0000) | (0.0000) | (0.0000) |
| Standardized Honda | 9.083835 | 29.23947 | 22.40081 |
| | (0.0000) | (0.0000) | |
| | | | (0.0000) |
| Standardized King-Wu | 9.083835 | 29.23947 | 23.98013 |
| | (0.0000) | (0.0000) | (0.0000) |
| Gourierioux, et al.* | -- | -- | 824.8289 |
| | | | (< 0.01) |

*Mixed chi-square asymptotic critical values:

| | |
|---|---|
| 1% | 7.289 |
| 5% | 4.321 |
| 10% | 2.952 |

Appendix 4.4.5: Hausman Test Output without Interactive Relationship

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 11.669133 | 5 | 0.0396 |

Cross-section random effects test comparisons:

| Variable | Fixed | Random | Var(Diff.) | Prob. |
|---|---|---|---|---|
| CKA_NGDP | 0.002171 | 0.001167 | 0.000000 | 0.0011 |
| INST | -0.006101 | -0.002636 | 0.000056 | 0.6439 |
| LEXR | -0.008549 | 0.000058 | 0.000026 | 0.0929 |
| M2_NGDP | -0.000001 | -0.000007 | 0.000000 | 0.8390 |
| RUS | 0.001622 | 0.001707 | 0.000000 | 0.4184 |

Appendix 4.5.1: Output for FEM with Interactive Relationship

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 02:00

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.005527 | 0.000673 | 8.217704 | 0.0000 |
| CKA_NGDP | 0.010140 | 0.007366 | 1.376555 | 0.1692 |
| CKA_NGDP*INST | -0.000564 | 0.005411 | -0.104183 | 0.9171 |
| CKA_NGDP*LEXR | -0.003232 | 0.002509 | -1.288287 | 0.1982 |
| CKA_NGDP*M2_NGDP | -0.000192 | 0.000610 | -0.314196 | 0.7535 |
| CKA_NGDP*RUS | -0.000940 | 0.000602 | -1.559994 | 0.1194 |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.216723 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.166945 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.011567 | Akaike info criterion | -6.021964 |
| Sum squared resid | 0.071575 | Schwarz criterion | -5.755127 |
| Log likelihood | 1751.260 | Hannan-Quinn criter. | -5.917852 |
| F-statistic | 4.353763 | Durbin-Watson stat | 0.735482 |
| Prob(F-statistic) | 0.000000 | | |

## Appendix 4.5.2: Output for REM with Interactive Relationship

Dependent Variable: DLRGDP

Method: Panel EGLS (Cross-section random effects)

Date: 07/18/16 Time: 02:01

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

Swamy and Arora estimator of component variances

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.006019 | 0.001025 | 5.871733 | 0.0000 |
| CKA_NGDP | 0.005441 | 0.006518 | 0.834740 | 0.4042 |
| CKA_NGDP*INST | 0.002233 | 0.003507 | 0.636796 | 0.5245 |
| CKA_NGDP*LEXR | -0.002264 | 0.002423 | -0.934384 | 0.3505 |
| CKA_NGDP*M2_NGDP | 0.000347 | 0.000402 | 0.863122 | 0.3884 |
| CKA_NGDP*RUS | -0.001205 | 0.000550 | -2.192354 | 0.0288 |

| | Effects Specification | |
|---|---|---|
| | S.D. | Rho |
| Cross-section random | 0.004784 | 0.1461 |
| Idiosyncratic random | 0.011567 | 0.8539 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.027634 | Mean dependent var | 0.002918 |
| Adjusted R-squared | 0.019013 | S.D. dependent var | 0.011704 |
| S.E. of regression | 0.011592 | Sum squared resid | 0.075784 |
| F-statistic | 3.205664 | Durbin-Watson stat | 0.694951 |
| Prob(F-statistic) | 0.007296 | | |

Unweighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.027264 | Mean dependent var | 0.006017 |
| Sum squared resid | 0.088887 | Durbin-Watson stat | 0.592506 |

## Appendix 4.5.3: Likelihood Test Output with Interactive Relationship

Redundant Fixed Effects Tests

Equation: FEM

Test cross-section fixed effects

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 4.395500 | (29,535) | 0.0000 |
| Cross-section Chi-square | 121.813427 | 29 | 0.0000 |

Cross-section fixed effects test equation:

Dependent Variable: DLRGDP

Method: Panel Least Squares

Date: 07/18/16 Time: 02:03

Sample (adjusted): 2007Q2 2011Q4

Periods included: 19

Cross-sections included: 30

Total panel (balanced) observations: 570

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.006171 | 0.000543 | 11.35759 | 0.0000 |
| CKA_NGDP | 0.002994 | 0.006646 | 0.450438 | 0.6526 |
| CKA_NGDP*INST | 0.001262 | 0.003284 | 0.384221 | 0.7010 |
| CKA_NGDP*LEXR | -0.001415 | 0.002515 | -0.562866 | 0.5738 |
| CKA_NGDP*M2_NGDP | 0.000617 | 0.000259 | 2.383475 | 0.0175 |
| CKA_NGDP*RUS | -0.001290 | 0.000581 | -2.221027 | 0.0267 |

| | | | |
|---|---|---|---|
| R-squared | 0.030099 | Mean dependent var | 0.006017 |
| Adjusted R-squared | 0.021501 | S.D. dependent var | 0.012673 |
| S.E. of regression | 0.012536 | Akaike info criterion | -5.910011 |
| Sum squared resid | 0.088628 | Schwarz criterion | -5.864267 |
| Log likelihood | 1690.353 | Hannan-Quinn criter. | -5.892163 |
| F-statistic | 3.500528 | Durbin-Watson stat | 0.594391 |
| Prob(F-statistic) | 0.003995 | | |

Appendix 4.5.4: Langrange Multiplier Test Output with Interactive Relationship

Lagrange Multiplier Tests for Random Effects

Null hypotheses: No effects

Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

| | Test Hypothesis | | |
|---|---|---|---|
| | Cross-section | Time | Both |
| Breusch-Pagan | 104.3691 | 851.8831 | 956.2522 |
| | (0.0000) | (0.0000) | (0.0000) |
| Honda | 10.21612 | 29.18704 | 27.86224 |
| | (0.0000) | (0.0000) | (0.0000) |
| King-Wu | 10.21612 | 29.18704 | 29.24890 |
| | (0.0000) | (0.0000) | (0.0000) |
| Standardized Honda | 11.07702 | 30.03705 | 24.51722 |
| | (0.0000) | (0.0000) | (0.0000) |
| Standardized King-Wu | 11.07702 | 30.03705 | 25.98536 |
| | (0.0000) | (0.0000) | (0.0000) |
| Gourierioux, et al.* | -- | -- | 956.2522 |
| | | | (< 0.01) |

*Mixed chi-square asymptotic critical values:

| | |
|---|---|
| 1% | 7.289 |
| 5% | 4.321 |
| 10% | 2.952 |

Appendix 4.5.5: Hausman Test Output with Interactive Relationship

Correlated Random Effects - Hausman Test

Equation: REM

Test cross-section random effects

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 7.463694 | 5 | 0.1884 |

Cross-section random effects test comparisons:

| Variable | Fixed | Random | Var(Diff.) | Prob. |
|---|---|---|---|---|
| CKA_NGDP | 0.010140 | 0.005441 | 0.000012 | 0.1709 |
| CKA_NGDP*INST | -0.000564 | 0.002233 | 0.000017 | 0.4973 |
| CKA_NGDP*LEXR | -0.003232 | -0.002264 | 0.000000 | 0.1369 |
| CKA_NGDP*M2_NGDP | -0.000192 | 0.000347 | 0.000000 | 0.2397 |
| CKA_NGDP*RUS | -0.000940 | -0.001205 | 0.000000 | 0.2811 |

Appendix 4.6.1: Probit Model output for Model 1

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:09

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 4 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.032224 | 0.066731 | -15.46834 | 0.0000 |
| CKA_NGDP | 0.010665 | 0.032332 | 0.329852 | 0.7415 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.000228 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.359531 |
| Akaike info criterion | 0.859029 | Sum squared resid | 69.54326 |
| Schwarz criterion | 0.874924 | Log likelihood | -229.9379 |
| Hannan-Quinn criter. | 0.865246 | Deviance | 459.8758 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 0.104746 | Avg. log likelihood | -0.425811 |
| Prob(LR statistic) | 0.746207 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.6.2: Probit Model Output for Model 2

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:11

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 7 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.079926 | 0.069322 | -15.57843 | 0.0000 |
| CKA_NGDP | 0.583781 | 0.169033 | 3.453664 | 0.0006 |
| CKA_NGDP*INST | -3.215157 | 1.107214 | -2.903827 | 0.0037 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.034392 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.353210 |
| Akaike info criterion | 0.833631 | Sum squared resid | 66.99473 |
| Schwarz criterion | 0.857473 | Log likelihood | -222.0804 |
| Hannan-Quinn criter. | 0.842956 | Deviance | 444.1609 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 15.81965 | Avg. log likelihood | -0.411260 |
| Prob(LR statistic) | 0.000367 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.6.3: Probit Model for Model 3

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:12

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.042101 | 0.067122 | -15.52551 | 0.0000 |
| CKA_NGDP | 0.914075 | 0.502668 | 1.818448 | 0.0690 |
| CKA_NGDP*LEXR | -0.363022 | 0.202387 | -1.793699 | 0.0729 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.007526 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.357423 |
| Akaike info criterion | 0.856517 | Sum squared resid | 68.60250 |
| Schwarz criterion | 0.880359 | Log likelihood | -228.2595 |
| Hannan-Quinn criter. | 0.865841 | Deviance | 456.5189 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 3.461603 | Avg. log likelihood | -0.422703 |
| Prob(LR statistic) | 0.177142 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.6.4: Probit Model for Model 4

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:13

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.043488 | 0.067970 | -15.35222 | 0.0000 |
| CKA_NGDP | 0.055003 | 0.056622 | 0.971422 | 0.3313 |
| CKA_NGDP*M2_NGDP | -0.026374 | 0.027795 | -0.948870 | 0.3427 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.002107 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.359553 |
| Akaike info criterion | 0.861132 | Sum squared resid | 69.42261 |
| Schwarz criterion | 0.884974 | Log likelihood | -229.5056 |
| Hannan-Quinn criter. | 0.870456 | Deviance | 459.0112 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 0.969305 | Avg. log likelihood | -0.425010 |
| Prob(LR statistic) | 0.615911 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.6.5: Probit Model Output for Model 5

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:14

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 8 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.058254 | 0.067654 | -15.64212 | 0.0000 |
| CKA_NGDP | -0.326022 | 0.225200 | -1.447700 | 0.1477 |
| CKA_NGDP*RUS | 1.764699 | 1.154216 | 1.528916 | 0.1263 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.050877 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.348546 |
| Akaike info criterion | 0.819589 | Sum squared resid | 65.23699 |
| Schwarz criterion | 0.843431 | Log likelihood | -218.2890 |
| Hannan-Quinn criter. | 0.828914 | Deviance | 436.5781 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 23.40244 | Avg. log likelihood | -0.404239 |
| Prob(LR statistic) | 0.000008 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.7.1: Logit Model Output for Model 1

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:15

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.726105 | 0.121634 | -14.19093 | 0.0000 |
| CKA_NGDP | 0.017109 | 0.054507 | 0.313883 | 0.7536 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.000202 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.359530 |
| Akaike info criterion | 0.859051 | Sum squared resid | 69.54299 |
| Schwarz criterion | 0.874946 | Log likelihood | -229.9438 |
| Hannan-Quinn criter. | 0.865267 | Deviance | 459.8875 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 0.093002 | Avg. log likelihood | -0.425822 |
| Prob(LR statistic) | 0.760395 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.7.2: Logit Model output for Model 2

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:16

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 7 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.816722 | 0.128090 | -14.18317 | 0.0000 |
| CKA_NGDP | 0.998044 | 0.276867 | 3.604782 | 0.0003 |
| CKA_NGDP*INST | -5.502597 | 1.829972 | -3.006929 | 0.0026 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.034556 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.353113 |
| Akaike info criterion | 0.833492 | Sum squared resid | 66.95791 |
| Schwarz criterion | 0.857334 | Log likelihood | -222.0428 |
| Hannan-Quinn criter. | 0.842816 | Deviance | 444.0856 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 15.89493 | Avg. log likelihood | -0.411190 |
| Prob(LR statistic) | 0.000354 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.7.3: Logit Model Output for Model 3

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:20

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 4 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.750811 | 0.123282 | -14.20167 | 0.0000 |
| CKA_NGDP | 1.845565 | 0.908122 | 2.032288 | 0.0421 |
| CKA_NGDP*LEXR | -0.736227 | 0.369240 | -1.993897 | 0.0462 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.008830 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.356951 |
| Akaike info criterion | 0.855405 | Sum squared resid | 68.42138 |
| Schwarz criterion | 0.879247 | Log likelihood | -227.9594 |
| Hannan-Quinn criter. | 0.864730 | Deviance | 455.9188 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 4.061772 | Avg. log likelihood | -0.422147 |
| Prob(LR statistic) | 0.131219 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.7.4: Logit Model output for Model 4

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:21

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 4 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.746264 | 0.124120 | -14.06918 | 0.0000 |
| CKA_NGDP | 0.094371 | 0.095901 | 0.984045 | 0.3251 |
| CKA_NGDP*M2_NGDP | -0.046897 | 0.048065 | -0.975702 | 0.3292 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.002075 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.359548 |
| Akaike info criterion | 0.861160 | Sum squared resid | 69.42069 |
| Schwarz criterion | 0.885002 | Log likelihood | -229.5131 |
| Hannan-Quinn criter. | 0.870484 | Deviance | 459.0262 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 0.954367 | Avg. log likelihood | -0.425024 |
| Prob(LR statistic) | 0.620529 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |

Appendix 4.7.5: Logit Model Output for Model 5

Dependent Variable: DUM_RECLRGDPQ2Q

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 07/18/16 Time: 02:21

Sample (adjusted): 2007Q3 2011Q4

Included observations: 540 after adjustments

Convergence achieved after 9 iterations

Coefficient covariance computed using observed Hessian

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | -1.777731 | 0.124592 | -14.26846 | 0.0000 |
| CKA_NGDP | -0.571659 | 0.397355 | -1.438660 | 0.1502 |
| CKA_NGDP*RUS | 3.122045 | 2.003575 | 1.558237 | 0.1192 |

| | | | |
|---|---|---|---|
| McFadden R-squared | 0.051076 | Mean dependent var | 0.151852 |
| S.D. dependent var | 0.359210 | S.E. of regression | 0.348468 |
| Akaike info criterion | 0.819420 | Sum squared resid | 65.20801 |
| Schwarz criterion | 0.843262 | Log likelihood | -218.2433 |
| Hannan-Quinn criter. | 0.828744 | Deviance | 436.4866 |
| Restr. deviance | 459.9805 | Restr. log likelihood | -229.9903 |
| LR statistic | 23.49390 | Avg. log likelihood | -0.404154 |
| Prob(LR statistic) | 0.000008 | | |

| | | | |
|---|---|---|---|
| Obs with Dep=0 | 458 | Total obs | 540 |
| Obs with Dep=1 | 82 | | |