GROUP 2

DEBT, BUDGET DEFICIT AND ECONOMIC GROWTH OF MALAYSIA

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DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is 15726.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The European sovereign debt crisis in 2010 shook the global economy when countries such as Greece, which had been maintaining high levels of debt and fiscal deficit, faced the risk of defaulting on sovereign debt. The great uncertainty resulting from sovereign risk faced by these countries are mainly attributed to excessive debt and budget deficit levels maintained by governments. Although the crisis mainly pertained to European countries, the concern of a similar sovereign debt crisis is also shared by other regions of the world, particularly with countries that bear similarities to crisis-struck countries in Europe.

The rising debt level and widening budget deficit level of Malaysia have raised the concern of policymakers and academician in discussion of whether Malaysia would face a similar sovereign crisis. This had raised our interest and motivated us to conduct an empirical analysis to determine the long run relationship between debt, budget deficit and economic growth for Malaysia. Using quarterly data spanning from 1970-2009, the long run relationships of the variables were determined by estimating an equation using Ordinary Least Squares (OLS) method. Besides that, threshold levels for debt and budget deficit, exceeding which would negatively affect economic growth, were also estimated.

Based on the findings of our empirical analysis, we found evidence that led us to the conclusion that debt ratio negatively affects economic growth in the long run consistent with what was found in the literature. Besides that, the the threshold level for debt ratio was estimated at 0.83. On the other hand, we also found evidence that budget deficit negatively affects economic growth in the long run and the threshold level for budget deficit was estimated at -0.025.

CHAPTER 1: INTRODUCTION

1.0 Introduction

This section first provides the background that inspired the carry out of this research by discussing various recent issues surrounding debt, budget deficit and economic growth of Malaysia. Graphical analyses are done to examine the trend, dynamics and relationships over time for the selected variables relevant to the research topic. Preliminary findings from graphical analyses on the series will be further examined using econometric methodologies in the following chapters. Besides that, comparison between Malaysia and other country on issues relating to the research topic is also carried out. From the research background, several issues will be highlighted to help form the problem statements for the research in the following section. After identifying and formulating the problem statements relating to the issues discussed, the research objectives are laid down and research questions pertaining how on the study will be conducted are formulated. Finally, the significance of the study and how it can contribute to the literature as well as policymaking is stated.

1.1 Research Background

As the world slowly recovers from the worst recession after the Great Depression, triggered by a credit crunch in the US financial system that spread throughout the global financial system, the world economic recovery is once again threatened by the possibility of a sovereign debt crisis spreading across the European Union (EU). It began in the middle of 2010, when the sovereign rating

of the government of Greece was downgraded to "junk" level, indicating a dangerous possibility of insolvency and bankruptcy due to its excessive debt-to-GDP level and fiscal deficits (Sibert, 2010). The contagion soon spread to other nations that had similarly higher than average debt level, fiscal deficit, or a combination of both, such as Portugal, Ireland and Spain. Greece in particular, faced immense pressure in fulfilling its debt obligations as investors demand increasingly greater yield on sovereign bonds due to the perceived risk of default. This had destabilized the Greek economy and austerity measures taken to reduce the level of debt and fiscal deficits further hampered its recovery (BBC, 2010).

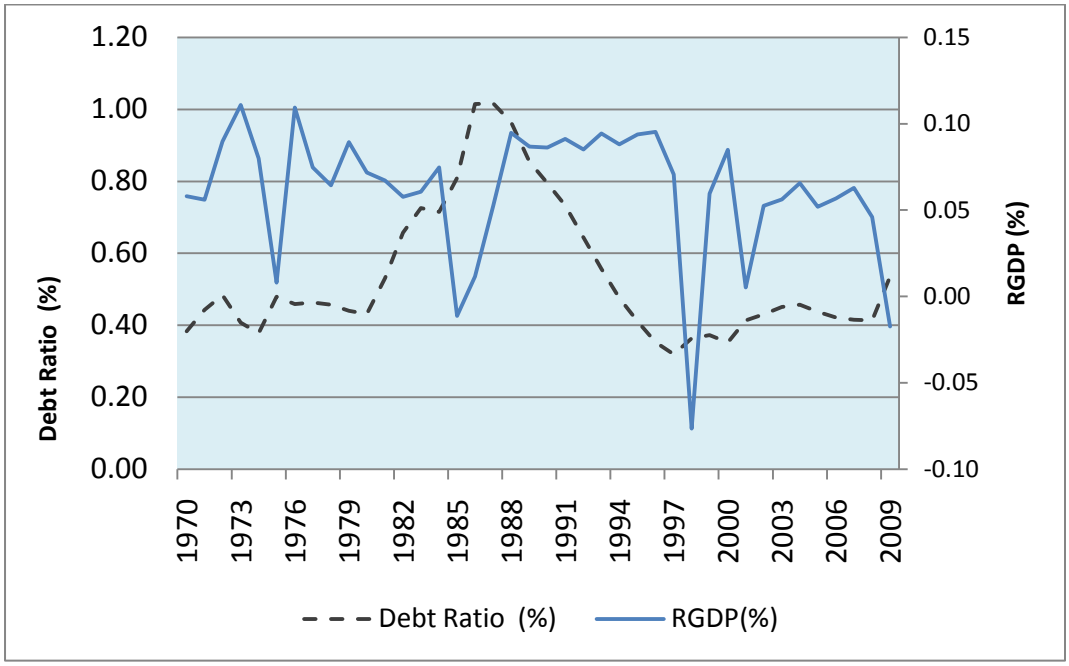
The sovereign debt crisis in the EU also raised the possibility of such crisis spreading to other parts of the world including Asia. The debate on whether the national debt level of Malaysia is on a sustainable path also comes into question as Malaysia has considerably high debt and fiscal balance ratios. Malaysia has been experiencing burgeoning fiscal deficits financed by increasing debts throughout the years after the Asian Financial Crisis, as a result of expansionary fiscal policies aimed at stimulating growth through increased consumption. However, the idea of Malaysia deviating from the path of fiscal sustainability and towards possible insolvency was never conceived until a recent study made by the Performance Management & Delivery Unit (PEMANDU) that suggested the possibility of bankruptcy by 2019 should the debt level of Malaysia continues to rise and subsidies which stand a large portion of government budget are not reduced (Jala, 2010). This has raised the concern of policymakers and academicians alike and created many discussions regarding the fiscal health of the Malaysian economy.

Hence, on the surface Malaysia does have the ingredients that pose the risk of insolvency such as a large and increasing debt level coupled with a widening fiscal deficit. While the question of whether or not Malaysia is on the path of fiscal insolvency has become the interest of many, it also has inspired us to conduct an empirical research to examine such possibility. In order to gain a

preliminary understanding of the trends demonstrated by the debt level, budget balance and economic growth over the period of study, the series are plotted in charts and examined graphically. Average growth rates are calculated using data sourced from the respective bodies.

Figure 1.1 shows the national debt level expressed as a percentage of real gross domestic product (RGDP), as well as the RGDP growth rate from 1970 to 2009. Based on graphical analysis, there seems to be a negative relationship between debt level and economic growth for the period from 1985 to 1988, but for other period no certain relationship can be determined for the two. The debt level had been increasing steadily from 1970 to 1984 when economic growth averaged at 6% throughout the period. It continued to increase in 1985 when fiscal measures were carried out to alleviate the economy out of its first recession in 1985. Debt level peaked at 1986 following Plaza Accord and the appreciation of Yen as a large portion of foreign debt was denominated in Yen (Twomey, 2010). It began to decrease from 1988 to 1997 when Malaysia experienced a period of strong and stable growth that averaged around 9%. Debt level took a turn in direction as Malaysia plunged into a recession following the Asian Financial crisis and since then the debt level has been on a steady increase until present.

Figure 1.1: Debt Level and Real GDP Growth of Malaysia (1970-2009)

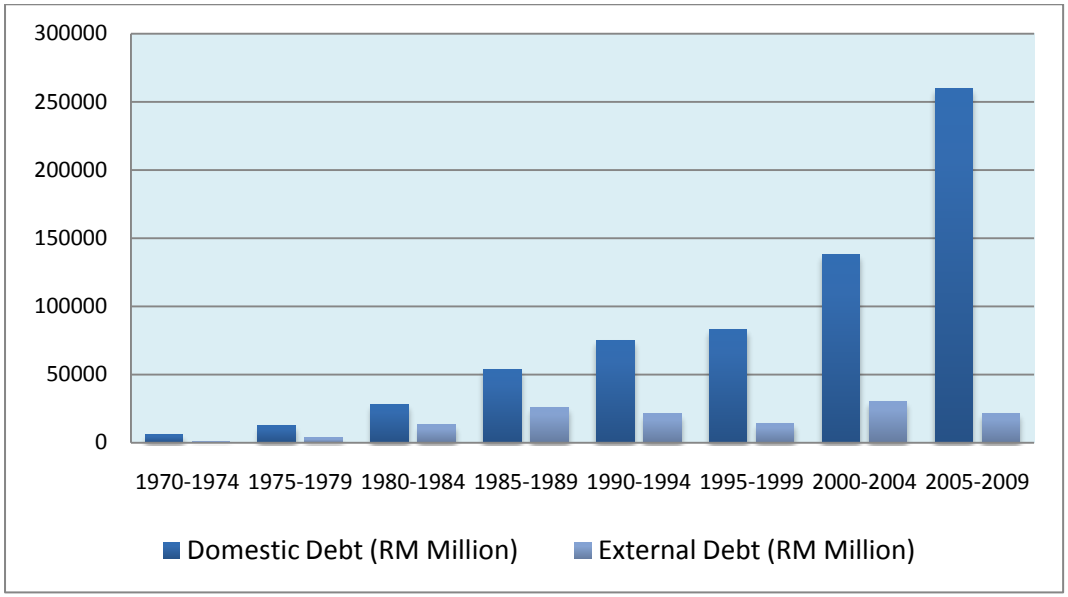


Source: Bank Negara Malaysia (BNM) and World Development Indicators (WDI)

Figure 1.2 shows the national debt composition of Malaysia whether it is domestically or externally financed. In the period of 1970-1974, the national debt was financed by domestic and external means at an almost equal proportion. Beginning from 1975 to 1989, domestic debt began to gain more importance as the source of government debt and stood at twice as much the amount as compared to external debt. The proportion of domestic debt continued to increase throughout 1990 to 2009 and overtook external debt by an increasingly larger proportion to become the primary source of financing. By 2009 almost 96% of the national debt was consist of domestic debt. Given that the national debt is mainly domestically financed, with the government administered pension plan, Employees Provident Fund (EPF) being the largest holder of government securities ("*Gross borrowings expected to decline,*" 2010), this suggests to a

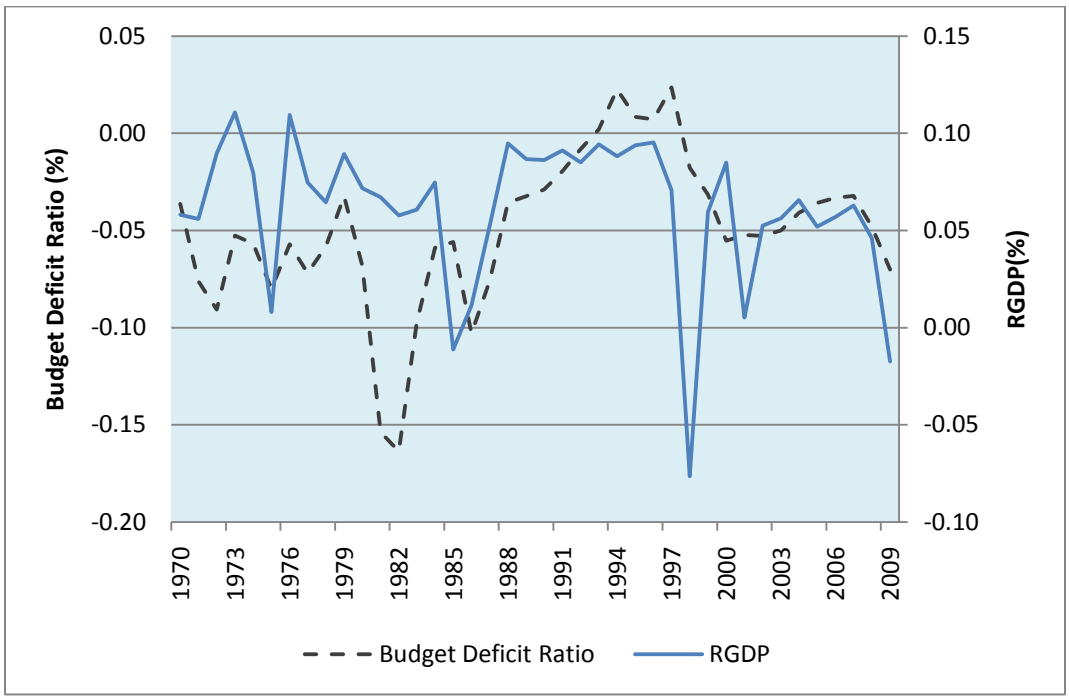
certain extend that the country faces less risk of insolvency due to currency fluctuations as compared to a national debt that is primarily financed through external debt. Nonetheless, the rising debt level still remains a concern and an interest of research of whether it will continue to increase and reach unhealthy level.

Figure 1.2: Debt Composition in Terms of Domestic and External Financing of Malaysia (1970-2009)



Source: Bank Negara Malaysia (BNM)

Figure 1.3: Budget Balance and RGDP Growth of Malaysia (1970-2009)



Source: Bank Negara Malaysia (BNM) and World Development Indicators (WDI)

Since a portion of national debt is used to finance government expenditures, it is also important to examine how the government budget deficit interacts with economic growth. Figure 1.3 shows the ratio of the government budget deficit over RGDP and economic growth over the period of 1970 to 2009. Based on graphical analysis, movements of the two variables do not show any correlation and thus no certain relationship between the two can be identified. However, interaction between budget balance and economic growth during certain periods can be explained by the state of the economy in the corresponding period. For example, when the economy was experiencing stable growth of an average of 9% from 1986 to 1997, the budget balance gradually improved from a deficit to a

positive balance as national income increased over the period. When the economy plunged into a recession in 1998 following the Asian Financial crisis, the sharp decline in RGDP also caused the ratio of budget balance in terms of RGDP to deteriorate and turned into deficit levels. However, the budget deficit did not improve over the period of 1999 to 2008 even though RGDP growth was positive and averaged at 7% throughout the period and continued to decline further in 2009 when the economy again plunged into a recession.

The deteriorating budget deficit has prompted policymakers to look for measures to improve the budget balance by focusing on reducing government expenditures, such as subsidies, as the primary approach to tackle the issue of budget deficit. If government expenditures are not gradually reduced, the budget deficit is expected to further worsen and more borrowings are required to finance the deficit, thus further increasing the level of national debt to possibly unsustainable levels. Furthermore, rising debt level may affect the sovereign rating of the country and increase the cost of borrowing for the government. Therefore, future generations will ultimately bear the burden of increasing national debt and the cost of maintaining it.

The uncertainty faced by the EU countries, particularly Greece, invoked thoughts and attention on fiscal sustainability of countries in other regions. Therefore, it is not surprising that there are growing concerns that Malaysia, with its rising debt level coupled with widening budget deficit may face outcomes similar to those of Greece. However, caution should be exercised while comparing and examining the current situation of Malaysia because the national debt is primarily financed by domestic borrowings denominated in local currency and external borrowings only make up a significantly smaller proportion of national debt. This risk of insolvency may differ from Greece which has a much larger portion of debts financed externally. Furthermore, being a member of a monetary union such as the Eurozone, Greece does not have monetary policies at its disposal to address economic issues as monetary decisions are generally governed

by the European Central Bank (ECB). On the other hand, monetary policy of Malaysia is governed by Bank Negara Malaysia (BNM), providing more flexibility in responding to economic issues such as rising debt and budget deficit.

One particular feature of the Eurozone that interests us is the Stability and Growth Pact (SGP) signed by the member countries in effort to facilitate and maintain the stability of the Economic and Monetary Union (EMU) (*"Resolution of the Amsterdam European Council,"* 2005). The main objective of the SGP is to instill fiscal discipline among member states by requiring them to abide to fiscal rules such as maintaining an annual budget deficit no higher than 3% of GDP and a national debt level that is lower than 60% of GDP or approaching that value. Member states that fail to abide to the fiscal rules laid down in the SGP are given warning to restore debt and budget deficit levels to stipulated levels or face sanctions should the situation persists. Malaysia, however, does not have clearly written guidelines or fiscal rules on the fiscal position of the government like those in the EU. Thus, there is no threshold level of debt and budget deficit that policymakers are obliged to maintain or fulfill.

1.2 Problem Statement

Although graphical analysis does not give us a certain understanding of the relationship between debt and economic growth, empirical analysis has to be carried out to further examine the relationship between the two. It is important to determine the relationship between debt and economic growth empirically in order to examine how debt contributes to economic growth, whether positively or negatively, and the significance of its contribution. This is crucial because debt obligation of a country somehow has to be fulfilled in the medium or long term, with the future generations of the country inheriting the debt of the country and bearing the costs of borrowing. Therefore, the empirical findings will give a clear picture on how debt actually affects growth.

The widening budget deficit has also become a major concern because increasingly more debt is needed to finance the government's budget deficit should it continue to widen. As governments normally run deficits to sustain economic growth or provide stimulus for economic recovery, the effectiveness of a deficit budget needs to be determined so that the appropriate government budget positions can be maintained to best suit the economic condition of the country, be it positive growth or recession. This is also to avoid the danger of a government running excessive deficits that might destabilize the economy. Therefore, the empirical findings at the end will demonstrate how the budget deficit affects growth over the period of study.

Since there are currently no guidelines for policymakers regarding what level of national debt and budget deficit has to be maintained, there is a possibility that the debt and budget deficit will further increase to a level that is detrimental to growth and might pose great risk of insolvency or even worse, possible bankruptcy of the country in the future. The lack of threshold levels to serve as guidelines in maintaining and ensuring that debt and budget deficit level are on a sustainable path may cause the fiscal position of the country to go out of control as there are no formal guidelines for policymakers to adhere to when it comes to increasing debt and running budget deficits. The construction of a threshold model in this study to determine the threshold levels for both debt and budget deficit will serve the purpose of formulating guidelines for policymakers.

1.3 Research Objectives

As numerous studies have been carried out in this field, ranging from different approaches and methodologies to different datasets used, we aim to build this empirical study on the foundation laid down in the literature by previous researchers. Since most of the empirical analyses in the literature consist of panel estimation of groups of countries similar in income, size of the economy and

geographical region, our research aims to investigate whether some of the findings in the literature on how growth is affected by debt and budget deficit hold at a country-specific level, particularly on Malaysia.

1.3.1 General Objective

The problems surrounding debt, budget deficit and economic growth of Malaysia have motivated us to conduct an empirical analysis to find answers and solutions to such problems. Therefore, the objective of our research is to investigate the long-run relationship between debt, budget deficit and economic growth for Malaysia.

1.3.2 Specific Objectives

Based on the general objective laid down above, there are three specific objectives that we aim to achieve in our empirical research:

1. Determine the long-run relationship between debt and growth.
2. Determine the long-run relationship between budget deficit and growth after taking into account the potential crowding out effect of tax and the effect of exchange rate on the economy.
3. Estimate the threshold levels for debt and budget deficit of Malaysia.

1.4 Research Questions

With the general and specific research objectives of the empirical research laid down clearly, we aim to answer three research questions pertaining to problem statements stated above. The research questions listed below will serve as the guidance for the argument and inquiries of this empirical analysis:

1. What is the long-run relationship between debt and economic growth of Malaysia, whether it positively or negatively affects growth?
2. What is the long-run relationship between budget deficit and economic growth of Malaysia, whether it positively or negatively affects growth?
3. What are the threshold levels for debt and budget deficit for Malaysia before it becomes detrimental to economic growth in the long-run?

1.5 Significance of Study

This empirical research aims to contribute to the literature by examining the long-run relationship between debt, budget balance and economic growth on a country- specific level that is Malaysia. By empirically determining the relationship between debt, budget balance and economic growth, the findings of this study will help answer some of the stated problems surrounding the topic of research. Besides that, policymakers will have a better understanding of the issues relating to the study and this will help them in tackling issues of rising debt level and widening budget deficit.

The understanding of the relationship between debt and growth is crucial for policymakers in formulating policies because excessive debt poses great threat to economic stability. Therefore, this study aims to aid policymakers in their decision making by providing a clear reference of how debt affects growth as well as to determine the threshold level for debt, exceeding which would become detrimental to economic growth and pose great risk of insolvency. This will ensure that economic objectives are achieved without compromising on debt sustainability.

Besides that, this study aims to provide an answer to how budget deficit affects growth in the long-run, whether or not it actually translates into economic well-being. It is important to determine this because for the case of Malaysia, budget deficits are normally financed by debt and seldom financed through

increased taxation in the following periods. An ineffective budget deficit not only fails to achieve the objective of stimulating growth, but also further burdens the country's debt level. The findings of this study will aid policymakers in budget decision makings, and the threshold level found will serve as a guideline for policymakers to maintain the budget deficits at levels that will not be detrimental to growth.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter reviews the previous studies relating to the relationship between debt, budget deficit and economic growth and how they affect each other. We have reviewed the relevant literature carefully and the findings of previous researches serve as a foundation which we rely on in developing the theoretical framework as well as formulating hypotheses for our own empirical research. This chapter consists of two sections; the first section focuses on the discussion on theoretical and empirical findings of the literature on debt level and growth while the second section focuses on theoretical and empirical findings on budget deficit and growth.

2.1 Review of the Literature

2.1.1 Debt and Economic Growth

In Pattillo, Poirson, and Ricci (2004), the author explained that the effect of debt on growth could occur through all the main sources of growth. One of it is through the capital-accumulation channel and this is supported by two arguments. First, the debt-overhang concept implies that when external debt increases, investors lower their expectations of returns in anticipation of higher and progressively more distortionary taxes needed to repay debt. This discourages new domestic and foreign investment and subsequently hampers capital-stock

accumulation. The debt-overhang concept was also explained in earlier literature such as Krugman (1988) and Sachs (1989). In the study on debt problems surrounding developing countries, Krugman (1988) provided an explanation of the debt overhang problem from creditors' perspective. The author described debt overhang as "inherited debt" that is sufficiently large that creditors are not confident to fully repay. The doubt surrounding repayment leads on to the difficulty of a debtor country to secure new borrowings to service existing debt and fund new investments. Furthermore, Sachs (1989) also stated that the foreign debt creates a disincentive to investment and growth in the debtor economies because part of the returns to investment is channeled away from the domestic economy in the form of payments to foreign creditors.

The second argument in the literature, which also comes to a similar conclusion, stresses that in heavily indebted countries, investment is held back given the uncertainties about what portion of the debt will actually be serviced with the countries' own resources. Both arguments also suggest that nonlinear effects of debt on economic growth are likely to occur through lower capital accumulation. In an attempt to explore the debt overhang hypothesis, Deshpande (1995) conducted an empirical analysis on a panel of heavily indebted countries spanning across Asia, Africa and Latin America, by using the ordinary least squares (OLS) method. The author found the debt overhang effect to be valid and external debt is found to negatively influence the investment ratio. Deshpande (1995) went on to explain the effect of debt on the economy by stating that excessive debt leads to a decline in domestic investment and subsequently declining growth rate of real GDP per capita. The decline in net investment, which is crucial for expansion of industrial capacity, not only diminished future growth prospects but also curtails the ability to generate resources for repayment, consistent with what stated by Krugman (1988).

Kaminsky and Pereira (1996) also reexamined the debt overhang explanation in the literature by conducting their empirical analysis using simulation scenarios and econometric methods on Latin American countries that faced a severe debt crisis in the 1980s. The simulation results were similar with earlier studies of Arrau (1990) and Borensztein (1990) where debt crisis caused a moderate and short-lived slowdown in investment and growth in the debtor countries. Other than that, the burden of debt servicing was reflected in a decrease in consumption in the countries. Kaminsky and Pereira (1996) also noted a surge in fiscal deficits in the countries studied throughout the period of their study, during which government expenditure crowded out private investment. Another study aimed at determining the empirical validity of the debt overhang hypothesis is Sen, Kasibhatla and Stewart (2006) in which dynamic panel data estimation and system generalized method of moments (GMM) estimation were conducted on Latin American and South East Asian countries. It was found that heavy debt burden negatively impacted growth rate of Latin American countries by an average of 2% as compared to what it would have been without heavy debt burden. Therefore, strong evidence was found in support that high level of debt caused a significant slowdown of economic growth. The findings for Asian countries were similar to those of Latin American countries, although to a much lesser extent and the magnitude of decline of growth due to debt overhang in Asia is quite moderate.

In an attempt to answer the channels through which debt affects growth Pattillo, Poirson, and Ricci (2004) conducted an empirical analysis to investigate whether debt affects growth mostly through an effect on factor accumulation or an effect on total factor productivity growth, and whether these effects are nonlinear. Results showed that a nonlinear relationship between debt and growth but the impact of debt on growth is very different at low levels of debt than at high levels, with generally positive but often not significant effect observed in low levels, whereas large negative impact is observed in high levels of debt. Besides that, robust results were also found in the regressions for the sources of growth that

high debt seems to have quite a strong negative effect on both physical capital accumulation and on total factor productivity. Overall the results of Pattillo, Poirson, and Ricci (2004) suggest that doubling debt in a high debt environment would reduce per capita growth by about 1 percentage point, with two thirds of the effect arise from total factor productivity and one third via per capita capital accumulation.

While economic suggests that a reasonably productive investment of borrowed funds can enhance the economic growth, large external debts have been found to be detrimental to economic growth. Hameed, Ashraf and Chaudhary (2008) explained that countries at the initial stages of economic development usually have smaller capital stocks and limited capability for investments which promise high rates of returns. The rationale for external debt is often to channel borrowed funds into productive investments to accelerate economic growth of the borrowing countries provided if there is macroeconomic stability and no difficulty in settling debt obligations. However, foreign debt, after being accumulated beyond a certain limit can hamper growth because of increasing debt-service requirement that crowds out investment and productivity growth and erodes creditworthiness of the borrowing country, causing reduction in access to external financial resources.

In their empirical analysis on the long-run and short-run relationships between external debt and economic growth of Pakistan using cointegration tests, Hameed, Ashraf and Chaudhary (2008) found that increase in debt service leads to decreased economic growth in the long-run. Besides that, by running Granger causality tests, they also found short-run and long-run causality running from debt service to output. These provided evidence in support of the debt overhang hypothesis. Furthermore, Hameed, Ashraf and Chaudhary (2008) suggested that high debt burden could be a result of mismanagement of resources, when borrowed resources were misallocated or wasted on consumption. Excessive debt

affects economic development by diverting increases in output to debt-servicing, increasing sovereign risk and cost of borrowings and reducing the efficiency of the economy in adjusting to economic shocks and fluctuations.

The question of how burgeoning debt levels affect economic growth in the long run has also prompted researches to determine the threshold level for public debt, exceeding which growth is negatively affected. Using a new multi-country historical data set on central government debt that which covered both developed and emerging economies including Malaysia, Reinhart and Rogoff (2010) found evidence of a threshold level for public debt at 90 percent over GDP, exceeding which would cause a decrease of median growth by 1 percent for developed economies and 2.9 percent for emerging economies. Furthermore, Caner, Grennes and Koehler-Geib (2010) investigated on the findings of Reinhart and Rogoff (2010) by further testing threshold levels for debt using more econometrically rigorous methodology such as pooled least squares regressions on a similar group of developed and emerging economies which also included Malaysia. The authors found threshold level for long-term average public debt at 77 percent of GDP for the full sample while 64 percent for the subsample of developing countries.

In conclusion, the empirical findings of Deshpande (1995) on a panel of heavily indebted countries spanning across Asia, Africa and Latin America validates the debt overhang effect as discussed by Krugman (1988) that excessive debt leads to a decline in domestic investment and negatively affects growth rate of real GDP per capita. Besides that, findings of Kaminsky and Pereira (1996) on Latin American countries during a severe debt crisis also showed a moderate and short-lived slowdown in investment and growth in the debtor countries. Similarly, Sen, Kasibhatla and Stewart (2006) also found strong evidence that debt burden negatively impacted growth rate of Latin American countries. On a country-specific level, Hameed, Ashraf and Chaudhary (2008) found that increase in debt service leads to decreased economic growth in the long-run for Pakistan. Other

than that, Reinhart and Rogoff (2010) found the threshold level for debt at 90 percent of GDP while Caner, Grennes and Koehler-Geib (2010) found the threshold level for debt at 64% for developing economies.

2.1.2 Budget Deficit and Economic Growth

The explanation on the economic effects of budget deficits varies across different school of thoughts. According to Bernheim (1989), Neoclassical school envisions farsighted individuals planning consumption over their own life cycles. Through budget deficits, individuals raise total lifetime consumption by shifting taxes to subsequent generation. If economic resources are fully employed, increased consumption implies decreased saving and interest rates must then rise to bring capital markets into balance. Thus, persistent deficits crowd out private capital accumulation and can be highly detrimental to the economy. Contrary to this, the Keynesian school views budget deficit as contributing to the rise in national income and generate second round known as the Keynesian multiplier, provided if resources in the economy are initially underemployed. This is because deficits stimulate both consumption and national income; saving and capital accumulation need not be adversely affected. On the other hand, Barro (1989) explained the Ricardian view on budget deficit by using the government's budget constraint, which equates total expenditures including interest payments, to revenues from taxation or other sources. Hence, by holding fixed the path of government expenditures and non-tax revenues, a budget deficit today must be matched by a corresponding increase in the present value of future taxes. Therefore, running a budget deficit will not impact on the aggregate demand because fiscal policy would affect aggregate consumer demand only if the expected present value of taxes is altered to be lower, which will unlikely to be the case as consumers expect an increase in future taxes following deficit finance in the present.

In an empirical study on how budget deficit affects the economy, Martin and Fardmanesh (1990) examined the impact of several fiscal variables such as taxes, expenditures and deficits simultaneously on a cross section of developed and developing countries by using a reduced form formula. The authors pointed out that the partial focus of previous studies on either taxes or government expenditures alone and its impact on economic performance could be misleading if the impact of budget deficit was not considered together. By considering these fiscal variables simultaneously, this approach could circumvent the conceptual flaw on the partial focus of existing studies and provide a more comprehensive empirical basis for policy analysis. Besides that, the authors also attempted to put the irrelevance of the budget deficit as explained by the Ricardian equivalence to test.

Contrary to the Keynesian explanation of budget deficit on growth, Martin and Fardmanesh (1990) found empirical evidence that budget deficit negatively affects growth after controlling for taxes and expenditures. Furthermore, the authors found that by separating the sample countries based on their level of development and running the regression again resulted in significant differences as compared to the results when all the countries are aggregated. The magnitude of budget deficit for low-income countries became unimportant when regression is done on low-income countries only. Besides that, the negative impact of the budget deficit appeared to affect middle-income the most, overwhelming the direct effect of taxes and expenditures more strongly as in the aggregate results. High-income countries, however, showed no significant relationship between budget deficit and growth. The authors thus pointed out that country-specific factor may be crucial in determining the impact of budget deficits on growth and therefore, general policy recommendations for all countries should be avoided.

Cebula (1995) also carried out an empirical analysis on the impact of the federal budget deficit and other fiscal variables on the economic growth of the US. The author based his model to some extent on the study of Martin and Fardmanesh (1990) and provided an Instrumental Variable (IV) that indicates the impact of budget deficits and other fiscal variables on the economy. Instead of using cross-sectional data on many countries like what was done by Martin and Fardmanesh (1990), quarterly time series of the US was used in the study of Cebula (1995). Besides that, the author also measured economic growth in per capita terms to allow for population size to be taken into consideration. Empirical results of Cebula (1995) showed that budget deficit also had a negative and statistically significant impact on per capita real GNP growth. Besides that, similar results were also found when various linearly weighted averages of the budget deficit variable were used, thus confirming the findings of Martin and Fardmanesh (1990) on a country-specific basis.

In another study of Adam and Bevan (2005), the relation between fiscal deficits and growth was studied on a panel of developing countries which includes Malaysia. The authors pointed out that most studies in the literature tend to assume that relation between deficits and growth was linear, but such linear representation might conceal masks important and policy-relevant non-linearities, especially at low levels of the fiscal deficit. Therefore, the authors' study was aimed at examining the relation between deficit and growth without assuming it to be linear in the first place. Based on the government budget constraint, the authors found empirical evidence of a threshold effect at a level of the deficit around 1.5 percent of GDP. For values of the budget deficit less than or equal to the threshold, a marginal increase in deficit in positive to growth but when budget deficit at levels above the threshold the effect on growth becomes negative. Furthermore, the authors also found that reducing deficits to the threshold level results in a

payoff in growth but this effect disappears or reverses itself if further fiscal contraction is continued. Other than that, the authors also found evidence of interaction effects between deficits and debt stocks, with high debt stocks exacerbating the negative effects of high deficits on growth.

In conclusion, Martin and Fardmanesh (1990) found empirical evidence that budget deficit negatively affects growth after controlling for taxes and expenditures. With the model of Martin and Fardmanesh (1990) as reference, Cebula (1995) conducted a country-specific research on the US and also found that budget deficit had a negative and statistically significant impact on per capita real GNP growth, consistent with the cross-country research by Martin and Fardmanesh (1990). Furthermore, Adam and Bevan (2005) found empirical evidence of a negative relationship between budget deficit and growth with a threshold level of 1.5 percent and a reduction in deficits to this level results in a payoff in growth.

2.2 Hypothesis Development

The empirical findings of Deshpande (1995), Kaminsky and Pereira (1996), Sen, Kasibhatla and Stewart (2006) and Hameed, Ashraf and Chaudhary (2008) are consistent with the debt overhang hypothesis discussed in earlier studies by Krugman (1988) and Sachs (1989) that debt negatively affects growth. Based on the empirical findings in the literature, there is sufficient evidence to establish a negative relationship between debt and growth for a country. Therefore, we hypothesize the relationship between debt and growth in our study on Malaysia to be a negative one.

On the other hand, empirical findings of Martin and Fardmanesh (1990), Cebula (1995) and Adam and Bevan (2005) on budget deficit and growth also show consistent results of a negative relationship between budget deficit and growth, resembling the explanation of the neoclassical school. Based on the empirical findings in the literature, we therefore hypothesize that budget deficit negatively affects growth for Malaysia.

2.3 Conclusion

The relationship of debt and growth as a negative one is widely accepted because high level of debt creates uncertainties on the repayment ability of the debtor and thus affecting its ability to secure new borrowings to service existing debt and fund new investments. For the effect of budget deficit on growth, however, there is still room for debate as each school of thought offers a different explanation on how budget deficit affects growth and empirical evidence may vary across the sample of countries studied. Although the hypotheses formulated above are based on the empirical findings of previous literature, they will be empirically tested in our own analysis to examine whether such relationships between the variables hold valid for Malaysia. The methodologies and empirical results of our analysis on Malaysia will be discussed in the following chapters.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter discusses the theoretical background of our study as well as the empirical framework of our analysis to answer the research questions laid out in the beginning. The aim of this empirical analysis is to determine the relationship between debt, budget deficit and growth by using time series analysis and relying on various methodologies concerning time series data, such as Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests to determine unit root and stationarity of macroeconomic series as well as Johansen-Joselius (JJ) cointegration test to determine long-run relationship between variables. Besides that, a threshold model based on Mubarik (2005) is employed to determine the threshold levels for debt and budget deficit below which will be conducive to economic growth. Finally, discussion on how the series of data are collected, treated and employed in our analysis is carried out.

3.1 Theoretical Framework

Public debt is defined as money owed by a government of a country and encompasses various levels of governments such as federal, state and municipal. Besides deriving revenue from taxation, government also relies on the issuance of debt as a source of income to fund development expenditures for the benefit and welfare of the people. Debt can be divided into internally financed debt that is issued domestically for purchase by domestic investors and externally financed debt that is issued overseas and for purchase by foreign investors. Whether it is internally or externally financed, debt certainly involves the service of interest and

repayment of principal at a future date. Since the government represents the people, the total debt is actually borne by taxpayers today and also future generations. Therefore, in our empirical analysis we choose debt as an independent variable to examine its relationship with growth.

Budget deficit occurs when the expenses of the government is greater than its income stream. This is often due to the disproportionate balance between the stream of income and expenses of the government. Because of this, government runs budget deficit so that its expenditures can be sustained and it can stimulate the economy through fiscal measures such as increasing spending. Budget deficits need to be financed by either issuing debt or an increase on tax in the future. As raising tax is often regarded as an unpopular move for policymakers that might hurt their popularity among the people, budget deficits are normally financed by issuing more debt. Therefore, an overly large budget deficit run by the government is a burden for future generations because they are the ones that ultimately bear the costs associated with it in the future. Therefore, this motivates us to choose budget deficit as an independent variable in our empirical analysis to examine its relationship with growth and whether or not it actually contributes to growth.

In order to examine the relationship between debt, budget deficit and economic growth, we have formulated an empirical model that is equation (1) to conduct our estimation:

$$\boldsymbol{DRGDP\_A_t = \beta_0 + \beta_1 DEBTR_t + \beta_2\ DEFICITR_t + \varepsilon_t} \quad (1)$$

$DRGDP\_A$ denotes per annum RGDP growth, $DEBTR$ denotes quarterly debt ratio and $DEFICITR$ denotes quarterly budget deficit ratio.

The model is then expanded by fitting more independent variables into equation (1) to perform multiple stage regression to determine the ideal model. Below are the equations used in our regression to determine the ideal model:

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEFICITR_t + \varepsilon_t \quad (2)$$

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEBTR(-1)_t + \beta_4\, DEFICITR_t + \varepsilon_t \quad (3)$$

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEBTR(-1)_t + \beta_4\, DEFICITR_t + \beta_5\, DEFICITR(-1)_t + \varepsilon_t \quad (4)$$

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEBTR(-1)_t + \beta_4\, DEFICITR_t + \beta_5\, DEFICITR(-1)_t + \beta_6 DUM86Q1 + \varepsilon_t \quad (5)$$

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEBTR(-1)_t + \beta_4\, DEFICITR_t + \beta_5\, DEFICITR(-1)_t + \beta_6\, DUM86Q1 + \beta_7 DUM98Q1 + \varepsilon_t \quad (6)$$

$$DRGDP\_A_t = \beta_0 + \beta_1 DRGDP\_A(-1)_t + \beta_2\, DEBTR_t + \beta_3\, DEBTR(-1)_t + \beta_4\, DEFICITR_t + \beta_5\, DUM86Q1 + \beta_6 DUM98Q1 + \varepsilon_t \quad (7)$$

3.2 Threshold model

The threshold model used to determine the threshold level for debt and budget deficit is based on the work of Khan and Senhadji (2001) that was originally used for analysis of threshold level for inflation. We have adopted similar techniques used by the author for our threshold analysis of debt and budget deficit. Threshold level of debt is based on the following equation:

$$DRGDP\_A = \beta_0 + \beta_1(DRGDP\_A_t) + \beta_2(DEBTR_t) + \beta_3 * D_t(DEBTR_t - k) + \beta_4\ DEFICITR_t + U_t \quad (8)$$

while the threshold level of budget deficit is based on the following equation:

$$DRGDP\_A = \beta_0 + \beta_1(DRGDP\_A_t) + \beta_2(DEFICITR_t) + \beta_3 * D_t(DEFICITR_t - k) + \beta_4\ DEBTR_t + U_t \quad (9)$$

k denotes the threshold for debt ratio in equation (1) and threshold for budget deficit ratio in equation (2).

The dummy variable for equation (1) is defined as

$$D_t = \begin{cases} 1: DEBTR_t > k \\ 0: DEBTR_t \leq k \end{cases}$$

whereas the dummy variable for equation (2) is

$$D_t = \begin{cases} 1: DEFICITR_t > k \\ 0: DEFICITR_t \leq k \end{cases}$$

The parameter *k* represents the threshold level for debt ratio in the threshold estimation equation for debt ratio with the property that the relationship between growth and debt is given by: (i) low debt: β_2; (ii) high debt: $\beta_2 + \beta_3$. High debt means that when long-run debt estimate is significant then both $\beta_2 + \beta_3$ would be added to examine their impact on growth and that would be the threshold level for debt. Similarly, the parameter *k* also represents the threshold level for budget deficit ratio in the threshold estimation equation for budget deficit

While the value of *k* is determined arbitrarily as suggested by Khan and Senhadji (2001), a histogram is formed to obtain the mean and standard deviation of debt ratio and budget deficit so that a more reliable range of *k* values can be used to generate equations for threshold estimation. The threshold level is determined by identifying the *k* that minimizes the residual sum of squares (RSS) of the equations used in the estimation.

3.3 Econometric Methods

The use of time series analysis in our study of debt, budget deficit and economic growth requires us to deal with certain properties of time series data such as stationarity and spurious regression problem. For example, the stationarity of time series data has to be first determined before estimating any time series models since time series data often inherent a seasonally unadjusted form and display clear trends over the time. A model containing non-stationary variables will cause many results to be invalid, especially for OLS and thus require certain treatment. Therefore, macroeconomic series has to be first examined for the existence of unit root by using ADF and KPSS tests. Furthermore, cointegration test is carried out to examine the long-run relationship between the series.

3.3.1 Augmented Dickey-Fuller (ADF) Test

The ADF test is used to determine whether a time series data contains unit root and thus non-stationary. It is a version of the Dickey-Fuller test for a larger and more complicated set of time series models. Below is the equation for the ADF test:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\beta_1} + \boldsymbol{\beta_{2\,t}} + \boldsymbol{\gamma Y_{t-1}} + \boldsymbol{\alpha_i} \sum \Delta \boldsymbol{Y_{t-t}} + \boldsymbol{\varepsilon t}$$

In the equation, Y_t= is our variable of interest = { dt}, Δ is the differencing operator, *t* is the time trend and *ε* is the white noise residual of zero mean and constant variable. {*β1*, *β2,* γ, α1,…., αm} is a set of parameters to be estimated. Both of the null and hypothesis in unit root tests are:

$$H_0: \gamma = 0 \ (Yt \text{ is unit root/ non-stationary})$$

$$H_0: \gamma \neq 0 \quad (Yt \text{ is stationary})$$

Gujarati and Porter (2009) pointed out that the unit root hypothesis of the Dickey-Fuller can be rejected if the t-test statistic from these tests is negatively less than the critical value tabulated. In other words, for the ADF test, a unit root exists in the series if the null hypothesis of γ equals to zero is not rejected.

3.3.2 Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test

The KPSS test differs from the other unit root tests, the null hypothesis that a series is I(0) against the alternative that series is I (1). Therefore, the null hypothesis and the alternative hypothesis are as below:

H_0 : $\sigma^2 = 0$ (Stationary)

H_1 : $\sigma^2 \neq 0$ (Unit root/ Non-stationary)

Based on Kwiatkowski, Phillips, Schmidt and Shin (1992), the test statistic for the KPSS test is given as below:

$$\hat{\eta}_\mu = \frac{\eta_\mu}{s^2} = T^{-2} \sum \frac{S_t^2}{s^2(l)}$$

The KPSS test rejects H_1 in favor of H_0 for large values of the statistic.

3.4 Johansen Cointegration Test

The test for cointegration between variables is calculated by looking at the rank of the Π matrix via its eigenvalue. The rank of a matrix is equal to the number of its characteristic roots (eigenvalues) that are different from zero. There are two test statistics for cointegration under the Johansen approach:

$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \lambda_i)$ and

$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1})$

Where r is the number of cointegrating vectors under the null hypothesis and λ_i is the estimated value for the *i*th ordered eigenvalue form the Π matrix. If the test statistic is greater than the critical value from Johansen's tables, reject the null hypothesis that there are *r* cointegrating vectors in favor of the alternative that there are *r*+1 for (λ_{trace}) or more than *r* for λ_{max} (Brooks, 2008).

3.5 Diagnostic Checking

Econometrics problem such as serial correlation, heteroscedasticity, models specification error and normality of error term that might exist in estimated models are diagnostically checked using the various tests below:

3.5.1 Breusch-Godfrey (BG) Test

The BG test tests serial correlation that allow for nonstochastic regressors such as the lagged value of the regressand, higher-order autoregressive schemes such as AR(1), AR(2) etc and simple or higher-order moving averages of white noise error terms. The null hypothesis H_0 to be tested is that:

$$H_0 : \rho_1 = \rho_2 = \cdots = \rho_\rho = 0$$

If the p-value of the Chi-squared test is > 0.01, H_0 is not rejected and there is no serial correlation problem.

3.5.2 ARCH Test for Heteroscedasticity

Homoscedasticity explains that the variance of each disturbance term u_i is conditional upon the chosen values of the explanatory variables and is some constant number equal to σ^2, that is equal variance. Symbolically it means:

$$E(u_i^2) = \sigma^2 \quad \text{where } i = 1, 2, \ldots, n$$

Heteroscedasticity happens when the conditional variance of Y_i increases as X increases and the variance of Y_i are not the same:

$$E(u_i^2) = \sigma_i^2$$

The ARCH test for heteroscedasticity can be used to detect this problem. When comparing p-value with critical value, we refer to the p-value of F-stats and if p > 0.01 we do not reject H_0 of no heteroscedasticity problem.

3.5.3 Ramsey RESET Test

The Ramsey RESET test for model misspecification comprise of a few steps. From a chosen model, say for example $Y_i = \lambda_1 + \lambda_2 X_i + u_{3i}$, the estimated Y_i that is rerun to obtain a new R^2 and let it be R^2_{new}. The R^2_{new} is used together with the R^2 of the original equation to perform the F-test. If the computed F-value is significant, that is > 0.01, we do not reject the null hypothesis and say that the model is correctly specified.

3.5.4 Jargue-Bera (JB) Test for Normality

The JB test of normality is an asymptotic, or large-sample test based on the OLS residuals. The test computes the skewness and kurtosis measures of the OLS residuals and uses the following test statistic:

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

The p-value of the test statistic is then used to decide whether or not to reject the null. If p-value for JB-stats > 0.01 we do not reject the null that the residuals of the equation are normally distributed.

3.6 Data Sources and Description

The empirical analysis is conducted by using time series data of debt, budget deficit for the period of 1970-2009. To obtain greater frequency of the data to capture more dynamics of the movement of the series, dates and frequency conversion method is employed to transform annual data to quarterly by using the low to high frequency conversion method in Eviews. Series in absolute values are fetched into Eviews using quadratic-match sum while series in the form of ratio are fetched using quadratic-match average method.

Data for the series of $RGDP$ is obtained from World Development Indicators (WDI) by World Bank made available on the World Bank's online database. Data of $RGDP$ is in the form of absolute value and local currency unit and therefore, no currency conversion is needed. However, the absolute values are divided by one million to obtain series in the unit measurement of RM million. After being fetched into Eviews using quadratic match sum method, $RGDP$ is given the log form to obtain per annum $RGDP$ growth rates using the formula of $drgdp = \log(rgdp) - \log(rgdp(-4))$ to obtain $DRGDP\_A$.

Data for the series of debt and budget deficit are taken from the Bank Negara Malaysia (BNM) Monthly Statistical Bulletin July 2010. The series for both variables are in nominal values and unit of measurement is in RM million. To take away price effect in both of the series, the GDP deflator with 2000=constant, obtained from the WDI is employed to transform the data into real values that are free of price effect using the formula $Real\ Values = \frac{Nominal\ Values}{GDP\ Deflator}\ x\ 100$. The real values are then divided by $RGDP$ from World Bank to obtain the debt ratio and budget deficit ratio, denoted by $DEBTR$ and $DEFICITR$ respectively. After converting to ratio form, both the series are fetched into Eviews using the quadratic-match average.

The data for the controlling variable real exchange rate RER in the robustness test is derived from data obtained from WDI. 1970-2009 data for nominal exchange rate and Consumer Price Index (CPI) for both Malaysia and the US are obtained to calculate the RER , using the formula $RER = \frac{Nominal\ exchange\ rate\ x\ Foreign\ CPI}{Domestic\ CPI}$. The other controlling factor real tax $RTAX$ is derived from data obtained from BNM. Data for total tax revenues in nominal RM million is transformed into real value by the GDP Deflator using the formula explained above. The real tax revenue is then divided by $RGDP$ to obtain the real tax ratio. And finally real tax ratio is fetched into Eviews using quadratic-match average method.

CHAPTER 4: RESULTS AND INTERPRETATION

4.0 Introduction

In this chapter, methods and tests discussed in Chapter 3 will be employed to conduct the empirical analysis and results are reported accordingly. Before conducting OLS regression on the selected variables, the level of stationarity of the variables is first determined by unit root and tests such as the ADF and the KPSS. Next, the Johansen cointegration test is conducted to examine whether there is a long-run cointegrating relationship between the dependent and independent variables. After that, Ordinary Least Squares (OLS) regression is carried out to determine the equation that best explains the relationship between the variables. Robustness of the equation is also tested by including variables that might affect the independent variables into the equation. Finally, a threshold model is formulated using the equation found to determine the threshold levels for debt and budget deficit.

4.1 Unit Root Tests

The stationarity of the macroeconomic series is tested by using the Augmented Dickey-Fuller (ADF) test and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test. Nonstationarity of a series in both of the tests will be further tested beyond its level form to determine the level of difference required for a series to become stationary. For the ADF test, the null hypothesis states that a series contains a unit root and thus nonstationarity exists in the series of a chosen variable. Therefore, a series is said to be stationary when the null hypothesis of the

ADF test is rejected at any level of difference. On the other hand, the null hypothesis for Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test indicates stationarity and nonexistence of a unit root in a series. Therefore, failure to reject the null hypothesis of the KPSS test gives the conclusion that a series is stationary at that particular level of difference.

The results of the ADF test on the series of variables are reported in Table 4.1. At level form with trend and intercept, the test statistics for the series $RGDP$, $RDEBT$ and $RDEFICIT$ are insignificant to reject the null hypothesis at all levels of significance and thus those series contain a unit root and nonstationary. At first difference of the ADF test with trend and intercept, both the test statistics for $RGDP$ and $RDEFICIT$ are significant to reject the null of a unit root at 5% level of significance. Test statistic for $RDEBT$, however still fails to reject the null at first level of difference and only be able to do so at second level of difference. Therefore, it can be concluded that the series $RGDP$ and $RDEFICIT$ are stationary at first difference while $RDEBT$ is stationary at second difference based on the ADF test.

Table 4.1: Unit Root Test for Variables using ADF Test

Order of Difference	**Level**		**1st Diff.**		**2nd Diff.**	
	Intercept	Trend And Intercept	Intercept	Trend And Intercept	Intercept	Trend And Intercept
$RGDP$	1.617	-1.673	-3.365**	-3.431*	-8.152***	-8.562***
$RDEBT$	1.772	0.314	0.123	-0.215	-6.543***	-6.783***
$RDEFICIT$	0.458	-0.294	-3.364**	-3.584**	-10.132***	-8.699***

Note: *, **, *** indicate the rejection of the null hypothesis at 1%, 5%, and 10% significance levels. Values represent t-statistics of ADF test. Akaike information criterion with a lag length of 4 (due to data being quarterly in nature) is used in the ADF unit root test.

To test the robustness of our conclusions from the ADF test, the KPSS stationarity test is conducted on the same series and Table 4.2 shows the results of the KPSS test. At level form with trend and intercept, the LM-test statistics for $RGDP$, $RDEBT$ and $RDEFICIT$ are significant to reject the null hypothesis that the series is stationary at 1%, 10% and 5% level of significance respectively. However, KPSS test results at first difference with trend and intercept show that the LM-test statistics for $RGDP$, $RDEBT$ and $RDEFICIT$ are insignificant to reject the null hypothesis of stationarity. Therefore, it can be concluded that all the series are stationary at first level of difference based on the KPSS test.

Even though $RGDP$ and $RDEFICIT$ are found to be integrated at first difference while $RDEBT$ is integrated at second difference based on the ADF test, but when the KPSS test is employed, all of the series are integrated at the first order, consistent with the norm of macroeconomic series being *I(1).*

Table 4.2: Stationarity Test for Variables using KPSS

Order of Difference	**Level**		**1st Difference**	
	Intercept	Trend And Intercept	Intercept	Trend And Intercept
$RGDP$	1.4891***	0.3678***	0.5788	0.0665
$RDEBT$	1.3632***	0.1291*	0.3747*	0.0817
$RDEFICIT$	0.5276**	0.2019**	-3.3638	0.2327

Note: *, **, *** indicate the rejection of the null hypothesis at 1%, 5%, and 10% significance levels. The bandwidth for the KPSS unit root test is based on the Newey-West estimator using the Bartlett kernel spectral estimation method.

4.3 Cointegration Test

We then proceed with Johansen-Joselius (JJ) cointegration methodology to test for cointegrating relationship between the series of the variables to determine whether they are bound by some relationship in the long run. Table 4.3 shows the cointegration test results of the JJ test. The results of the Trace test indicate the existence of at least a single cointegrating vector in the model because the trace statistic 82.2875 is greater than the critical value 42.9153 and the null hypothesis of r = 0 is rejected at least at 5% level of significance. Besides that, the Max Eigenvalue test also similar results with Trace where the Max Eigenvalue test statistic 58.2803 is greater than the critical value of 25.8232 and the null hypothesis of r = 0 is also rejected at least at 5% level of significance. Therefore, we can conclude from both the Trace and Max Eigenvalue test that there is at least a single long-run relationship between the variables in the model.

Table 4.3: Johansen Test for Cointegration between Debt, Budget Deficit and Growth

Variables: $RGDP$, $RDEBT$, $RDEFICIT$
Sample: 1971Q2 2009Q4

Order of Cointegration	**Critical Value (Trace)**		**Critical Value (Max Eigenvalue)**	
Null (Alternative Hypothesis)	λ_{trace}	95%	λ_{max}	95%
r = 0 (r > 0)	82.2875***	42.9153	58.2803***	25.8232
r ≤ 1 (r > 1)	24.0073	25.8721	18.2452	19.3870
r ≤ 2 (r > 2)	5.7620	12.5179	5.7620	12.5179

Note: The asterisks indicate the rejection of null hypothesis as follow: * *5% and *** 1%. Linear deterministic trend allowed with intercept and trend included. Lag intervals 1 to 4

4.4 Growth Regression using Ordinary Least Squares (OLS)

With cointegration test results indicating that there is at least a long-run relationship between the variables, regressing nonstationary variables such as $RGDP$, $RDEBT$ and $RDEFICIT$ using OLS will not result in spurious regression problem and thus the estimation results are meaningful and relationship between variables can be explained. In order to find the equation that best explains the relationship between the dependent and independent variables, multi-stage regressions are carried out by fitting the initial model with lagged of dependent and independent variables, as well as including dummy variables to capture structural breaks that deviate series of the variables from its general path. Regressions are run using OLS method and the Newey-West coefficient covariance is employed to deal with heteroscedasticity problem in the data.

Table 4.4 shows the growth regression results with the per annum RGDP growth as dependent variable for each stage. The rationale behind the decision to include the lagged of the dependent variable as one of the independent variables on the right hand side of the equation is that RGDP growth of previous periods can have an effect on the growth of the current period. For example, an increase in RGDP in previous periods may increase the income and savings level of a country and affect growth positively in the coming periods, like what usually explained in the growth literature. Furthermore, dummy variables are included into the equation after examining the residual plot for the equations, in order to capture the shocks of certain events that caused abrupt change in the path of the economy. For example, the dummy variable $DUM86Q1$ captures the first economic recession and sovereign debt crisis faced by Malaysia while another dummy variable $DUM98Q1$ captures the effect of the Asian Financial Crisis.

We begin the multi-stage regression with Equation (1) where only $DEBTR$ and $DEFICITR$ are on the right hand side of the equation. Equation (1) has a low R^2 and thus a poor goodness of fit and all of the independent variable are insignificant. Besides that, the equation also suffers from heteroscedasticity and model specification error as the ARCH test and JB test fail to reject the null hypothesis of no such problems. Next, we proceed to the next stage to form Equation (2) by including the lagged dependent variable $DRGDP\_A\ (-1)$ as an independent variable. Goodness of fit of Equation (2) improved significantly with R^2 increasing to 0.8040 and the lagged dependent variable turns out to be significant at 1% level. The debt and deficit variables, however, are still insignificant. Heteroscedasticity and model specification problem are solved with both the test statistics of ARCH and Ramsey RESET greater than 0.01.

Table 4.4: Growth Regression for Malaysia using Ordinary Least Squares (OLS)

$DRGDP\_A$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
C	0.06914 (3.5334)	(0.0137)	0.0060 (0.6919)	0.0069 (0.8258)	0.0102 (1.3412)	0.0117*** (1.6406)	0.0108 (1.5373)
$DRGDP\_A\ (-1)$	--	0.9191*** (13.0867)	0.7739*** (13.1865)	0.7785`*** (13.0432)	0.7676*** (13.3886)	0.7685*** (13.1158)	0.7649*** (12.9945)
$DEBTR$	0.0043 (0.1381)	0.0084 (0.9482)	-0.6590*** (-3.4319)	-0.6085*** (-3.5147)	-0.7681*** (-6.0458)	-0.7109*** (-5.5906)	-0.7470*** (-6.1551)
$DEBTR\ (-1)$	--	--	0.6587*** (3.5174)	0.6066*** (3.6194)	0.7571*** (6.0709)	0.7009*** (5.6090)	0.7388*** (6.2425)
$DEFICITR$	0.1993 (1.7430)	0.0049 (0.1151)	-0.1699*** (-2.6643)	0.0258 (0.0943)	0.1064 (0.3747)	-0.0024 (-0.0107)	-0.1743*** (-5.0118)
$DEFICITR\ (-1)$	--	--	--	-0.1879*** (-0.6399)	-0.3096 (-1.0486)	-0.1675 (-0.7663)	--
$DUM86Q1$	--	--	--	--	0.0807 (5.2929)	0.0713*** (6.3029)	0.0686*** (6.9657)
$DUM98Q1$	--	--	--	--	--	-0.0775*** (-13.5888)	-0.0799*** (-17.8549)
R^2	0.0405	0.8040	0.8644	0.8655	0.8865	0.9103	0.9094
D-W test stat	0.2027	1.0145	1.1557	1.1348	1.1518	1.2638	1.2908
Diagnostic Checking							
LM Test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ARCH	0.0000	0.3460	0.1563	0.1836	0.0946	0.2612	0.2477
Ramsey RESET	0.0226	0.1266	0.5252	0.3344	0.1938	0.1111	0.0701
Jarque- Bera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. t-statistics in parentheses

The lagged of the debt variable $DEBTR\,(-1)$ is then introduced into Equation (3) and this improves the goodness of fit marginally and all the independent variables become significant at 1%. The sign of the coefficient of $DEBTR$ changed from positive to negative. Besides that, heteroscedasticity and model specification problem are solved too. Another lagged of independent variable, $DEFICITR\,(-1)$, is also introduced in Equation (4). The goodness of fit almost remains the same as the previous equation while heteroscedasticity and model specification problem are still solved but with a weaker ARCH test statistic and a stronger Ramsey RESET test statistics.

A dummy variable $DUM86Q1$ is added in Equation (5) and increases the goodness of fit slightly but it is statistically insignificant. The only variables that turn out significant are $DRGDP\_A\,(-1)$, $DEBTR$ and $DEBTR\,(-1)$ at 1%. ARCH and Ramsey Reset test statistics still reject the null but have become even weaker. Another dummy variable $DUM98Q1$ is included into Equation (6) and this further improved R^2 to 0.9103. All of the independent variables including the dummies are also statistically significant at 1%. Both heteroscedasticity and model specification are overcome with the test statistics of ARCH improved significantly while Ramsey RESET further decreased. However, it is worth noting that up to Equation (6), the serial correlation problem has not been solved and the normality assumption still being violated

After various stages of testing with different variables, Equation (7) turns out to be the most ideal equation to explain the relationship between debt, budget deficit and growth with all of the variables statistically significant at 1% level of significance. Although Equation (7) might suffer from serial correlation problem as the p-value of the Chi-squared test is less than 0.01, it is free from other problems such as heteroscedasticity and model misspecification as both the p-value of the ARCH and Ramsey RESET test are greater than 0.01. However, Equation (7) also suffers from

normality problem as the p-value of the Jarque-Bera test is less than 0.01and thus rejecting the null that the error term is normally distributed. Another reason that we choose Equation (7) even though ARCH and Ramsey RESET for Equation (6) seem better is because budget deficit variables for Equation (7) are all statistically significant and this is important given that the variable is central to the discussion of this study as well as some previously conducted studies in the literature.

4.4.1 Robustness Check On Regression Results

The negative relationship between debt and growth as suggested by Equation (7) intrigues us because policymakers run budget deficits with the objective to stimulate and sustain economic growth. However, based on Equation (7) that we found, budget deficit actually hampers growth over time. Following the footsteps of Martin and Fardmanesh (1990), Equation (7) is further tested by including the variables of tax and real exchange rate into the regression as controlling factors for budget deficit.

The rationale of including tax as a controlling factor is that budget deficit in the current period brings upon increase in tax in the future as explained by Ricardian Equivalence. The expectation of other agents of the economy on future tax as a result of budget deficit in the current period might have an effect on future consumption and subsequently growth. Furthermore, budget deficit is financed either through debt or tax. If debt financing is the most important mean of financing and external debt is relied upon substantially, domestic exchange rate will appreciate as a result of the issuance of bonds and increase in foreign purchase of those bonds. An appreciation in domestic currency might affect the competitiveness of domestic exports and subsequently affecting growth.

The series for tax variable is obtained by dividing total real tax revenue with RGDP to obtain the real tax ratio for the years studied. The series for the exchange rate variable, however, is obtained by using the formula as explained in Chapter 3, using domestic and foreign (US in this case) nominal exchange rate and consumer price index (CPI), calculated using a conversion formula to obtain the real exchange rate. Table 5 shows the regression results of the robustness test on Equation (7).

Equation (1) in Table 4.5 shows the equation that we choose from previous growth regression results. As $RTAX$ is added to Equation (2), $DEFICITR$ almost remains the same and the goodness of fit is almost the same as the before. However, the tax variable added is statistically insignificant. The equation does not suffer from heteroscedasticity and model misspecification error with ARCH test statistics increases slightly while Ramsey RESET decreases slightly. Next, the lagged of $RTAX$ is also added to Equation (3) but this time $DEFICITR$ becomes insignificant. The variable is also statistically insignificant but the goodness of fit of the equation increases marginally. Both ARCH and Ramsey RESET test statistics have become stronger to solve the econometric problems.

Next, the exchange rate variable RER is introduced into Equation (4) but again, it has no impact on $DEFICITR$ and it is still negatively significant. The exchange rate variable is insignificant but both heteroscedasticity and model misspecification is solved, though at a weaker ARCH and Ramsey RESET test statistics. As the lag of RER is included into Equation (5), $DEFICITR$ is still negatively significant with the goodness of fit increases slightly. Heteroscedasticity is solved with a higher ARCH test statistics while Ramsey RESET test statistics fail to solve model misspecification. Throughout the equations, serial correlation exists and cannot be solved while normality assumption is violated.

Table 4.5: Growth Regression of Robustness Test for Equation (7)

$DRGDP\_A$	(1)	(2)	(3)	(4)	(5)
C	0.0108 (1.5373)	0.0124 (1.0821)	0.0121 (1.0538)	0.0162 (1.5078)	0.0173 (1.7064)
$DRGDP\_A\ (-1)$	0.7649*** (12.9945)	0.7660*** (13.0798)	0.7846*** (12.4554)	0.7533*** (11.9902)	0.7514*** (14.3315)
$DEBTR$	-0.7470*** (-6.1551)	-0.7414*** (-5.8925)	-0.6750*** (-5.2091)	-0.7469*** (-6.2134)	0.6241*** (-3.5944)
$DEBTR\ (-1)$	0.7388*** (6.2425)	0.7339*** (5.9993)	0.6673*** (5.2764)	0.7379*** (6.3112)	0.6197*** (3.6789)
$DEFICITR$	-0.1743*** (-5.0118)	-0.1729*** (-4.8594)	-0.1592 (-4.3662)	-0.1649*** (-4.7555)	-0.1194** (-2.2585)
$DUM86Q1$	0.0686*** (6.9657)	0.0683*** (6.7558)	0.0654*** (6.7322)	0.0679*** (6.9393)	0.0583*** (4.3591)
$DUM98Q1$	-0.0799*** (-17.849)	-0.0802*** (-16.7102)	-0.0879*** (-11.2868)	-0.0796*** (-17.7476)	-0.0419 (-1.5129)
$RTAX$		-0.0089 (-0.2111)	-0.3150 (-1.0734)	--	--
$RTAX\ (-1)$		--	0.3068 (1.0170)	--	--
RER		--	--	-0.0014 (-0.7574)	-0.0839 (-1.3761)
$RER\ (-1)$		--	--	--	0.0822 (1.3417)
R^2	0.9093	0.9094	0.9114	0.9098	0.9187
D-W test stat	1.2908	1.2896	1.3229	1.2853	1.1295
Diagnostic Checking					
LM Test	0.000	0.0000	0.0000	0.0000	0.0000
ARCH	0.2477	0.2523	0.3347	0.2097	0.2257
Ramsey RESET	0.0701	0.0656	0.1484	0.0339	0.0002
Jarque- Bera	0.0000	0.0000	0.0000	0.0000	0.0000

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. t-statistics in parentheses

After including $RTAX$ and RER and their lagged variables into Equation (7), the equation does not become better as the tax and exchange rate variables are insignificant. Besides that, there seem to be no change in coefficient sign or significance for $DEFICITR$ when the controlling factors are regressed together with Equation (7).

Based on the regression results, the effect of the expectation on future tax increase by other economic agents because of budget deficit in the current period is not captured in the regression and cannot be explained. Similar results are also found for the exchange rate variable and the exchange rate channel on budget deficit seems to be not present. This may due to the national debt composition being largely consists of domestic debt rather than external debt like what depicted in Figure 1.2.

4.5 Interpretation of Equation

After conducting multiple stage regression and robustness test, the final equation is chosen and interpretation on the estimated coefficients for the model is carried out:

$$\boldsymbol{DRGDP\_A = 0.0108 + 0.7649\ DRGDP\_A(-1) - 0.74570\ DEBT + 0.7388\ DEBTR(-1) - 0.174\ DEFICITR + 0.0685\ DUM86Q1 - 0.0799\ DUM98Q1}$$

R^2: 0.9093

D-W test statistics: 1.2908

The sign of the coefficient of $DEBTR$ is consistent with our a priori expectation of a negative relationship between debt and growth based on the findings of Deshpande (1995), Kaminsky and Pereira (1996), Sen, Kasibhatla and Stewart (2006) and Hameed, Ashraf and Chaudhary (2008). The negative effect of debt on the economic growth of Malaysia as suggested by Equation (7) can be explained by the crowding effect. As the national debt level increases, investors perceive higher risk on the repayment on government borrowings and demand higher yield on government bonds. The increase in the yield of government bonds not only raises the cost of borrowing of the government, but also has an effect on the yield private debt. Investors' demand for higher yield increases the cost of borrowing and crowds out investment. Besides that, the sign of the coefficient of $DEFICITR$ is also consistent

with our a priori expectation of a negative relationship between budget deficit and growth based on the findings of Martin and Fardmanesh (1990), Cebula (1995) and Adam and Bevan (2005).

All the variables in Equation (7) are found to be statistically significant at 1% level of significance and interpretation on the coefficients are as follows: The coefficient of $DRGDP\_A(-1)$ is interpreted as 1% increase in per annum RGDP growth in the current period results in a 0.7654% increase in per annum RGDP growth for the following period. In other words, this also means that 76.54% of the 1% of past per annum RGDP growth is brought forward to the present. Thus, economic growth is said to be persistent and growth dynamics can be sustained on itself without relying on other forces.

The coefficient of $DEBTR$ is interpreted as 1% increase in debt ratio results in 0.7457% decrease in per annum RGDP growth. This shows that debt ratio has a contemporarous negative effect on per growth. Furthermore, the coefficient of $DEBTR(-1)$ is interpreted as 1% increase in the lagged one period of the debt ratio results in a 0.739% increase in the per annum RGDP growth of the current period. This also means that debt ratio also has a delayed effect on growth, with the debt ratio of the lagged one period affecting current growth. Both the coefficient interpretations of $DEBTR$ and $DEBTR(-1)$ show the temporary effect of debt ratio on economic growth. The permanent effect of debt ratio, however, can be determined by summing the coefficients of debt ratio of the current and lagged period. The sum of both of the coefficients shows negative and close to zero. Thus, we can conclude that debt ratio negatively impacts on economic growth in the long run.

The coefficient on $DEFICITR$ is interpreted as 1% increase in deficit ratio results in 0.1743% decrease in per annum RGDP growth. This explains a negative relationship between budget deficit ratio and growth in the long run. Besides that, the

coefficient of the dummy variable $DUM86Q1$ is interpreted as during the first quarter of 1986, per annum RGDP growth increases by 6.85%. The dummy variable captures the sharp increase in per annum RGDP growth that happened in the first quarter of 1986 which represents an outlier in the movement of growth throughout the period. Furthermore, the coefficient of the dummy variable $DUM98Q1$ is interpreted as during the first quarter of 1998, per annum RGDP growth decreases by 7.99%. Similarly, the dummy variable captures the sharp decrease in per annum RGDP growth that happened in the first quarter of 1998 which represents another outlier in the movement of growth throughout the period. Equation (7) has an R^2 of 0.9093 which means 90.93% of the variation in the dependent variable can be explained by the variation in the independent variables.

4.6 Threshold Level Estimation

Threshold levels of debt ratio and budget deficit ratio of Malaysia are estimated using threshold estimation methodology used in previous literature. Further step is taken in the estimation procedure to obtain more accurate threshold levels for debt ratio and budget deficit ratio.

4.6.1 Threshold Level for Debt Ratio

Using the threshold estimation model introduced by Khan and Senhadji (2001), the threshold level of debt ratio is tested using this equation:

$$DRGDP\_A = \beta_0 + \beta_1(DRGDP\_A_t) + \beta_2(DEBTR_t) + \beta_3 * D_t(DEBTR_t - k) + \beta_4\ DEFICITR_t + U_t$$

As suggested by the author, k is determined arbitrarily by first forming a histogram for the series $DEBTR$ to obtain the mean and standard deviation. Next, the range of values for k is set from 0.75 to 1.00 with a standard deviation 0.05 to formulate the equations for each k value within the range. After that, each of the equations is regressed using the least squares method to obtain the residual sum of squares (RSS) of each equation. Based on the selection criteria laid down by Khan and Senhadji (2001), the threshold level is determined by selecting the k value that produces the lowest RSS for the regression on the equation above.

Table 4.6 shows the regression results of each equation using different k value. Based on the results found, k = 0.85 produces the lowest RSS of 0.044671 for the regression on the equation and thus we can conclude that 0.85 is the threshold level for $DEBTR$. In order to obtain a more accurate threshold level up to two decimal places, we proceed to another level of threshold estimation by using a smaller standard deviation of 0.01 for k values in the range of 0.81 to 0.86 using the similar method discussed above. Table 4.7 shows the regression results of each equation with different k values and from the results found, k = 0.83 produces the lowest RSS for the regression of equations and thus we can conclude that 0.83 is the more accurate threshold level for $DEBTR$. If $DEBTR$ exceeds 0.83, economic growth will be negatively affected.

Our estimated threshold level for debt ratio of 0.83, which also means a debt level of 83 percent over GDP, closely resembles the threshold level of 90 percent over GDP found by Reinhart and Rogoff (2010) for developing countries with Malaysia included. However, our estimated threshold is higher than the threshold of 64 percent over GDP as estimated by Caner, Grennes and Koehler-Geib (2010) for developing countries, also with Malaysia included.

Table 4.6: Estimation of Threshold Level for Debt at K= 0.75 to 1.00

(Dependent variable: $DRGP\_A$)

k	Variable	Coefficient	Std.Error	t-statistic	Prob.	RSS
0.750	DEBTR	-0.007578	0.012874	-0.588675	0.5570	0.044736
	(DEBTR>0.750)*(DEBTR-0.750)	0.046520	0.034628	1.343428	0.1812	
	DEFICITR	-0.037611	0.037721	-0.997073	0.3203	
	DRGDP_A(-1)	0.935292	0.038136	24.52546	0.0000	
	C	0.004528	0.006409	0.706500	0.4810	
0.800	DEBTR	-0.005898	0.011534	-0.511325	0.6099	0.044677
	(DEBTR>0.800)*(DEBTR-0.800)	0.055963	0.039508	1.416480	0.1587	
	DEFICITR	-0.034234	0.037346	-0.916669	0.3608	
	DRGDP_A(-1)	0.935173	0.038023	24.59524	0.0000	
	C	0.003962	0.006051	0.654756	0.5136	
0.850	DEBTR	-0.004230	0.010659	-0.396859	0.6920	**0.044671**
	(DEBTR>0.850)*(DEBTR-0.850)	0.069604	0.048914	1.422990	0.1568	
	DEFICITR	-0.031510	0.037211	-0.846788	0.3985	
	DRGDP_A(-1)	0.934912	0.037981	24.61506	0.0000	
	C	0.003359	0.005818	0.577407	0.5645	
0.900	DEBTR	-0.002748	0.010141	-0.270992	0.7868	0.044719
	(DEBTR>0.900)*(DEBTR-0.900)	0.093362	0.068400	1.364951	0.1743	
	DEFICITR	-0.029562	0.037198	-0.794728	0.4280	
	DRGDP_A(-1)	0.934931	0.038056	24.56743	0.0000	
	C	0.002772	0.005672	0.488708	0.6258	
0.950	DEBTR	0.000393	0.009520	0.041262	0.9671	0.044942
	(DEBTR>0.950)*(DEBTR-0.950)	0.120351	0.114201	1.053852	0.2936	
	DEFICITR	-0.027803	0.037314	-0.745095	0.4574	
	DRGDP_A(-1)	0.933080	0.038210	24.42000	0.0000	
	C	0.001519	0.005504	0.275911	0.7830	
1.000	DEBTR	0.004768	0.008567	0.556583	0.5786	0.045223
	(DEBTR>1.000)*(DEBTR-1.000)	0.122102	0.295047	0.413839	0.6796	
	DEFICITR	-0.028180	0.037494	-0.751583	0.4535	
	DRGDP_A(-1)	0.927972	0.038161	24.31752	0.0000	
	C	-0.000207	0.005262	-0.039314	0.9687	

Note: *k* denotes the threshold level used for the threshold estimation model for $DEBTR$

Table 4.7: Estimation of Threshold Level for Debt at K= 0.81 to 0.86

(Dependent variable: $DRGP\_A$)

k	Variable	Coefficient	Std.Error	t-statistic	Prob.	RSS
0.810	DEBTR	-0.005512	0.011320	-0.486943	0.6270	0.044674
	(DEBTR>0.810)*(DEBTR-0.810)	0.058063	0.040910	1.419275	0.1579	
	DEFICIT RATIO	-0.033598	0.037305	-0.900649	0.3692	
	DRGDP_A(-1)	0.935093	0.038009	24.60205	0.0000	
	C	0.003825	0.005994	-0.638139	0.5244	
0.820	DEBTR	-0.005118	0.011101	-0.461013	0.6455	0.044671
	(DEBTR>0.820)*(DEBTR-0.820)	0.060350	0.042109	1.423039	0.1568	
	DEFICIT RATIO	-0.032957	0.037268	-0.884305	0.3779	
	DRGDP_A(-1)	0.934981	0.037990	24.61130	0.0000	
	C	0.003686	0.005937	0.620937	0.5356	
0.830	DEBTR	-0.004813	0.010933	-0.440190	0.6604	**0.044668**
	(DEBTR>0.830)*(DEBTR-0.830)	0.063145	0.044264	1.426567	0.1558	
	DEFICIT RATIO	-0.032434	0.037243	-0.870887	0.3852	
	DRGDP_A(-1)	0.934927	0.037979	24.61701	0.0000	
	C	0.003578	0.005892	-0.607184	0.5446	
0.840	DEBTR	-0.004511	0.010792	-0.417973	0.6766	0.044670
	(DEBTR>0.840)*(DEBTR-0.840)	0.066153	0.046451	1.424155	0.1565	
	DEFICIT RATIO	-0.031961	0.037225	-0.858574	0.3919	
	DRGDP_A(-1)	0.934934	0.037983	24.61475	0.0000	
	C	0.003463	0.005854	-0.591680	0.5550	
0.850	DEBTR	-0.004230	0.010659	-0.396859	0.6920	0.044671
	(DEBTR>0.850)*(DEBTR-0.850)	0.069604	0.048914	1.422990	0.1568	
	DEFICIT RATIO	-0.031510	0.037211	-0.846788	0.3985	
	DRGDP_A(-1)	0.934912	0.037981	24.61506	0.0000	
	C	0.003359	0.005818	0.577407	0.5645	
0.860	DEBTR	-0.003928	0.010518	-0.373476	0.7093	0.044673
	(DEBTR>0.860)*(DEBTR-0.860)	0.073390	0.051637	1.421275	0.1573	
	DEFICIT RATIO	-0.031045	0.037188	-0.834553	0.4053	
	DRGDP_A(-1)	0.934853	0.037976	24.61693	0.0000	
	C	0.003248	0.005781	-0.561910	0.5750	

Note: *k* denotes the threshold level used for the threshold estimation model for $DEBTR$

4.6.2 Threshold Level for Budget Deficit Ratio

On the other hand, the threshold level of debt ratio is tested using this equation:

$$DRGDP\_A = \beta_0 + \beta_1(DRGDP\_A_t) + \beta_2(DEFICITR_t) + \beta_3 * D_t(DEFICITR_t - k)$$

$$+ \beta_4\ DEBTR_t + U_t$$

Similar to the threshold estimation method for debt ratio above, k is determined arbitrarily by first forming a histogram for the series $DEFECITR$ to obtain the mean and standard deviation. Next, the range of values for k is set from -0.019 to -0.044 with a standard deviation 0.005 to formulate the equations for each k value within the range. After that, each of the equations is regressed using the least squares method to obtain the residual sum of squares (RSS) of each equation. Based on the selection criteria laid down by Khan and Senhadji (2001), the threshold level is determined by selecting the k value that produces the lowest RSS for the regression on the equation above.

Table 4.8 shows the regression results of each equation using different k value. Based on the results found, k = -0.024 produces the lowest RSS of 0.045207 for the regression on the equation and thus we can conclude that -0.024 is the threshold level for $DEFECITR$. In order to obtain a more accurate threshold level up to three decimal places, we proceed to another level of threshold estimation by using a smaller standard deviation of 0.001 for k values in the range of -0.023 to -0.028 using the similar method discussed above.

Table 4.8: Estimation of Threshold Level for Budget Deficit at

K= -0.019 to -0.044

(Dependent variable: $DRGP\_A$)

k	Variable	Coefficient	Std.Error	t-statistic	Prob.	RSS
-0.019	DEFICITR	0.024499	0.039800	0.615562	0.5391	0.045292
	(DEFICITR>-0.019)*(DEFICITR-(-0.019))	-0.120623	0.133178	-0.905726	0.3665	
	DEBTRATIO	0.007831	0.008823	0.887646	0.3762	
	DRGDP1_A(-1)	0.923980	0.069427	13.30870	0.0000	
	C	0.001654	0.010577	0.156360	0.8760	
-0.024	DEFICITR	0.030398	0.039543	0.768746	0.4433	**0.045207**
	(DEFICITR>-0.024)*(DEFICITR-(-0.024))	-0.131686	0.136341	-0.965857	0.3357	
	DEBTRATIO	0.007797	0.008774	0.888698	0.3756	
	DRGDP1_A(-1)	0.925075	0.069349	13.33943	0.0000	
	C	0.002070	0.010450	0.198039	0.8433	
-0.029	DEFICITR	0.030747	0.037784	0.813768	0.4171	0.045226
	(DEFICITR>-0.029)*(DEFICITR-(-0.029))	-0.113301	0.127345	-0.889713	0.3750	
	DEBTRATIO	0.007918	0.008729	0.907059	0.3658	
	DRGDP1_A(-1)	0.924183	0.070089	13.18578	0.0000	
	C	0.002097	0.010255	0.204517	0.8382	
-0.034	DEFICITR	0.028299	0.036374	0.778018	0.4378	0.045296
	(DEFICITR>-0.034)*(DEFICITR-(-0.034))	-0.087159	0.121640	-0.716534	0.4748	
	DEBTRATIO	0.008143	0.008727	0.933072	0.3523	
	DRGDP1_A(-1)	0.922901	0.070896	13.01774	0.0000	
	C	0.001888	0.010073	0.187467	0.8515	
-0.039	DEFICITR	0.024627	0.036497	0.674751	0.5009	0.045364
	(DEFICITR>-0.039)*(DEFICITR-(-0.039))	-0.062830	0.122022	-0.514993	0.6073	
	DEBTRATIO	0.008330	0.008787	0.948010	0.3446	
	DRGDP1_A(-1)	0.921838	0.071463	12.89949	0.0000	
	C	0.001598	0.009916	0.161162	0.8722	
-0.044	DEFICITR	0.019016	0.038094	0.499196	0.6184	0.045415
	(DEFICITR>-0.044)*(DEFICITR-(-0.044))	-0.039177	0.123689	-0.316739	0.7519	
	DEBTRATIO	0.008414	0.008878	0.947663	0.3448	
	DRGDP1_A(-1)	0.920823	0.071857	12.81470	0.0000	
	C	0.001189	0.009777	0.121613	0.9034	

Note: *k* denotes the threshold level used for the threshold estimation model for $DEFICITR$

Table 4.9: Estimation of Threshold Level for Budget Deficit at K= -0.023 to -0.028

(Dependent variable: $DRGP\_A$)

k	Variable	Coefficient	Std.Error	t-statistic	Prob.	RSS
-0.023	DEFICITR	0.029188	0.039403	0.740755	0.4600	0.045225
	(DEFICITR>-0.023)*(DEFICITR-(-0.023))	-0.129796	0.135642	-0.956906	0.3402	
	DEBTRATIO	0.007800	0.008781	0.888269	0.3758	
	DRGDP1_A(-1)	0.924913	0.069396	13.32805	0.0000	
	C	0.001982	0.010465	0.189432	0.8500	
-0.024	DEFICITR	0.030398	0.039543	0.768746	0.4433	0.045207
	(DEFICITR>-0.024)*(DEFICITR-(-0.024))	-0.131686	0.136341	-0.965857	0.3357	
	DEBTRATIO	0.007797	0.008774	0.888698	0.3756	
	DRGDP1_A(-1)	0.925075	0.069349	13.33943	0.0000	
	C	0.002070	0.010450	0.198039	0.8433	
-0.025	DEFICITR	0.030932	0.039356	0.785940	0.4331	**0.045202**
	(DEFICITR>-0.025)*(DEFICITR-(-0.025))	-0.129959	0.135367	-0.960049	0.3386	
	DEBTRATIO	0.007811	0.008764	0.891332	0.3742	
	DRGDP1_A(-1)	0.925030	0.069434	13.32249	0.0000	
	C	0.002108	0.010418	0.202339	0.8399	
-0.026	DEFICITR	0.030924	0.038896	0.795045	0.4278	0.045207
	(DEFICITR>-0.026)*(DEFICITR-(-0.026))	-0.125694	0.133160	-0.943927	0.3467	
	DEBTRATIO	0.007834	0.008753	0.894993	0.3722	
	DRGDP1_A(-1)	0.924828	0.069611	13.28560	0.0000	
	C	0.002100	0.010373	0.203394	0.8391	
-0.027	DEFICITR	0.030931	0.038476	0.803893	0.4227	0.045213
	(DEFICITR>-0.027)*(DEFICITR-(-0.027))	-0.121668	0.131215	-0.927237	0.3553	
	DEBTRATIO	0.007862	0.008743	0.899279	0.3699	
	DRGDP1_A(-1)	0.924650	0.069779	13.25104	0.0000	
	C	0.002108	0.010328	0.204114	0.8385	
-0.028	DEFICITR	0.030901	0.038072	0.811639	0.4183	0.045218
	(DEFICITR>-0.028)*(DEFICITR-(-0.028))	-0.117747	0.129278	-0.910803	0.3639	
	DEBTRATIO	0.007888	0.008734	0.903103	0.3679	
	DRGDP1_A(-1)	0.924475	0.069935	13.21908	0.0000	
	C	0.002105	0.010285	0.204644	0.8381	

Note: *k* denotes the threshold level used for the threshold estimation model for $DEFICITR$

Table 4.9 shows the regression results of each equation with different k values and from the results found, k = -0.025 produces the lowest RSS for the regression of equations and thus we can conclude that -0.025 is the more accurate threshold level for $DEFECITR$. If $DEFICITR$ exceeds -0.025, economic growth will be negatively affected.

Our estimated threshold level for budget deficit ratio of -0.025, which also means a budget deficit level of 2.5 percent over GDP, is higher than the threshold level of 1.5 percent of GDP found by Adam and Bevan (2005) using panel estimation on a group of developing countries with Malaysia included.

4.7 Graphical Analysis Using Estimated Threshold Levels

After determining the threshold levels for debt ratio and budget deficit, graphical analyses are done by plotting a line representing the threshold level of debt ratio and budget deficit on the initial graphs on debt ratio, budget deficit ratio and economic growth explained in Chapter 1. The graphical analyses are carried out on a basis of three periods; 1970-1985 representing the period before and until the first recession faced by Malaysia, 1986-1997 representing the period of rapid growth until the aftermath of the Asian Financial Crisis and the subsequent recession and 1998-2009 representing the period after the Asian Financial Crisis until the recent global financial crisis in 2009. Table 4.10 shows the average growth and standard deviation of the three periods on which the graphical analyses are carried out.

Table 4.10: Average and Volatility of RGDP Growth Rate

Period	1970-1985	1986-1997	1998-2009
Mean	0.066	0.079	0.037
Standard Deviation	0.032	0.025	0.045

Note: Mean represents the average while standard deviation represents the volatility of *RGDP* growth for the respective periods. Values calculated using *RGDP* growth rate obtained from World Development Indicators (WDI).

4.7.1 Debt Ratio and Economic Growth

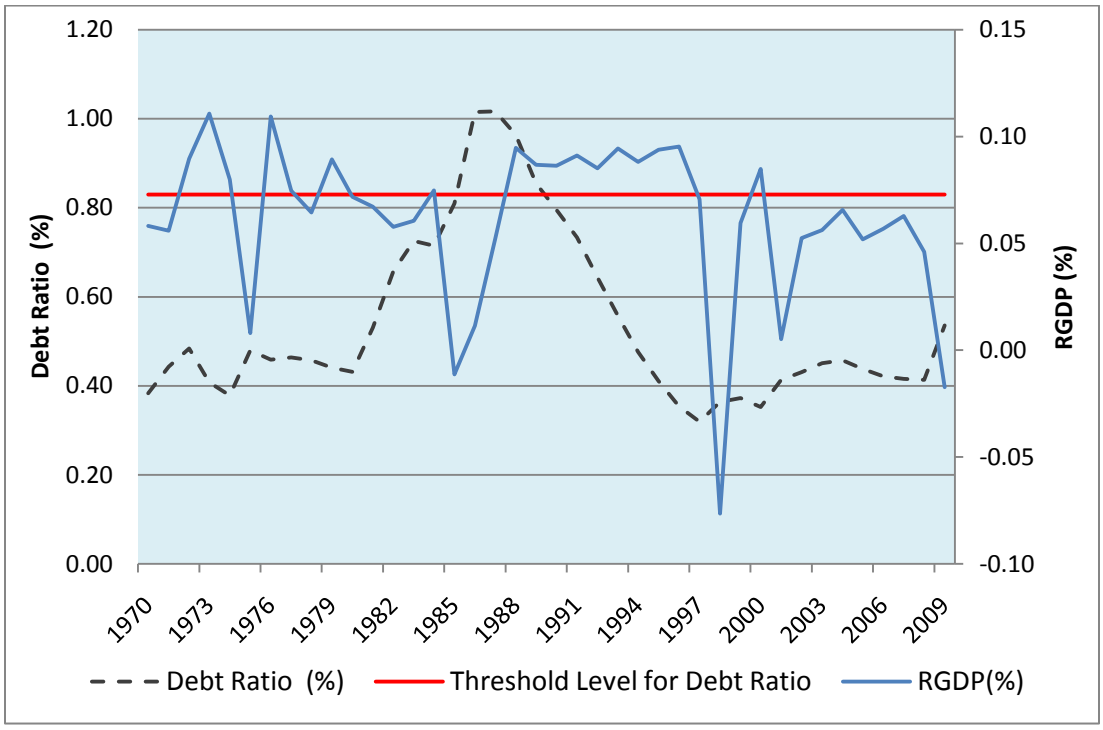
Figure 4.1 below shows the graph of debt ratio and *RGDP* growth with a horizontal line plotted representing the threshold level of 0.83 found for debt ratio. Throughout the period of 1970-2009, the debt ratio is below the threshold level most of the time except for the period of 1986-1989 following Plaza Accord and the appreciation of the Yen. As most of the external debt of Malaysia during the 1980s was denominated in Yen, the sudden appreciation of Yen immediately increased the debt level in terms of domestic currency and subsequently the debt ratio. Besides that, Malaysia also faced its first recession in that period and aggressive expansionary fiscal policy was conducted the lift the economy out of recession. Thus, the debt ratio further increased with the implementation of fiscal stimulus.

For the period of 1970-1985, debt ratio remained below the threshold level of 0.83 but was on an increased trend beginning from the 1980s. During this period, *RGDP* growth averaged at 6.6% with a volatility of 3.2%. However, for the period of 1986-1997 debt ratio breached the threshold level for three consecutive years from

1986 to 1989 but gradually turned its direction to a decreasing trend. During this period, *RGDP* growth averaged higher at 7.9% with a lower volatility at 2.5%. Finally for the period of 1998-2009, though debt ratio remained below the threshold level, it was on a gradual increasing trend. During the period, *RGDP* growth averaged at a much lower 3.7% percent but volatility of growth increased significantly to 4.5%.

Based on the graphical analysis, an increasing debt ratio seems to increase the volatility of growth and vice versa for that period studied. Both periods of 1970-1985 and 1998-2009 experienced higher volatility in growth when debt ratio had been on an increasing trend in certain years. On the other hand, growth in the period of 1986-1997 was less volatile as debt ratio had been on a decreasing trend.

Figure 4.1: Debt Level and Real GDP Growth of Malaysia (1970-2009)



Source: Bank Negara Malaysia (BNM) and World Development Indicators (WDI)

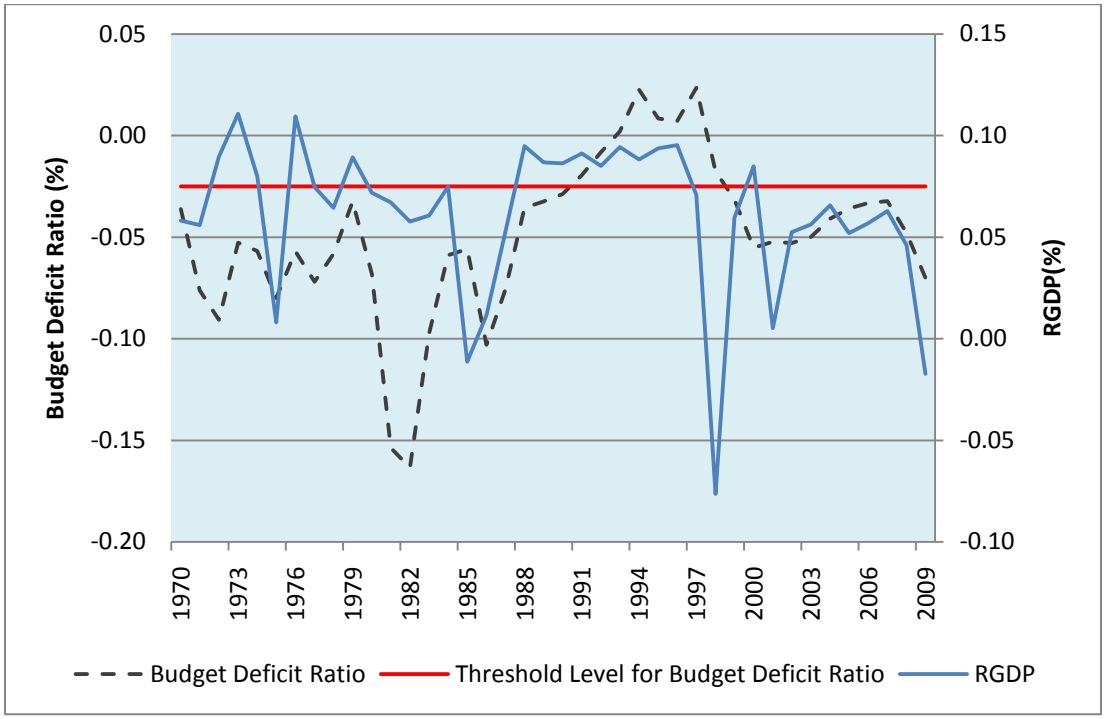
4.7.2 Budget Deficit and Economic Growth

Figure 4.2 below shows the graph of budget deficit ratio and *RGDP* growth with a horizontal line plotted representing the threshold level of -0.025 found for budget deficit ratio. Throughout the period of 1970-2009, the budget deficit breached the threshold level of -0.025 most of the time except for 1991-1997 when the economy was in a period of strong and stable growth. The stable growth in output had increased the income of the country and allowed improvement in the budget balance.

For the period of 1970-1985, budget deficit ratio exceeded the threshold level of -0.025 and was at the largest level at 1981 but gradually improved over time. During this period, *RGDP* growth averaged at 6.6% with a volatility of 3.2%. However, for the period of 1986-1997 budget deficit level improved gradually and managed to achieve levels lower than the threshold level from 1991 to 1997. During this period, *RGDP* growth averaged higher at 7.9% with a lower volatility at 2.5%. Finally for the period of 1998-2009, budget deficit ratio breached the threshold level and has remained higher than the threshold ever since. During the period, *RGDP* growth averaged at a much lower 3.7% percent but volatility of growth increased significantly to 4.5%.

Based on graphical analysis, the increase in budget deficit ratio also seems to induce volatility to growth and vice versa. For example, the periods of 1970-1985 and 1998-2009 experienced higher volatility in growth when budget deficit ratio exceeded the threshold level with increasing trend observed for certain years. On the other hand, growth for the period 1986-1997 was less volatile as budget deficit ratio improved and reached levels lower than the threshold, even after taking in the effect of external shock caused to the economy by the Asian Financial Crisis.

Figure 4.2: Budget Deficit Level and RGDP Growth of Malaysia (1970-2009)



Source: Bank Negara Malaysia (BNM) and World Development Indicators (WDI)

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATION

5.0 Introduction

As the global economy still recovering from a severe recession with major economies such as the US and Europe is facing stagnant growth, news of Western economies facing sovereign debt crisis certainly creates more uncertainty in the global economy. Various studies have been done to examine the relationship of debt, budget deficit and economic growth, ranging from different methodologies and sample of countries used. However, there seem to be few studies relating to this topic that is done on a country-specific level. Therefore, this empirical analysis aims to contribute to the literature by examining the relationship of debt, budget deficit and economic growth on a single country, Malaysia.

5.1 Summary of Results

Based on the various tests carried out to examine the relationship between debt, budget deficit and economic growth, this empirical study manage to answer all of the research questions set in the beginning of the research. After performing multi-stage regressions using various variables, we have chosen the best equation to explain the relationship between debt, budget deficit and economic growth. Based on the results of the OLS regression, we can conclude that the relationship between debt and economic growth is a negative one in the current period and a positive one for debt in

the previous period. By summing up the coefficient of debt in the equation and not to analyze the effects just contemporaneously but over the time, the coefficient is still negative and indicates a negative relationship. The relationship between budget deficit and growth is also a negative one. Through threshold model testing, we are able to determine the threshold levels for debt and budget deficit at 0.83 and -0.025 respectively.

5.2 Policy Recommendation

The negative relationship between debt and growth should serve as a reminder for policymakers to monitor and control the debt ratio of the country so that the country and its future generations will not be overburdened with excessive debt and cost of servicing debts. Although the real debt ratio as at 2009 is 0.53 and there is still some distance before reaching the threshold level of 0.83, the government should continue to monitor the debt ratio to make sure that it is still at healthy levels that will not be detrimental to growth. A debt ratio that is too high might send a signal of possible insolvency and causes investors to demand higher yield on government securities, making it more difficult for the government to secure borrowings cheaply. Besides that, heavily indebted countries also shun potential foreign capital from entering the country because of perceived risk and uncertainty in the economic climate.

Besides that, the negative relationship between budget deficit and growth should serve as a warning to the government to control and reduce fiscal deficit and not continuing to run deficit by increasing debt levels. With a large portion of government expenditures allocated to subsidizing petrol and other goods, the government should revise its subsidy policy and gradually reducing it so that resources can be reallocated to sectors that have the potential to employ such

resources more efficiently and productively. Government should increase the transparency of its procurement system in order to reduce wastages, reduce rent seeking activities as well corruption. Adopting an open tender system for procurement and tender of government projects shall ensure that government does not overpay for projects and incur unnecessarily high expenditures.

The enactment of legislation similar to the Stability and Growth Pact (SGP) to facilitate and maintain the stability of the economy by instilling fiscal discipline on the government is also feasible. Such legislation will require the government to abide by fiscal rules to maintain debt and budget deficit levels that will not be detrimental to growth, and also provide a guidance and reference level for policymakers in managing the national debt and fiscal position. Therefore, determining the threshold level for debt and budget deficit is crucial because this enables a reference level to be established and to be used in enacting legislation to monitor, control and hold the government accountable for national debt level and fiscal position of the government.

5.3 Recommendations for Future Research

One of the limitations of this empirical research is that data gathered by us is constrained to low frequency annual data conversion technique in the software Eviews has to be used to transform sets of lower frequency annual data to higher frequency quarterly data. The process of conversion might have an effect on the dynamics and behavior of the data of our research variables and certain characteristics of the data might not be observed. For example, data frequency conversion might have caused the series to appear smoother and less representative of the actual dynamics of the series, thus causing the dynamics in the series to be captured less in data analysis. Regressing on such series of data might yield results that are less accurate to answer the research questions of the relationship between variables.

Therefore, accurate quarterly time series data from Bank Negara Malaysia, Department of Statistics, Economic Planning Unit and Ministry of Finance is recommended to be used for future research on debt, budget deficit and economic growth of Malaysia so that the limitation above can be addressed and more accurate results can be obtained to answer questions on the relationship between variables.

Besides that, this empirical research only relies on OLS regression to analyze the relationship between the variables and the OLS method has its limitations and may not be meaningful enough when it comes to explaining the endogeneity of variables. Endogeneity occurs when a dependent variable is determined by independent variables and at the same time some of the independent variables are determined by the dependent variable. In short, there is a two-way or simultaneous relationship between the dependent and independent variable(s). For example, in our analysis we take budget deficit as exogenous to growth so that budget deficit only affects growth. But the effect of budget deficit on growth can also affect budget deficit through the expected level of government spending following a deficit budget. Thus, budget deficit may be endogenous to growth and therefore more sophisticated methodology such as simultaneous equations is recommended to take into account the information provided by other equations in the system before estimating the parameters. This will provide a more meaningful explanation on the relationship of variables as compared to single equation models such as OLS.

Furthermore, we also recommend future researches to focus their analysis on other scopes such as the composition of total debt whether it mainly consists of short-term or long-term debt, as well as the source of debt financing whether it is domestically financed or externally financed in. For example, debt may have varying effects on economic growth due to the characteristics associated with debt with different maturities. Short-term debt generally has a lower cost of borrowing but the uncertainty associated with rolling over debts is greater, especially in the event of

economic uncertainty or the presence of shocks. On the other hand, long-term debt is more costly and the burden of servicing the debt will borne by the future generations of the country. Besides that, the source of debt financing might also have an impact on the debt-issuing country because of exchange rate fluctuations and outflow of funds to service debt and repay principal.

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